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# УЧЕБНИК АНГЛИЙСКОГО ЯЗЫКА



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технических вузов и специальностей*

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ИЗДАТЕЛЬСТВО ПРИ ЛЬВОВСКОМ ГОСУДАРСТВЕННОМ УНИВЕРСИТЕТЕ  
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Учебник преследует цель обеспечить подготовку студентов к самостоятельному чтению, пониманию и переводу научно-технической и общественно-политической литературы на английском языке, а также развитие элементарных навыков устной речи на темы, предусмотренные программой по иностранным языкам.

Предназначен для студентов технических вузов и специальностей.

Редакция общественно-политической литературы

## ПРЕДИСЛОВИЕ

Настоящий учебник предназначен для студентов I и II курсов технических вузов стационарной формы обучения, а также для студентов I, II и III курсов общетехнических факультетов (вечерней формы обучения), продолжающих изучение английского языка в вузе.

Учебник состоит из следующих разделов:

1. Основной курс (28 уроков). На факультетах стационарной формы обучения учебный материал основного курса распределяется следующим образом: первый семестр — уроки 1—11, второй семестр — уроки 12—17, третий семестр — уроки 18—23, четвертый семестр — уроки 24—28.

На общетехнических факультетах учебный материал основного курса распределяется так: первый курс — уроки 1—11, второй курс — уроки 12—22, третий курс — уроки 23—28.

2. 28 текстов для самостоятельного чтения и перевода, соответствующие 28 урокам основного курса (Приложение I).

3. Краткий фонетико-орфоэпический курс (Приложение II).

4. Краткий грамматический справочник (Приложение III).

5. Англо-русский словарь, в который включены слова, входящие в состав текстов и диалогов основного курса.

С целью развития навыков правильного чтения и произношения как отдельных слов, так и групп слов основным текстам уроков предпосылаются специальные, подробно разработанные упражнения в чтении в соответствии с правилами, изложенными в фонетико-орфоэпическом курсе.

Необходимость включения в учебник подробного изложения основных правил чтения и поурочных упражнений в чтении возникла в связи с тем, что у большинства поступающих в технические высшие учебные заведения навыки чтения и произношения находятся на весьма низком уровне.

Уроки учебника строятся по следующему плану:

1) Упражнения в чтении.

2) Основной текст урока (с переводом отдельных выражений или словосочетаний, встречающихся в тексте).



3) Диалог \*.

4) Лексические и грамматические упражнения.

5) Дополнительный текст.

Упражнения в чтении построены в основном на лексике урока. Внимательная проработка этих упражнений приведет студента к правильному чтению текста. При составлении упражнений авторы считали целесообразным придерживаться следующей классификации слов: односложные слова, двусложные слова с ударением на первом слоге, двусложные слова с ударением на втором слоге, различные группы многосложных слов. В каждом уроке даются также упражнения на слитное чтение сочетаний слов и указывается произношение трудных слов, составляющих исключения из правил чтения. Перед упражнениями указываются в скобках номера соответствующих параграфов краткого фонетико-орфоэпического курса.

Тексты учебника подбирались главным образом из английской оригинальной литературы — научной и общественно-политической — с тем расчетом, чтобы в них содержалась основная лексика, характерная для литературы, над которой студентам придется работать на старших курсах. Авторы адаптировали эти тексты. Редко встречающиеся слова и выражения заменены более употребительными. Авторы старались обеспечить достаточную повторяемость основной лексики.

Тематика диалогов в основном соответствует темам, указанным в программе по иностранному языку. Авторы стремились не перегружать диалоги трудными словами и выражениями, чтобы облегчить студентам усвоение разговорной лексики.

Тексты и диалоги учебника сопровождаются грамматическими и лексическими упражнениями, предназначенными для закрепления и активизации учебного материала и расширения словарного запаса студентов. Большое количество таких упражнений даст возможность варьировать задания и подбирать их в зависимости от подготовки студентов. Часть упражнений может быть использована для составления контрольных заданий. Выполнение ряда упражнений рассчитано на работу со словарем.

Дополнительные тексты для самостоятельного чтения в конце каждого урока увязаны с основными текстами как в грамматическом, так и в лексическом отношении. Авторы стремились здесь свести количество незнакомых слов к минимуму, так как главная цель дополнительных текстов — развитие навыков беспереводного понимания английской оригинальной литературы.

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\* В отдельных случаях диалоги даны в качестве основных текстов уроков.

## МЕТОДИЧЕСКИЕ УКАЗАНИЯ

### Последовательность работы над учебным материалом

В работе над языком необходима определенная последовательность. На каждом этапе изучения иностранного языка следует исходить из того, что составляет основу для развития и усовершенствования приобретаемых знаний и навыков. На начальном этапе изучения этой основой является усвоение правил чтения и формирование навыков правильного чтения и произношения. Если на начальном этапе обучения этому уделяется недостаточное внимание, вся дальнейшая работа над языком может затормозиться.

На последующих этапах основным будет практическое овладение необходимыми грамматическими нормами и лексикой.

Изучая материал по учебнику, необходимо соблюдать следующую последовательность в работе:

1. Усвоение правил произношения и чтения.
2. Усвоение основных грамматических сведений.
3. Работа над текстом.
4. Выполнение упражнений для закрепления грамматического и лексического материала.
5. Проработка диалогов и дополнительных текстов.

#### I. Произношение и чтение

1. Студенты, изучающие иностранный язык, нередко смешивают два понятия: правильное чтение и правильное произношение. Между тем можно уметь правильно произносить отдельные звуки и слова иностранной речи и в то же время не уметь правильно читать.

2. Прежде всего нужно хорошо усвоить правила произношения звуков английского языка.

3. Чтобы научиться правильно читать, надо знать различие между звуком и буквой в английском языке. Для этого необходимо выучить правила чтения и твердо запомнить, какому звуку соответствует данная буква или буквосочетание.

4. Руководствуясь правилами произношения и чтения, следует систематически читать упражнения, предшествующие каждому уроку, до чтения текста. Их надо читать вслух, следя за произно-

шением и точно соблюдая ударение в слове, словосочетании и предложении.

При упражнениях в чтении указаны номера соответствующих правил, изложенных в Приложении I.

5. Правильность чтения слов можно проверить в словаре по фонетической транскрипции.

6. Работая над языком, студент должен систематически закреплять приобретенные навыки правильного произношения и чтения, для чего рекомендуется многократное чтение вслух каждого изучаемого текста.

7. Большое значение имеет соблюдение логического ударения в предложении и словосочетании. Надо твердо усвоить, что предлоги, союзы, личные и притяжательные местоимения, артикли, глаголы-связки, вспомогательные глаголы в большинстве случаев не несут на себе ударений и произносятся слитно с теми словами, с которыми они грамматически связаны. При чтении предложений надо правильно делить речь на речевые такты согласно смысловым группам и соблюдать правила интонации.

## II. Работа над грамматикой

1. Следует помнить, что без прочного усвоения определенного минимума грамматических сведений невозможно ни правильно понимать и переводить литературу, ни правильно говорить на иностранном языке. Необходимо отличать минимум грамматических правил, используемых в разговорной речи, от объема грамматических сведений, без которых нельзя научиться правильно переводить и понимать оригинальный английский текст.

2. К грамматическому минимуму, необходимому для развития навыков устной речи, можно отнести:

1) Порядок слов в повествовательном предложении (утвердительная, отрицательная и вопросительная формы).

2) Понятие об артиклях — определенном, неопределенном и нулевом.

3) Оборот *there is, there are*.

4) Множественное число имен существительных.

5) Степени сравнения имен прилагательных и сравнительные обороты.

6) Имена числительные — количественные и порядковые.

7) Местоимения — личные, притяжательные, указательные, вопросительные, относительные, неопределенные.

8) Времена действительного залога: *Present, Past, Future Indefinite; Present, Past Continuous; Present, Past Perfect; Present Perfect Continuous*.

Времена страдательного залога: *Present, Past, Future Indefinite*.

9) Неличные формы глагола:



Инфинитив в составе сложного дополнения в сочетании с глаголами to want, to hear, to see типа I want him to come, He saw me come in, I heard her sing a beautiful song.

Причастие в составе сложного дополнения в сочетании с глаголами to hear, to see типа I heard (I saw) him opening the door.

Простой герундий разговорного типа: He began reading the book, Stop smoking.

10) Основные предлоги и союзы.

11) Наречия, степени сравнения наречий.

12) Понятие о согласовании времен, время Future-in-the-Past.

13) Условные обороты.

14) Сложноподчиненные предложения простой формы.

15) Словосочетание.

Для усвоения грамматического минимума может быть использован любой учебник грамматики английского языка. Краткий грамматический справочник настоящего учебника (Приложение II) содержит грамматические сведения, необходимые для правильного понимания и перевода оригинальной литературы по специальности.

3. Грамматические пояснения рекомендуется усваивать постепенно, согласно распределению по урокам учебника. Каждое из них необходимо внимательно прочитать и постараться пересказать своими словами.

4. Усвоив грамматические пояснения, следует еще раз повторить их и закрепить упражнениями.

5. Студенту необходимо усвоить систему словообразования английского языка, научиться разбираться в морфологическом составе слова, т. е. уметь расчленить производное слово на приставку, корень, суффикс, а сложное слово — на его составные части. Знание системы словообразования помогает, во-первых, определить значение неизвестного слова по его морфологическому составу, во-вторых, образовать от известного слова производные. Знание основных значений префиксов и суффиксов способствует запоминанию производных слов.

### III. Работа над текстом

После усвоения всех грамматических разделов данного урока можно приступить к работе над текстом. Прежде чем приступить к чтению и переводу текста по предложениям, необходимо, предварительно ознакомившись с пояснениями к тексту, прочитать весь текст или его законченную часть, чтобы уяснить себе его общее содержание.

После этого можно перейти к чтению и переводу текста по предложениям.

В целом работа над текстом состоит из следующих этапов:

а) Лексико-грамматический анализ,  
работа со словарем и перевод текста

1. Перевод с иностранного языка на родной — это возможно более точная передача содержания иностранного текста грамматическими и лексическими средствами родного языка.

Перевод и лексико-грамматический анализ взаимно дополняют друг друга, так как они являются двумя сторонами единого процесса.

2. Для того чтобы правильно перевести предложение, надо определить значения незнакомых слов. Прежде чем искать незнакомое слово в словаре, необходимо уяснить себе, какой частью речи оно является.

3. Для пользования словарем нужно твердо знать алфавит английского языка. Кроме того, каждый словарь имеет свою систему условных обозначений, сокращений и свой порядок построения, которые объясняются в предисловии к словарю. Поэтому прежде чем пользоваться словарем, следует ознакомиться с его структурой.

4. Если в тексте встречается незнакомое производное или сложное слово, то для раскрытия его значения нужно, используя знание правил словообразования и словосложения, расчленить производное слово на приставку, корень, суффикс, а сложное слово — на составляющие его слова-основы.

5. Буквальный, дословный перевод нередко ведет к неточности в передаче мысли и даже к смысловым искажениям. Поэтому при переводе допускаются отступления грамматического и лексического характера с целью как можно лучше передать смысл оригинала. Бывает, что если перестроить порядок слов переведенного предложения в соответствии с требованиями строя и стиля родной речи, перевод приобретает большую ясность и точность.

6. Идиоматические и другие устойчивые словосочетания и выражения одного языка не могут быть дословно переведены на другой язык, и смысл не всегда можно уяснить из буквального перевода составляющих его слов. Значения таких словосочетаний или выражений рекомендуется искать в словаре по знаменательным словам, составляющим эти выражения.

7. Если в английском предложении грамматические связи неясны, необходимо провести тщательный грамматический и лексический анализ этого предложения.

Для этого следует прежде всего выделить главные члены предложения — сказуемое и подлежащее — и определить, какой частью речи выражен данный член предложения. Подробные пояснения приведены в первом разделе краткого грамматического справочника (Приложение II).

8. Выделив сказуемое и подлежащее, надо определить относящиеся к ним второстепенные члены предложения и уяснить зависимость одного члена предложения от другого.

9. Анализируя сложное предложение, следует предварительно определить его вид (сложносочиненное или сложноподчиненное) и выделить его составные части.

10. При анализе и переводе предложений рекомендуется особое внимание обращать на новые, только что изученные грамматические формы и обороты.

11. Перевод текста может быть сделан в устной или письменной форме. Оба эти вида работы взаимосвязаны и друг друга дополняют. Однако следует помнить, что основным является правильное понимание текста и правильное чтение его вслух.

#### **б) Чтение текста в целом и проверка письменного перевода**

После того как текст прочитан и переведен по предложениям, рекомендуется снова прочесть его от начала до конца и перевести или попытаться понять без перевода, добиваясь, чтобы в нем не осталось ничего, вызывающего сомнения.

Чрезвычайно полезно прочитать сделанный перевод через несколько дней, не глядя в оригинал. Тогда, не находясь под влиянием подлинника, легче и скорее можно заметить все смысловые искажения и стилистические недочеты.

#### **в) Повторное чтение текста вслух для развития навыков плавного чтения**

Для развития навыков правильного и плавного чтения следует повторно читать текст вслух без перевода. Читать надо медленно, громко, четко, не останавливаясь на неудачных элементах предложения (артиклях, предлогах, глаголах-связках, вспомогательных глаголах и других служебных словах), т. е. произнося их слитно с теми словами, с которыми они грамматически связаны, например, предлоги или местоимения со следующими за ними существительными.

Читать текст вслух желательно несколько раз, пока не будут достигнуты беглость и четкость чтения.

### **IV. Работа над грамматическими и лексическими упражнениями**

Проработав текст, студент должен выполнить грамматические и лексические упражнения к уроку. Эти задания нужно выполнять письменно с помощью словаря, ибо они содержат незнакомые слова и рассчитаны на расширение словарного запаса студента. Правильность выполнения упражнений легче проверить, когда они записаны.

Необходимо внимательно относиться к написанию каждого слова и помнить, что нередко замена одной буквы другой может привести к изменению смысла слова и всего предложения.



## **V. Работа над диалогами и дополнительными текстами**

1. В качестве дополнительного учебного материала в учебнике даны диалоги, служащие для развития навыков устной речи. Способ проработки диалогов подобен процессу работы над основными текстами учебника; следует лишь добавить, что диалоги полезно читать вслух до тех пор, пока они не будут заучены почти на память.

2. Ряд упражнений к текстам содержат перевод диалогов с русского языка на английский. Выполнять эти переводы следует очень внимательно, используя ранее выученные слова и выражения.

3. После проработки основного текста рекомендуется прочесть дополнительный текст (в конце каждого урока), в котором количество новых, незнакомых слов сведено к минимуму. Основной целью этого чтения является развитие навыков беспереводного понимания текста.

## **VI. Работа над закреплением и обогащением словарного запаса**

1. Для того чтобы овладеть иностранным языком, необходимо накопить соответствующий словарный запас и закрепить его в памяти. Для этого рекомендуется составлять собственный словарь, записывая слова и выражения в специальную тетрадь или на карточки.

2. Новое слово надо уметь не только правильно перевести, но и правильно прочитать. Поэтому, выписывая английское слово и заучивая его значение, необходимо также запомнить правильное написание и звучание этого слова.

3. Каждое впервые встречающееся производное слово рекомендуется анализировать с точки зрения словообразования (выделить корень, приставку, суффикс).

4. Записанные слова и словосочетания следует постоянно повторять. Повторению слов, их заучиванию и проверке усвоения нужно уделять ежедневно 10—15 минут.

5. Лучше всего запоминать слово не изолированно, а при повторении его в связном тексте, поэтому регулярное чтение литературы на английском языке способствует расширению словарного запаса.

Чтобы закрепить в памяти отдельные слова и выражения, рекомендуется: а) систематически перечитывать изученные ранее тексты; б) читать по возможности больше текстов, статей и книг на английском языке.

# LESSON 1

## Грамматический материал:

порядок слов в английском предложении;  
множественное число существительных;  
группа времен Indefinite (active);  
словообразование

## УПРАЖНЕНИЯ В ЧТЕНИИ

### 1. Чтение односложных слов:

(1) land, lamp, fact, gram; space, made, gave, state, came, same; park, start, card; care, stare, spare; got, job, spot, stop; note, role, whole; force, form; more, store; best, test, rest; eve, mete; term, germ; here, mere; such, much; mute, cube; turn, burn; cure, pure; rich, mist; time, fine, while; first, bird, third; fire, wire.

(21, 22) laid, paid, day; leave, each, means; year, near; learn, heard, search; speech, week, speed; found, bound, round; grow, growth, know; new, few; grew, crew; launch, pause.

### 2. Чтение двусложных слов с ударением на конечном слоге:

(12—16) invent, produce, became, effect, equip, assist, combine, complete, attend, beside, perform, entire, before, remain, detail, within, research, depend, create.

### 3. Чтение двусложных слов с ударением на начальном слоге:

(13—16) rocket, under, number, matter, object, system, progress, factor, congress, longer, extra, subject, manner, science, even, during, mural, student, fatal, pilot, spiral, focus, nature, culture, lecture, easy, party, outer, founder, thousand, early, daytime, detail.

### 4. Запомните произношение следующих слов:

technique [tek'ni:k] — техника, achievement [ə'tʃi:vmənt] — достижение, wonder ['wʌndə] — удивляться, geniuses ['dʒi:njəsɪz] — гении, discover [dis'kʌvə] — открыть, weapon ['wepən] — оружие, field [fi:ld] — поле, область, develop [di'veləp] — развивать, -ся, decisive [di'saɪsɪv] — решающий, laboratory [lə'bɒrətəri] — лаборатория, course [kɔ:s] — курс, foreign ['fɔ:ɡɪn] — иностранный, study ['stʌdi] — занятия, исследование, заниматься, изучать.

## ТЕКСТ

### HOW SCIENCE GREW IN THE SOVIET UNION

Two months after the Great October Socialist Revolution, Lenin said at the Third All-Russian Congress of Soviets: "Today, all the miracles of technique, all the achievements of culture will come within the reach of the entire people and the working people will perform their titanic historical work".

Now the whole world wonders at the achievements of the Soviet people who discover the secrets of the skies above us with their

Sputniks and space rockets which the sons and daughters of the people who heard Lenin's words, launched into space.

However, even before the October Revolution, Russian scientists made great contributions to world science. Peter I established the St. Petersburg Academy of Sciences as early as 1725. There the brilliant scientist Lomonosov worked in the fields of physics, chemistry, astronomy and laid the foundation of the Russian literary language.

The peoples of this great land produced many geniuses such as Mendeleyev who gave the world his periodic table of elements, mathematicians like Lobachevsky whom the world knows as the "Copernicus of Geometry".

The peoples of the U.S.S.R. are proud of scientists like Lodygin who produced the electric lamp, and Popov who invented the radio, Tsiolkovsky who was the founder of the modern theory of space rockets.

In scientific achievement before the October Revolution we shall also mention the name of the great biologist Mechnikov as well as Zinin, who discovered anilin, and Vernadsky who did brilliant work in geochemistry.

These are individual names which the whole world knows so well. But under the tsar, the individual contributions of Russian genius never got to the people. Under the Soviet power, research and technique became weapons of the people and now we already have a great number of brilliant scientists in all fields of science. In the socialist state, the development of science is no longer dependent upon individual scientists. Science now became an affair of the state, a matter of importance, an object of particular care of the Communist Party and the Soviet Government.

### ПОЯСНЕНИЯ К ТЕКСТУ

come within the reach of стать доступным для  
es early as 1725 еще в 1725 г.  
lay the foundation заложить основы  
as well as а также

get to the people доходить до народа  
... is no longer dependent on уже не  
зависит от ...  
of importance важный

### DIALOGUE

A group of foreign scientists came to the Soviet Union. They wonder at the great achievements of the Soviet people in the development of science and education. At one of the institutes they ask many questions about the system of higher education in the U.S.S.R.

Prof. Brown: What a fine building! So many laboratories with modern equipment! Soviet scientists have every possibility to carry on research work and naturally they make great contributions to world science.

Prof. Petrov: Of course. In our country the development of science is a matter of great importance. Our Government and the Communist Party take particular care of science.



Prof. Brown: That's why you have so many institutes and universities where your young people get higher education.

Prof. Petrov: Oh, yes, we have a great many of them. But not all students study in the daytime. Many people combine work with study at schools of higher education. They study at the evening and extra-mural (correspondence) departments and institutes.

Prof. Brown: Will you kindly give me some details about extra-mural and evening education in the Soviet Union. How long does the course for engineers last there?

Prof. Petrov: The complete correspondence course at the institute lasts about six years: three years at the general engineering department and another three years of specialised studies. The evening department also takes six years to complete.

Prof. Brown: What are the subjects which the correspondence students study during the first year of studies?

Prof. Petrov: They start with mathematics, physics, a foreign language and some other subjects.

Prof. Brown: Do correspondence and evening class students attend the institute every day?

Prof. Petrov: No, they don't. They attend the institute only three or four evenings a week. They get different consultations, listen to lectures and do the lab. The students take examinations in the same manner as daytime students and when they graduate, they get the same diplomas.

Prof. Brown: But isn't it difficult to combine work with studies?

Prof. Petrov: Of course, it isn't a very easy thing to do. But the students get every assistance necessary for their studies from the state.

Prof. Brown: What kind of assistance?

Prof. Petrov: They don't work during examination time — they get an extra paid leave. Besides, correspondence students in the fifth year of studies get an extra paid rest day each week.

Prof. Brown: And what about jobs for those who graduate from the institutes and universities?

Prof. Petrov: Thousands graduate from institutes and universities every year. Some of them work in various branches of industry, while others carry on research work in different research institutes. In fact, the Government provides all graduates with jobs according to their qualification.

*(To be continued in Lesson 2)*

## ПОЯСНЕНИЯ К ТЕКСТУ

have every possibility иметь все возможности  
of course конечно  
take particular care проявлять особую заботу  
that's why вот почему

a great many очень много  
in the daytime днем  
school of higher learning (education) высшее учебное заведение  
evening and extra-mural departments вечерний и заочный факультеты

will you kindly give me дайте мне,  
пожалуйста  
correspondence course курс заочного  
обучения  
correspondence student студент-заоч-  
ник  
do the lab выполнять лабораторные  
работы

take examinations сдавать экзамены  
in the same manner так же, как  
daytime student студент стационара  
what kind of какой?  
student in the fifth year of studies сту-  
дент пятого курса

## УПРАЖНЕНИЯ

I. Переведите следующие глаголы и образованные от них существительные:

- а) с суффиксом **-ment**: to achieve — achievement, to develop — development, to establish — establishment, to govern — government;  
б) с суффиксом **-tion**: to contribute — contribution, to produce — production, to invent — invention.

II. Найдите в тексте синонимы к следующим словам и переведите их на русский язык:

technology, whole, do, branch, quantity, a lot of.

III. Найдите в тексте антонимы к следующим словам и переведите их на русский язык:

before, under, few, badly, always.

IV. Напишите прилагательные, соответствующие следующим словам, и переведите их на русский язык:

history, science, period, depend, technique, decide, production, pride.

V. Напишите существительные, соответствующие следующим словам, и переведите их на русский язык:

to invent, to found, to discover, physical, technical, to achieve, to contribute, science, chemical, important, grow, miraculous.

VI. Переведите на английский язык, пользуясь словами и выражениями из текста:

1. Еще в 1917 г. Ленин говорил о будущем развитии науки.
2. Советский народ гордится достижениями своих ученых.
3. Ломоносов, Менделеев, Циолковский, так же, как и другие русские ученые, внесли большой вклад в мировую науку.

VII. Проанализируйте следующие предложения и переведите на русский язык:

1. Under the Soviet power research and technique became weapons of the people. 2. Now the whole world wonders at the achievements of the Soviet people. 3. The people of this vast land produced many geniuses.

VIII. Поставьте глагол в скобках в нужном времени и переведите предложения на русский язык:

1. At the Third All-Russian Congress of Soviets Lenin (to speak) about the tasks of the Soviet people. 2. Soviet scientists (to make) great contributions to world science. 3. The brilliant scientist Lomo-

nosov (to work) in the fields of physics, chemistry, astronomy, geography and language. 4. Lenin (to be) the founder of the first Socialist state in the world. 5. Next year this scientist (to do) important work in geochemistry. 6. Who (to be) the founder of the modern theory of space rockets?

**IX. Напишите в вопросительной и отрицательной форме следующие предложения и переведите их на русский язык:**

1. She does research work in the field of chemistry.
2. This worker achieved good results in his work.
3. Our scientific workers are at the laboratory now.
4. Your work will be important for us.

**X. Составьте предложения из следующих групп слов, переведите их на русский язык:**

1. spoke, of, congress, at, All-Russian, Soviets, the, Lenin, third.
2. fields, Lomonosov, in, science, of, different, worked.
3. scientists, of, proud, peoples, the, are, their, U.S.S.R., the, of.
4. will, and, Soviet, many, scientists, launch, rockets, space, sputniks.

**XI. Поставьте вопросы к выделенным словам:**

**In 1725 Peter I founded the Academy of Sciences.**

**XII. Напишите следующие существительные во множественном числе и дайте произношение окончания:**

month, achievement, sputnik, daughter, word, contribution, language, table, lamp, theory, party, branch, industry, shelf.

**XIII. Переведите на английский язык:**

а) 1. Я — студент политехнического института. 2. Политехнический институт — очень хороший и большой институт. 3. У меня много товарищей. 4. Почти все они также студенты политехнического института. 5. Мы имеем по три лекции ежедневно. 6. Один из моих товарищей — студент-заочник. 7. Он — студент института иностранных языков. 8. У него есть много интересных английских книг и журналов.

б) 1. Советские ученые работают в различных областях науки. 2. Их открытия очень важны для развития промышленности и сельского хозяйства. 3. Работал ли этот ученый в области физики? Да. 4. Есть ли у вас работы в области математики? Нет. 5. Развитие науки и техники облегчает (to make easy) наш труд. 6. Мы используем последние (latest) достижения науки и техники на благо трудящихся. 7. Развитие науки и техники в нашей стране является делом огромной важности. 8. Весь мир хорошо знает имена наших ученых. 9. Много ученых приедет на Всесоюзный конгресс математиков. 10. Кто был основоположником современной теории космических ракет? 11. Где работал Ломоносов?

**XIV. Ответьте на следующие вопросы:**

1. What did Lenin say at the Third All-Russian Congress of Soviets? 2. Who established the St. Petersburg Academy of Sciences?



3. In what fields of science did Lomonosov work? 4. What did Mendeleev give to the world? 5. Who was the founder of the modern theory of space rockets? 6. What are the latest great achievements of Soviet science?

**XV. Расскажите текст по следующему плану:**

1. Lenin spoke at the Third All-Russian Congress of Soviets.
2. The Soviet Union has great achievements in the development of science.
3. Russian scientists made a great contribution to world science.
4. Under the Soviet power science serves the people.

**Контрольный текст. Прочтите и изложите устно без перевода.**

### COSMONAUTICS

The word cosmonautics comes from the Greek word "cosmos" meaning "universe" and "nautike" — "navigation" ("seafaring"). But cosmonautics means not only flights into space. It includes various branches of science and technology. Without them space flights would be impossible.

Tsiolkovsky was a pioneer of the science cosmonautics. In his works he studied many problems which served as basis for the development of cosmic flight theory. The 4th of October 1957 is the birthday of space era. It was the day when powerful rockets launched the first sputnik into orbit around the earth. It orbited our planet like a tiny moon. Since then a great number of sputniks flew into space. They sent back important information about the universe. On the 12th of April 1961 the first manned flight took place. The first cosmonaut Y. Gagarin was a Soviet citizen.

Following this, a great number of artificial satellites as well as other space vehicles traveled into space. They carried instruments to collect interesting information about the universe. In space cosmonauts carry out various observations and experiments to solve the many space travel problems. Their discoveries help increase our knowledge of the Moon, Venus and other terrestrial planets as well as the planets-giants, such as Jupiter, Saturn, and others. These discoveries include many interesting facts about meteors, the atmosphere, the earth's magnetic and electrical fields, the conditions of life in space and many others.

The time will come when scientists from the Moon and orbital stations will send robots (automatic instruments) to replace men in distant and dangerous travels to far-off planets and stars.

### ПОЯСНЕНИЯ К ТЕКСТУ

since then с тех пор  
following this вслед за этим  
space vehicles космический корабль  
carry out проводить

solve the problems решать проблемы  
terrestrial planets планеты солнечной  
системы

## LESSON 2

### Грамматический материал:

порядок слов в английском предложении;  
времена группы Indefinite (active);  
притяжательный падеж;  
предлог of

### УПРАЖНЕНИЯ В ЧТЕНИИ

#### 1. Чтение односложных слов:

(1) that, hand, take, state, car, charge, care, square; job, stop, close, stone, form, sport, more, shore; less, help, these, eve, term, here; must, but, use, cube, curve, pure; which, time, first, girl, wire.

#### 2. Чтение двусложных слов с ударением на конечном слове:

(12—16) begin, employ, provide, present, prepare, consist, equip, compare, apply, absorb, return, construct, oppose, prevent, combine, besides.

#### 3. Чтение двусложных слов с ударением на начальном слове:

(13—16, 18) science, student, extra, mural, practice, army, person, custom, final, ticket, future.

#### 4. Запомните произношение следующих слов:

group [gru:p] — группа, кружок, field [fi:ld] — поле, область (науки), people ['pi:pl] — люди, studies ['stʌdiz] — учеба, исследования, create [kri:'eit] — создавать, young [jʌŋ] — молодой, wonder ['wʌndə] — удивляться, хотеть знать, foreign ['fɔ:ɪn] — иностранный.

### ТЕКСТ

#### TRAINING SCIENTISTS IN THE U.S.S.R.

Soviet people learn to love science even while they are at school. Schools of higher learning develop the first elements of scientific training which school boys and girls get at secondary schools. At higher schools, for the first time, students begin to take part in scientific and engineering work. Besides their studies, they carry on research in different students' groups and societies. Professors help students to develop their abilities and discover in which field of science and technique they will employ these abilities.

The main way in which research workers and higher-school teachers get their scientific training is the post-graduate course. The establishment of such courses in 1925 laid the foundation for the training of scientists.

Young people who graduate from schools of higher learning and want to do a post-graduate course take examinations in the History of the C.P.S.U., a special subject and a foreign language.

In our country we also have an extra-mural course of post-graduate training for people who want to do scientific research but do not want to leave work.

All post-graduates study free of charge. Those who take a full-time post-graduate course get state allowances. Universities and institutes provide post-graduates free of charge with all scientific instruments and experimental equipment which enable them to carry on scientific research.

But that is not the only way to train future scientists. Another way is to create conditions for specialists to carry on research in different institutions, factories, laboratories, etc., and present a thesis for a scientific degree after they finish their work.

The Soviet State provides young people with everything necessary to prepare for a scientific career and enable them to make important contributions to the development of Soviet science. In our country a scientific worker does not look for a job, the job looks for him.

### ПОЯСНЕНИЯ К ТЕКСТУ

for the first time в первый раз  
take part принимать участие, участвовать  
carry on research вести научно-исследовательскую работу  
students' groups студенческие кружки  
post-graduate course аспирантура  
research worker научный работник  
do a post-graduate course заниматься в аспирантуре  
take examinations сдавать экзамены

extra-mural course of post-graduate training заочная аспирантура  
free of charge бесплатно  
full-time post-graduate course стационарная аспирантура  
post-graduate student аспирант  
present a thesis защищать диссертацию  
prepare for a scientific career готовиться к научной работе  
look for искать

### DIALOGUE

(continued from Lesson 1)

Prof. Brown: Do your students take part in scientific and engineering work?

Prof. Petrov: Yes, they do. They carry on research work in different students' groups and societies under professors and associate professors of the institutes, who help the students to develop their abilities in a certain field of engineering or science.

Prof. Brown: I wonder in what way you set about training scientific research workers.

Prof. Petrov: We have post-graduate courses at the institutes and universities for this purpose.

Prof. Brown: And who applies for these courses?

Prof. Petrov: Young people who graduate from institutes, colleges or universities, most of whom have practical experience.

Prof. Brown: They undergo special tests, don't they?

Prof. Petrov: Yes, they do. They take examinations in one

or two subjects from their special field of knowledge, the History of the C.P.S.U. and a foreign language.

Prof. Brown: Are there also post-graduate courses for people who want to combine scientific research with their work?

Prof. Petrov: Yes, we have extra-mural courses of post-graduate training for such people.

Prof. Brown: Do the post-graduates have to pay for the courses they are taking?

Prof. Petrov: Post-graduate courses are free of charge. Full-time post-graduates get state allowances.

Prof. Brown: Does the state provide the extra-mural post-graduates with any privileges?

Prof. Petrov: Oh, yes. Our extra-mural post-graduates have many privileges. For example, they get an extra-paid leave for creative work. They also have an extra-paid day off every week.

Prof. Brown: Thank you for this very interesting talk. I hope we shall soon meet again.

### ПОЯСНЕНИЯ К ТЕКСТУ

associate professor доцент

I wonder интересно знать

you set about training вы проводите подготовку

who applies for these courses? кто поступает в аспирантуру?

undergo special tests подвергаться специальной проверке

subjects from their special field of knowledge специальные предметы

day off выходной день

### УПРАЖНЕНИЯ

I. Найдите в тексте синонимы к следующим словам и переведите их на русский язык:

receive, apply, chief, supply, and so on.

II. Найдите в тексте антонимы к следующим словам и переведите их на русский язык:

old, to enter a school of higher learning, to begin, part-time.

III. Найдите в тексте существительные, соответствующие следующим словам:

able, establish, scientific, equip, contribute, develop, found.

IV. Найдите в тексте прилагательные, соответствующие следующим словам: differ, speciality, experiment, importance.

V. Найдите в тексте английские эквиваленты для следующих слов и словосочетаний:

высшие учебные заведения, средние школы, впервые, принимать участие, кроме, аспирантура, заложить фундамент (положить начало), учиться в аспирантуре, сдавать экзамены, заочная аспирантура, бесплатно, аспирантура с отрывом от производства, стипендия, аспирант, единственный, защитить диссертацию, ученая степень, искать.

**VI. Переведите на английский язык следующий диалог:**

**А.** Здравствуй, Борис. Как живешь?

**Б.** Спасибо, хорошо. А ты как?

**А.** Спасибо, хорошо. Я сейчас много занимаюсь. Собираюсь сдавать экзамены и поступать в аспирантуру.

**Б.** Ты будешь учиться в аспирантуре с отрывом от производства или без отрыва?

**А.** Я буду учиться с отрывом от производства. Ведь я проработал на заводе три года после окончания института. Впрочем, институт имеет и заочную аспирантуру.

**Б.** Ты будешь получать стипендию?

**А.** Конечно. Государство обеспечивает всех аспирантов стипендией и научной литературой, кроме того, аспиранты учатся бесплатно.

**Б.** А где аспиранты проводят экспериментальную работу?

**А.** Все исследования аспиранты проводят в лабораториях института.

**Б.** В какой области науки ты будешь работать?

**А.** Я буду работать в области атомной физики.

**Б.** Это очень интересно. Наши ученые внесли большой вклад в эту область науки, особенно в мирное использование атомной энергии.

**А.** Да. Вот и я хочу внести свой вклад в развитие советской науки.

**Б.** Желаю успеха.

**VII. Напишите прошедшее время от следующих глаголов:**

learn, are, get, develop, love, begin, take, work, carry, employ, lay, graduate, have, leave, want, study, buy, make.

**VIII. Поставьте вопросы к выделенным словам:**

1. **Yes**, he studies at a higher school. 2. **At higher schools** students take part in scientific and engineering work. 3. **Yes**, they carry on research work in a students' society. 4. This post-graduate graduated from the institute **two years ago**. 5. No, I shall not take a post-graduate course.

**IX. Переведите следующие предложения на русский язык. Напишите их в вопросительной и отрицательной форме.**

1. He will graduate from the institute in two years. 2. Our post-graduates buy scientific literature every month. 3. My friend carried on research at the laboratory of our institute.

**X. Сгруппируйте следующие слова в предложения. Переведите предложения на русский язык.**

1. elements, get, of, training, boys, school, at, girls, first, the, scientific, and, secondary. 2. carry on, in, students, different, and, groups, research, societies. 3. post-graduates, of, free all, study, charge.



**XI. Поставьте выделенные слова во множественном числе и внесите другие необходимые изменения. Переведите предложения на русский язык.**

1. This **schoolboy** takes part in the work of a mathematical society. 2. That **young man** is a post-graduate student. He has an instrument before him. 3. The **school girl** has a text-book on the English language in her hand. She is going to do her lessons.

**XII. Поставьте глагол в скобках в нужном времени и переведите следующие предложения на русский язык:**

1. He (to take) his examinations next month. 2. The post-graduates (to carry on) research at the laboratories and shops of the universities and institutes. 3. Our scientists (to make) great contributions to the development of Soviet science. 4. The Soviet Government (to establish) post-graduate courses in 1925.

**XIII. Переведите следующие предложения на английский язык:**

1. В институтах и университетах студенты участвуют в исследовательской работе. 2. Молодые люди, которые хотят заниматься научной работой, поступают в аспирантуру. 3. После окончания исследовательской работы аспиранты защищают диссертации и получают ученую степень. 4. Советское государство создает все условия для подготовки ученых (training). 5. В каких областях науки и техники будут работать аспиранты вашего института? 6. Аспиранты учатся бесплатно? Да, они учатся бесплатно и получают государственную стипендию. 7. Наши ученые вносят большой вклад в развитие советской науки. 8. Студенты будут проводить исследовательскую работу в студенческом научном кружке. 9. Этот молодой ученый не занимался в аспирантуре нашего института. 10. Когда вы будете защищать диссертацию? 11. Какую ученую степень вы получили? 12. Где вы ведете научно-исследовательскую работу? 13. Кто помогает студентам в их работе? 14. Студенческий научный кружок нашего института ведет интересную работу. 15. Доклад этого аспиранта очень важен.

**XIV. Напишите в притяжательном падеже там, где это возможно:**

1. The invention of the scientist. 2. The research work of the post-graduate. 3. The department of the institute. 4. The discovery of the inventor. 5. The ability of the man. 6. The abilities of the men. 7. The training of the school boy. 8. The training of the school boys. 9. The professor of the institute. 10. The professors of the institutes.

**XV. Ответьте на следующие вопросы:**

1. When do young people begin to take part in scientific and engineering work? 2. What is the main way to get scientific training in our country? 3. When did the government establish post-graduate courses? 4. Who takes an extra-mural post-graduate course? 5. Do post-graduates get state allowances? 6. Who provides post-graduates with scientific instruments and experimental equipment? 7. When do post-graduates present their theses for a scientific degree?

**Контрольный текст. Прочтите и изложите устно без перевода:**

### HIGHER EDUCATION IN THE U.S.S.R.

Before the Great October Socialist Revolution higher education was beyond the reach of the wide masses of the people.

The very first decree of the young Soviet government for the first time in history widely opened the doors to all the people who wished to enter the schools of higher learning.

As a result of the great support of the government, the number of higher educational institutions as well as students increased greatly. At all our institutes we have evening and extramural departments for all those who want to combine work with studies. A lot of privileges are granted to such students by our government.

All higher education is free of charge. Most of the students get allowances. Universities and institutes provide students with comfortable hostels and well-organized service establishments.

Soviet higher schools give our young people an all-round education. Besides special subjects, the humanities (philosophy, political economy, foreign languages, etc.) are obligatory subjects for the young specialists — future builders of communism. The aim of higher education is not only to provide the students with the necessary knowledge, but also to develop them creatively.

Our higher education is planned and the right number of specialists leaves our higher schools each year. All graduates from higher schools get work according to their speciality.

### ПОЯСНЕНИЯ К ТЕКСТУ

beyond the reach недоступно  
the very first decree самый первый декрет  
for the first time в первый раз  
a lot of privileges are granted много привилегий предоставляется  
service establishments обслуживающие предприятия

all-round education всестороннее образование  
obligatory subjects обязательные предметы  
the right number of specialists надлежащее количество специалистов

### LESSON 3

#### Грамматический материал:

словосочетание;  
порядок слов в английском предложении;  
времена группы Indefinite (active);  
степени сравнения имен прилагательных;  
личные и притяжательные местоимения;  
словообразование;  
усилительный оборот, it is ... that;  
числительные

#### УПРАЖНЕНИЯ В ЧТЕНИИ

##### 1. Чтение односложных слов:

(1, 21, 22) man, men, spot, stone, make, best, fire, thing, breathe, year, note, these, since, nine, from, gas, same, care, far, Greek, heat,

clear, end, size, see, large, air, food, wood, ground, found, true, earth, learn;

(2, 46, 6) kind, grind, find, mind; high, right, tight; small, salt, all, fall; want, watch, was; walk, chalk, talk.

**2. Чтение двусложных слов с ударением на конечном слоге:**

(12—16) consist, exist, provide, arise, divide, increase, prepare, destroy; until, between; research, affair.

**3. Чтение двусложных слов с ударением на начальном слоге:**

(13—18) open, substance, common; little, structure, simple, simply, compound, inter, nature, problem, hundred, matter, further, farther, number, powder, unit, differ, plastics;

(13) limit, rapid, physics, solid, liquid, value, chemist, civil.

**4. Чтение многосложных слов с ударением на третьем от конца слоге:**

(29, 31) history, century, particle, energy, possible, divisible, divisibility, mineral, philosopher, experiment, chemical, general, quantity, physical, property, molecule, molecular, similar, oxygen, visible, invisible.

**5. Чтение слов, оканчивающихся на -tion:**

(30) revolution, contribution, mention, introduction, application, education, consultation, determination, information, combination.

**6. Чтение слов, оканчивающихся на -ed:**

work — worked, fire — fired, learn — learned, park — parked, note — noted, found — founded, remain — remained, study — studied, combine — combined, invent — invented.

**7. Прочтите и переведите следующие словосочетания:**

the beginning of the century, the structure of the world, the particles of the atom, the nature of the particles, the limit of divisibility, the forms of matter, the end of the year, the quantity of information, the motion of the molecules; the material world, the invisible particles, the exact nature, the common substances, the simple forms, the chemical elements, the larger molecules.

**8. Запомните произношение следующих слов:**

believe [bi'li:v] — верить, at once [ət'wʌns] — сразу, сейчас же. achieve [ə'tʃi:v] — достигать, добиваться, discovery [dis'kʌvəri] — открытие, group [gru:p] — группа, группировать(ся), weight [weit] — вес.

**ТЕКСТ**

**A LESSON IN THE HISTORY OF LITTLE THINGS**

Until the beginning of the seventeenth century mankind had little understanding of the structure of the material world. Man believed that stones were stones, fire was fire, and water was simply water. Now we know that all kinds of substances consist of very small

invisible particles — atoms. They make up all the elements and compounds that exist in the world, the air that man breathes, the ground on which he walks, man's food. Their interactions provide the energy that man uses.

In this connection, the question at once arises what are atoms like? The determination of the exact nature of nature was a very difficult and interesting problem. For a hundred years some of the best men of science on earth thought of it, and today many scientists do a lot of research.

The word atom came from the Greek and means "indivisible". The ancient Greeks studied the structure of matter and noted that it is possible to divide and further subdivide a stone until the particles become like powder, which they thought was the limit of divisibility. The same was true for other common substances, such as wood or water or minerals. They called these smallest particles atoms. But since the Greeks were philosophers and not experimenters, they had no real understanding and knowledge of the true structure of matter.

It was at the beginning of the nineteenth century that the scientists first established experimentally the atomic theory of the structure of matter. They found that the simple forms of matter were chemical elements which consisted of atoms — particles of very small size.

At the end of the nineteenth century scientists achieved a great quantity of information on the atomic structure of matter and the general nature of the atom. They discovered most of the chemical elements and found that the atoms of each element were different in chemical and physical properties from the properties of other elements.

A further discovery was that the atoms combine in small numbers and form units of matter or molecules and that in all substances the atoms and molecules are in a state of rapid motion. Besides, some fundamental chemical characteristics became clear. One of these was that atoms group according to their atomic weights into eight groups the chemical properties of which are similar.

#### ПОЯСНЕНИЯ К ТЕКСТУ

have little understanding мало понимать  
all kinds of substances всевозможные вещества  
in this connection в связи с этим

at once сразу, тотчас же  
what are atoms like что представляют собой атомы  
a great quantity of очень много

#### WHAT IS A MOLECULE?

(Dialogue)

St u d. 1: What does the word molecule mean?

St u d. 2: The word molecule means a little structure. It is a combination of two or more atoms. If the atoms are of different kinds,

we call the combination a compound, and the molecule is the smallest possible unit of that compound.

Stud. 1: Two or more atoms of the same element combine and form a molecule. For example; oxygen in molecular form consists of two atoms of oxygen. However, such a molecule is not a compound as it divides and gives two atoms of oxygen.

Stud. 2: Is it possible to subdivide the molecule and not destroy the compound?

Stud. 1: Oh, no, it's impossible. As we know, a molecule of water consists of two atoms of hydrogen and one of oxygen; therefore, the molecule  $H_2O$  is the smallest quantity of water that exists. If we divide it further, the substance will not be water any more — all we get are two gases, hydrogen and oxygen.

Stud. 2: Then it is interesting to note that the physical form of an element has no connection with the form of the compound. Here two gases combine and form water. Such combinations are common in chemistry.

Stud. 1: Now, let's see, how big are molecules?

Stud. 2: Molecules differ greatly in size and weight. Some of the larger molecules which are characteristic of plastics are very, very big. Molecules of common size cannot be seen in a microscope, but very large molecules are seen in the electron microscope.

## УПРАЖНЕНИЯ

### I. Переведите прилагательные и образованные от них наречия:

simple — simply, experimental — experimentally; general — generally, common — commonly, chemical — chemically, similar — similarly, rapid — rapidly.

### II. Найдите в тексте синонимы к следующим словам и переведите их на русский язык:

humanity, matter, to supply, many, usual, during, as, to reach, amount, quick, similar.

### III. Переведите на английский язык следующие группы слов одного корня:

понимать — понимание; существовать — существование; использовать — использование — польза — полезный — бесполезный; определять — определение; трудный — трудность; наука — ученый — научный; знать — знание; делить — деление — делимость — делимый — неделимый; достигать — достижение; сообщать — сообщение; открывать — открытие; различаться — различие — различный; двигаться — движение.

### IV. Проанализируйте следующие предложения и переведите их на русский язык; обратите внимание на значение слова "that":

1. Now we know **that** all substances consist of very small invisible particles — atoms. 2. Atoms make up the air **that** man breathes, the food **that** he eats, the ground on which he walks, and their interactions provide the energy **that** he uses. 3. It was at the beginning of the nineteenth century **that** the scientists first established experi-

mentally the atomic theory of the structure of matter. 4. A further discovery was **that** the atoms combined in small numbers formed molecules and **that** in all substances the atoms were in a state of rapid motion. 5. The physical form of an element has no connection with **that** of the compound.

V. Переведите на русский язык следующие предложения с усилительным оборотом *it is (was) ...that (which, who)*:

1. It was under Soviet power that research and technique became weapons of the people. 2. It was Mendeleyev who established the periodic table of elements. 3. It is our country which uses all scientific discoveries for human benefit. 4. It is the Soviet Union that launched the first man into outer space.

VI. Поставьте вопросы к выделенным членам предложения и переведите каждое из них на русский язык:

1. At the end of the nineteenth century scientists discovered most of the chemical elements. 2. The word atom came from the Greek word "indivisible". 3. Atoms make up all the elements and compounds in the world.

VII. Напишите следующие предложения в утвердительной форме и переведите их на русский язык:

1. Did you begin to study the theory of the structure of matter? 2. He did not understand the importance of this work. 3. Will you use the results of this discovery in your work? 4. This scientist does not experiment on this substance.

VIII. Образуйте Past Indefinite от следующих глаголов и переведите их на русский язык:

to do, to find, to say, to be, to make, to give, to know, to have, to become, to begin, to understand, to arise, to come, to think.

IX. Напишите степени сравнения следующих прилагательных и переведите их на русский язык:

little, simple, small, difficult, good, great, early, possible, far, much, important, bad.

X. Составьте предложения из следующих групп слов, переведите их на русский язык:

1. scientists, today, many, a lot of, do research. 2. smallest, these, they, particles, called, atoms. 3. nineteenth, beginning, the, of, scientists, established, the, at, of, first, theory, the, experimentally, of, the, structure, atomic, matter, century. 4. scientists, establish, did, the, when, atomic, of, theory, matter, of, structure, the? 5. atoms, state, in, molecules, rapid, a, are, motion, and, of?

XI. Переведите на английский язык, употребляя там, где это возможно, форму притяжательного падежа:

1. Ученые Советского Союза имеют большие достижения в области исследования космоса. 2. Периодическая система Менделеева очень важна для развития науки. 3. Газеты часто упоминают о достижениях этого молодого ученого. 4. Знание строения материи необходимо для физиков и химиков.

## **XII. Переведите на английский язык следующие словосочетания:**

экспериментальная работа ученых, достижения наших ученых, область науки, значение исследовательской работы, народы мира, достижения науки, оружие народа, движение атомов, строение материи, свойства материалов.

## **XIII. Переведите на английский язык, обращая внимание на притяжательные местоимения:**

1. Я взяла свои материалы и начала проводить опыты. 2. В лабораторию пришли мой товарищ и его брат. 3. Я не видела его долгое время. 4. Он проводил свои исследования в заводской лаборатории. 5. Большинство наших ученых работает на заводах, так как их работа очень важна для промышленности. 6. Мы много слышали об этом заводе и его лабораториях. 7. Заводская газета писала о них и об их экспериментах, а также об их достижениях в области физики.

## **XIV. Напишите краткие утвердительные и отрицательные ответы на следующие вопросы; переведите предложения на русский язык:**

1. Do you work in the field of physics? 2. Is this young man an engineer? 3. Did you make a lot of research last year? 4. Did you achieve good results in your research work? 5. Have you an idea of the true structure of nature? 6. Are you a research worker?

## **XV. Переведите на английский язык следующие порядковые числительные: первый, второй, третий, четвертый, пятый, пятнадцатый, двадцатый, сотый.**

## **XVI. Напишите во множественном числе:**

1. This scientist works in the field of physics. 2. I don't know the structure of this substance. 3. An atom is a very, very small particle of matter. 4. That man has a good knowledge of mathematics.

## **XVII. Определите степени сравнения прилагательных и переведите каждое предложение на русский язык:**

1. The **smallest** particles that we see through a microscope are much **larger** than the molecules. 2. **Lighter** molecules move with **greater** speeds than **heavier** molecules. 3. Water is one of the **most common** things in our life. 4. From the **earliest** times people dreamed of air flights. 5. The **greatest** part of the matter around us is liquid or gas. 6. Zinc is **cheaper** than other metals. 7. The planet Mars is much **less massive** than the Earth but its density (плотность) is **greater** than that of the crystal rock (порода) of the Earth. 8. Silver is one of the **best** conductors of electricity. 9. Lead is one of the **heaviest** metals.

## **XVIII. Ответьте на следующие вопросы:**

1. What do all substances consist of? 2. Where does the word atom come from? 3. When did scientists first establish experimentally the atomic theory of the structure of matter? 4. What are atoms

like? 5. What properties of elements did scientists discover at the beginning of the 19th century?

**XIX. Расскажите текст урока 3.**

**Контрольный текст. Прочтите и изложите устно без перевода:**

**SCIENTISTS DISCOVER NEW PARTICLES**

People once thought that atoms were like very, very small indivisible balls. Now we know that atoms consist of many fundamental particles. We know about 100 such particles. Only in 1965 scientists discovered one of them, the omega-minus particle. Its discovery was very important because it helped scientists to arrange these very, very small particles like chemists arrange the elements in Mendeleev's table.

Nearly 100 years ago Mendeleev found that when the elements are arranged in the order of their atomic weights, every eighth element has similar properties.

This led scientists to foretell the existence of elements which, up to then, were not found in nature.

Now nuclear physicists with the help of giant accelerators are looking for new bits of atoms.

**ПОЯСНЕНИЯ К ТЕКСТУ**

once когда-то  
are looking for ищут  
bits of atoms (зд.) элементарные частицы

**LESSON 4**

**Грамматический материал:**

предложные словосочетания;  
оборот there is, there are;  
неопределенные местоимения some, any;  
отрицательное местоимение no;  
many, much, few, little;  
модальные глаголы can, may, must  
и их эквиваленты в прошедшем  
и будущем времени;  
особенности обстоятельственных придаточных  
предложений времени и условия;  
словообразование

**УПРАЖНЕНИЯ В ЧТЕНИИ**

**1. Чтение односложных слов:**

(1, 21, 22) hand, skate, grain, paint, shape, part, fare, air, block, strong, stone, force, still, bring, think, ice, times, till, mean, steam, free, heat, each, lump, pound, thus, pure, mute;  
(3) work, word, world, worm, worst, worth.



**2. Чтение двусложных слов с ударением на конечном слоге:**

(12—16) exist, consist, divide, contain, attract, expand, begin, vibrate; around, within, apart; amount.

**3. Чтение двусложных слов с ударением на начальном слоге:**

(13—16) vapour, carbon, substance, mixture, common, normal, number, equal, single, compound, differ, vessel, only, able, meaning, further.

**4. Чтение многосложных слов с ударением на третьем от конца слоге:**

(29—32) experiment, several, original, definite, quantity, physical, continual, occupy, typical, phenomenon.

**5. Запомните произношение следующих слов:**

building ['bɪldɪŋ] — здание, строительство, строительный, move [mu:v] — двигать(ся), change [tʃeɪndʒ] — изменение, изменять(ся), heavy ['hevi] — тяжелый, ocean ['ouʃn] — океан, piece [pi:s] — кусок.

**6. Прочтите и переведите следующие предложные словосочетания:**

to live in an ocean of air, gas around our planet, a mixture of several gases, the normal state for the substance, one of the possible states, the characteristics of the compound, the answer to this question, to consist of molecules, every portion of the vessel, to move within the body of the liquid.

**ТЕКСТ**

**MOLECULAR MOTION AND THE STATES OF MATTER**

We live in an ocean of air. There is a great quantity of gas around our planet: we call this gas air and experiments show that it is a mixture of several gases — oxygen, nitrogen, carbon dioxide, water vapour and others. When we think of the substance which we call water, we commonly think of it as a definite liquid. It does not mean, however, that that is the only possible state in which water can exist. The liquid state is the normal state for the substance which we call water, but water can exist also as a gas and as a solid; in the gaseous state it changes to steam or water vapour, and in the solid state it becomes ice. Many substances can and do at various times exist in more than one of these three possible states.

A lump of salt may consist of a number of grains of salt. If we divide the lump into some small parts we still have salt. Further subdivision will in the end bring us to a single grain of salt. We may divide the grain of salt again and again; still the pieces will all have the characteristics of the compound that we call salt. The last particle which still has the characteristics of the original compound is a molecule of salt. In general, substances consist of mole-

cules; molecules are therefore the building blocks of the physical world, though not the fundamental blocks, for molecules consist of atoms.

There is an equal number of molecules of the same kind in a pound of water as in a pound of steam or in a pound of ice. Why, then, do the various states exist and why do they differ so greatly? The answer to this question lies in the very fact that the molecules move differently in the three states.

In gases we find that the gas molecules are free to move and they are quite far apart. We find that gas molecules move rapidly and continually, spread and occupy every portion of the vessel which contains them. A body of gas therefore has no definite volume or shape, but takes the volume and shape of the vessel.

A solid, on the other hand, has both volume and shape. The molecules of a solid are also in motion, but they can move only a small amount because the atoms are very close together. The closer the molecules are together, the less free they are to move.

The liquid state is between the gaseous and solid states. The molecules of a liquid are less free to move than the gas molecules, but are more free to move than the molecules of a solid. A molecule is able to move within the body of the liquid from point to point and there exists an attractive force between the molecules. If a molecule moves very fast, it may overcome the force of attraction and will become a molecule of vapour; such a process is typical of the phenomenon which we know as vaporization.

### ПОЯСНЕНИЯ К ТЕКСТУ

can and do at various times exist могут в разное время существовать и действительно существуют  
a number of ряд, некоторое количество  
in general вообще  
the building blocks of... элементы, из которых состоит...  
...lies in the very fact that... заключается как раз в том, что

...are free to move могут свободно двигаться  
they are quite far apart они находятся очень далеко друг от друга  
on the other hand с другой стороны  
both ... and и ... и, как ... так и  
close together очень близко друг к другу  
the closer... the less free чем ближе, тем менее свободно

### УПРАЖНЕНИЯ

I. Напишите прилагательные, соответствующие следующим существительным, и переведите на русский язык:

importance, difference, dependence, existence, distance.

II. Найдите синонимические пары:

quantity, to call, several, usually, within, some, for, rapidly, various, since, fast, commonly, to name, different, therefore, shape, form, that is why, in, characteristic, number, property.

III. Переведите на русский язык группы слов одного корня:

to define — definition — definite — indefinite — indefinitely; to exist — existence; to mean — meaning; to free — freedom — free —

freely; gas — gaseous; to equal — equality — equation — equally; to continue — continuation — continuous — continual — continually; to occupy — occupation; to contain — container — content; to vaporize — vapour — vaporization — to evaporate — evaporation; to attract — attraction — attractive.

IV. Переведите на английский язык, используя слова и выражения из текста:

1. Мы проведем ряд экспериментов с несколькими газами. 2. Вообще молекулы газа движутся свободно и могут находиться очень далеко друг от друга. 3. Как строение молекул, так и строение атомов представляет очень большой интерес для ученых. 4. Жидкость — это не единственное состояние, в котором может существовать вода. 5. Молекулы — элементы, из которых состоит физический мир.

V. Переведите на русский язык, обращая внимание на значение выделенных слов:

1. When we compress a gas the **number** of molecules in each cubic centimetre increases. 2. Chemists produced a **number** of new elements by means of nuclear reactors. 3. Some substances exist **both** in crystalline and noncrystalline forms. We find **both** these properties in sulphur. 4. The Soviet **state** takes great care of scientists. 5. There are three **states** of matter. They are solid, liquid and gas. 6. There are fifty **states** in the United States of America. 7. Many of our electric stations use the **power** of water. 8. In 1917 the working class of Russia took over the **power** and established the first socialist **state** in the world. 9. The molecules of gas are in a **state** of **very** rapid and continual motion. 10. The **very** common air that we breathe can condense into a clear liquid.

VI. Определите препозитивную и постпозитивную группы в следующих предложных словосочетаниях, переведите на русский язык:

to think of the substance; changes to steam, exist at various times, to divide into small parts, bring to a single grain of salt, to consist of molecules, the building blocks of the physical world, to be in motion, to move within the body of the liquid, an attractive force between the molecules.

VII. Переведите предложения на русский язык и поставьте вопросы к выделенным членам предложения:

1. There are many post-graduates in our institute. 2. A foreign delegation visited the research institutes of our city. 3. We can determine the **pressure** of our atmosphere with the help of a barometer. 4. A molecule moves about within the body of the liquid **from point to point**. 5. In the nineteenth century scientists established **experimentally** the atomic theory of the structure of matter.

VIII. Переведите на русский язык:

1. There are more than a hundred different atoms. These atoms combine with each other in many different ways and make up the

thousands of different molecules of which matter consists. 2. There are hundreds of thousands of substances — combinations of elementary forms of matter. We call them compounds. 3. There is a connection between atmospheric pressure and the weather. 4. There exist many substances in more than one of three possible states. 5. There was much activity among the experimenters in the field of nuclear research. 6. There are molecules of different size and weight. 7. At the present time there are sputniks which travel round the sun.

**IX. Напишите следующие предложения в вопросительной и отрицательной форме, переведите каждое из них на русский язык:**

1. There are some interesting articles in this magazine. 2. There are some books on chemistry in this bookcase. 3. There is something interesting on this subject in the library. 4. There were some foreign delegations in our institute. 5. There will be many interesting reports at the conference. 6. There was a scientific conference not long ago. 7. There are some radioactive elements in our laboratory. 8. They have books in different fields of science in their library. 9. We must provide all the necessary materials for the experiment. 10. They will be able to begin their research in some days. 11. This post-graduate can submit his thesis next month. 12. There is somebody in the laboratory. 13. This post-graduate has some books on the structure of matter. 14. We can see large molecules in an electron microscope. 15. Chemists discovered some important elements not long ago.

**X. Переведите на русский язык, обращая внимание на значения слова "there":**

1. I work at the library as there are many kinds of books and dictionaries there. 2. There are many scientific workers at our institute. They work there many years. 3. There was a scientific conference at our institute. Many students were present there. 4. There will be many interesting reports at the conference. We shall go there.

**XI. Вставьте much или many, little или few, объясните их употребление и переведите следующие предложения на русский язык:**

1. ... scientists study the structure of matter. 2. We haven't ...time for the experiments; we shall be able to make very ... of them. 3. There were ... theories on the nature of heat. 4. There is ... water in this cup.

**XII. Напишите в прошедшем и будущем времени; переведите на русский язык:**

1. The scientists must study the composition of this substance. 2. The students may use different methods of work. 3. They can show their achievements. 4. He may work at the laboratory of our institute.

### XIII. Переведите на русский язык и объясните употребление времен:

1. When we finish our experiment, we shall be able to make a report about it. 2. As soon as you determine the structure of this substance, you will have to study the properties of the elements of which it consists. 3. If we divide a lump of salt into smaller lumps and then subdivide them into still smaller lumps, we shall get a single grain of salt in the end.

### XIV. Переведите на английский язык:

а) 1. Есть ли в вашем институте аспирантура? Да. 2. У нас много аспирантов. 3. В нашем институте есть стационарная и заочная аспирантура. 4. У них есть все условия для исследовательской работы, так как в институте есть много лабораторий с современным оборудованием и приборами.

б) 1. В молекуле воды имеется два вещества — кислород и водород. 2. В природе имеется свыше 100 элементов. 3. В СССР много ученых, которые внесли большой вклад в мировую науку. 4. В нашей стране будет много атомных электростанций. 5. У нас есть много талантливых ученых. 6. Мы сможем провести ряд опытов с этими веществами. 7. Студенты должны были определить свойства материалов перед проведением опытов. 8. Можно ли нам начинать экспериментальную работу? Нет, вам придется раньше изучить теорию. 9. Нам разрешат проводить экспериментальную работу, как только мы изучим основные теоретические вопросы. 10. До Октябрьской революции в нашей стране было мало заводов, фабрик и электростанций. 11. В нашей стране много нефти и угля. 12. Не так давно у нас добывали мало природного газа. 13. В этом журнале была интересная статья об элементарных частицах. 14. У наших ученых есть все условия для плодотворной работы.

### XV. Вставьте недостающие слова и переведите следующие предложения на русский язык:

I make my experiments every day  
he ... .. experiments every day  
she ... .. experiments every day  
we ... .. experiments every day  
you ... .. experiments every day  
they ... .. experiments every day

### XVI. Определите, к какой части речи относятся выделенные слова:

1. Our students did brilliant **work** in the field of physics. 2. These scientists **work** in the field of physics. 3. The Soviet **people** have great achievements in the development of science. 4. Many different nationalities **people** the Soviet Union. 5. We **make** many experiments in the laboratory. 6. These instruments are of the latest Soviet **make**. 7. All the world knows the **name** of the great Russian scientist Mendeleev. 8. We **call** the smallest physically indivisible particles of matter atoms. 9. **Radio** and electronics are very important in space research. 10. The instruments **radio** all the necessary information from our spaceships.

**XVII. Переведите на русский язык, обращая внимание на выделенные слова:**

1. An experiment will show that in air molecules occupy **only** a small portion of the space. 2. The liquid is not the **only** possible state in which water can exist. 3. The gas molecules **do** have attraction for one another although the attraction is very small. 4. We live at the bottom of an ocean of air and usually we **do** not notice its pressure. 5. Solids **do** not flow as liquids **do**, and they **do** not expand and occupy place as gases **do**. 6. The electrical power **does** much useful work today. 7. **Since** there is so much water, some people think that it is of little value or interest. 8. We **still** use alcohol in modern thermometers, **since** its expansion is greater than the expansion of mercury. 9. **Since** ancient times people studied nature and natural phenomena. 10. The molecules of gas move rapidly and continually. When we heat the gas the motion of the molecules becomes **still** more rapid. 11. Air, like the ocean, is never **still** but always full of waves.

**XVIII. Переведите на русский язык:**

1. The more experiments scientists make, the greater is their knowledge of the structure of matter. 2. The more Soviet scientists study and experiment, the greater are the achievements of our country. 3. The smaller the particles, the faster they move.

**XIX. Переведите на английский язык следующий диалог:**

- Как мы называем газ, который окружает нашу планету?
- Мы называем его воздух.
- Что представляет собой воздух?
- Воздух — это смесь нескольких газов.
- В каких состояниях может существовать вода?
- Вода существует в жидком, твердом и газообразном состоянии.
- Из чего состоят все вещества?
- Все вещества состоят из молекул, которые являются элементами физического мира.
- А из чего состоят молекулы?
- Молекулы состоят из атомов.
- Как движутся молекулы в газах, твердых телах и жидкостях?
- Они движутся по-разному, и это определяет существование различных состояний вещества.

**XX. Ответьте на следующие вопросы:**

1. What do we call the gas around our planet? 2. Is air a single gas or a mixture of several gases? 3. What gases does air consist of? 4. In what states can substances exist? 5. What do substances consist of? 6. What do molecules consist of? 7. In what way do molecules move in solids, liquids and gases?

## STATES OF MATTER: SOLIDS, LIQUIDS AND GASES

To understand the various states of matter and their connection to each other, we must understand the meaning of the word molecule.

We can divide a piece of material into small parts and then subdivide each of these small parts into still smaller parts. We shall continue this process of division until the parts become very, very small. In the end they will become so small that it will be impossible to divide them further. We call these smallest particles atoms. They are the fundamental building blocks of all materials and they have a definite attraction for each other.

Atoms combine into molecules and molecules may contain one, two, three and more atoms. In metals there is only one atom in a molecule, for example.

The molecules of a solid are very close together and have a great attraction for each other. The closer they are together, the heavier is the solid; however, the molecules are in a state of continual vibration. In this state their attraction for each other is very great, and that is why it is very difficult to change the shape of a solid.

Now, if we heat the solid, the molecules begin to vibrate more and more and therefore there is less attraction for each other. Thus, a solid expands when we heat it. When the molecules are quite far apart from each other, the solid changes into a liquid.

If we continue to heat the liquid, the molecules begin to vibrate so strongly and they move so far apart from each other that they will have very little attraction for each other. Now the liquid becomes a gas which has no definite size.

The three states of matter — solid, liquid and gaseous — are very close to each other and more heat or less heat will change the substance from one state to the other. Ice, water and steam are examples of this change of state.

### ПОЯСНЕНИЯ К ТЕКСТУ

...have a great attraction for each other  
сильно притягивают друг дру-  
га

they move so far apart from each  
other они так далеко отодвигаются  
друг от друга

## LESSON 5

### Грамматический материал:

Past Participle;  
группа времен Indefinite (passive);  
понятие о герундии;  
безличные предложения;  
предлоги to, with, by как  
эквиваленты падежей;  
словообразование

## УПРАЖНЕНИЯ В ЧТЕНИИ

### 1. Чтение односложных слов:

(4) kind, mind, bind, find, blind, grind [aɪ];  
(21) show, blow, flow, row, low, grow [ou]; how, now, town, brown, down [au].

### 2. Чтение двусложных слов с ударением на конечном слоге:

(12—16) affect, transform, return, subject, allow, obtain, occur, combine, produce, observe, consist, entire, without, unless.

### 3. Чтение двусложных слов с ударением на начальном слоге:

(13—16) matter, substance, heating, cooling, powder, proper, active, thousand, hundred, nature, under, product, common, compound;

(13) liquid, solid, rapid, chemist, acid, limit, habit, planet, rivet, volume, value, menu.

### 4. Чтение многосложных слов с ударением на третьем слоге от конца:

(29—32) evaporate, original, property, physical, family, natural, analysis, synthesis, individual, democracy, origin, typical;

(30) gaseous, sodium, material, serious, experience, radial, period, radio, transformation, combination, illustration, formation.

### 5. Чтение слов, оканчивающихся на -s:

kinds, changes, affects, masses, states, solves, substances, transforms, conditions, products, elements, gases, means, reactions, liquids, processes.

### 6. Запомните произношение следующих слов:

meant [ment] — Past Indefinite и Past Participle глагола to mean, sugar [ˈʃʊɡə] — сахар, dissolve [dɪˈzɒlv] — растворять(ся), pressure [ˈpreʃə] — давление, break [breɪk] — ломать(ся), разрушать(ся).

### 7. Прочтите и переведите следующие словосочетания:

affect the state, heat the liquid, cool the vessel, change the condition, transform into iron, combine the substances, observe the transformation, produce the material, divide the atoms, go into combination;

affected by heating, subjected to changes, obtained from iron, dissolved in water, produced by cooling, divided into particles, grouped into molecules, broken by force, changed by combining.

## ТЕКСТ

### PHYSICAL AND CHEMICAL CHANGES

Transformations are of two kinds, known as physical and chemical changes. Physical changes are those which affect the state or condition of matter without changing its composition. There is



no change in the composition of a substance when it is transformed from the liquid to the gaseous state by heating, or from the liquid to the solid state by cooling, and vice versa. Thus, in all three states, steam, water, and ice are all the same substance, made up of the simpler substances, hydrogen and oxygen. The state, but not the composition is affected by the process of heating or cooling.

By changes in the condition of a substance are meant changes such as when a solid mass is made to fine powder, salt or sugar are dissolved in water. It is clear that such transformations like the changes from one state of matter to another, do not affect the composition of the material. The fine powder of a substance may be made solid again, and we get back the salt or sugar unchanged by evaporating the water.

Chemical changes, however, are those matter changes in which a change of composition does take place and the new substance formed will not return to its original state, unless it is subjected to another chemical change. Thus iron, when it is affected by moist air, is slowly transformed into iron rust entirely different in its properties from the original iron. The new substance will not become iron again when it is allowed to stand, although the iron can be obtained from it if it is subjected to the proper conditions.

Thousands of physical and chemical changes take place in nature, and in a laboratory it is possible to cause many other changes artificially which do not occur naturally. For example, by subjecting air to very great pressure and cooling it is possible to transform it to the liquid state — a physical change; while by means of changing the materials which are combined, or the conditions under which they are combined, many substances will be produced by the chemist, some of which are formed in nature while others are not. In observing these transformations, it is important to be able to distinguish between physical and chemical changes.

## ПОЯСНЕНИЯ К ТЕКСТУ

**without changing** не изменяя  
**are meant** подразумеваются  
**... is made to fine powder** превращается в мелкий порошок  
**when it is allowed to stand** (зд.) в нормальных условиях

**which do not occur naturally** которые не происходят в естественном состоянии (в природе)  
**by means of** посредством, с помощью  
**the conditions under which ...** условия, при которых...

## УПРАЖНЕНИЯ

I. Образуйте при помощи суффикса -er (-or) существительные от нижеследующих глаголов, переведите каждое слово на русский язык:

to invent, to produce, to teach, to work, to write, to conduct, to transform.

II. Напишите, от каких существительных образованы следующие прилагательные, и переведите каждое слово на русский язык:

physical, technical, original, continual, natural, chemical, industrial.

**III. Определите, к какой части речи относятся следующие слова, подчеркните в них суффиксы и переведите на русский язык:**

transformation, substance, composition, usually, slowly, condition, continually, scientist, natural, chemist.

**IV. Найдите в тексте синонимы к следующим словам, переведите их на русский язык:**

change, to consist of, to go back, completely, to permit, to get, to happen, for instance.

**V. Найдите в тексте антонимы к следующим словам и переведите их на русский язык:**

unlike, old, changed, same, solid, artificially, few, rapidly.

**VI. Составьте предложения из следующих групп слов; переведите их на русский язык:**

1. two, are, of, kinds, there, changes, and, physical, chemical.  
2. physical, thousands, place, of, nature, changes, take, in. 3. physical, do, change, transformations, of, not, composition, the, substances.

**VII. Определите время сказуемого и переведите на русский язык (где возможно, дайте несколько вариантов):**

1. Many experiments with different kinds of gases were made in the laboratory. 2. The substance formed was made up of two elements. 3. When water was heated evaporation took place. 4. Various materials will be used for our report. 5. The substances obtained were subjected to a chemical change. 6. All the necessary conditions for the work of our scientists are provided by the Soviet Government. 7. Different new elements are produced artificially. 8. Some weather sputniks will be launched this year. 9. The St. Petersburg Academy of Sciences was established as early as 1725. 10. Atoms can be further divided into still smaller particles. 11. Substances can be changed from one state into another. 12. Air can be liquefied if it is subjected to great pressure and cooling. 13. Atomic energy must be used for peaceful purposes.

**VIII. Определите функцию Past Participle в следующих предложениях и переведите их на русский язык:**

1. The heroic spaceflight made by a Soviet man opened a new era in history. 2. We use many materials found in the earth. 3. Many materials can be found in the earth. 4. Every substance is made up of particles so small that they cannot be seen even under a good microscope. 5. The particles called molecules cannot be divided without changing the nature of the substance. 6. The substance formed possessed important properties.

**IX. Определите функции слова с окончанием -ed и переведите следующие предложения на русский язык:**

1. Iron and steel are both produced from iron ore. 2. The steel produced by our plant is of high quality. 3. Scientists produced new

elements in nuclear reactors. 4. For very low temperature work gases are the only substances that can be used. 5. The two very important types of thermometers widely used in industrial processes are electrical in character. 6. We used both types of thermometers in our work. 7. Our laboratory will be provided with all the necessary instruments. 8. The instruments provided by our plant are very accurate. 9. This plant provided a great number of accurate instruments last year. 10. The first sputnik was created in the Soviet Union. 11. The automatic space station created provides important information on space. 12. Soviet scientists and engineers created the first spaceship in the world.

**X. Определите функции герундия и переведите следующие предложения на русский язык:**

1. We spend energy in lifting an object. 2. By adding heat we cause a greater motion of the molecules. 3. By studying and experimenting man came to know the structure of matter. 4. You cannot transform water into steam without heating it. 5. The barometer is an instrument for determining atmospheric pressure. 6. In changing water into ice its composition is not changed. 7. Science cannot be studied without experimenting. 8. Electronics opens up wonderful possibilities for controlling various technological processes.

**XI. Переведите на английский язык при помощи страдательного залога:**

1. Работу нашего профессора использовали многие ученые. 2. Нами было проделано большое количество опытов. 3. Состав этого вещества будет определен экспериментально. 4. Нам разрешают проводить разные опыты в нашей лаборатории. 5. Можно ли продолжать нашу исследовательскую работу? 6. Когда будут известны свойства этого газа?

**XII. Переведите на русский язык, обращая внимание на значение выделенных слов (it, that, those):**

1. The principle of conservation of energy states **that** energy is uncreatable and indestructible: **it** states **that** in everything **that** occurs in the world a transformation of energy is all **that** takes place; **it** says **that** after it changes form, **it** is in sum total always of the same amount. 2. Water is one of the few substances **that** man knows well and uses in all of its three forms. **It** is a substance made up of two gases, hydrogen and oxygen. **It** is impossible to live without water. **It** is water **that** is the most common thing in our life. 3. The density of the liquid air is only a little less than **that** of water. 4. The substances **that** must have a long time to be heated will keep their heat much longer than **those that** can be heated more rapidly. 5. At temperatures higher than **those** mentioned before most substances melt or evaporate. 6. **That** part of the atmosphere which is above 7 miles is called stratosphere.

**XIII. Переведите на русский язык:**

1. It is hot in summer. 2. It often rains in autumn and it snows in winter. 3. What time is it? It is twelve o'clock. 4. It is not dif-

difficult to distinguish between chemical and physical changes. 5. It is necessary to subject a body to a chemical change if we want to alter its composition. 6. It will be remembered that weather changes are often caused by cyclones and anticyclones.

**XIV. Напишите три основные формы следующих глаголов:**

to know, to heat, to make, to mean, to glow, to be, to do, to become, to take, to put, to bring, to leave, to fly, to show.

**XV. Поставьте, где нужно, предлоги и переведите на русский язык:**

Professor Niels Bohr, the well known Danish physicist, delivered a lecture ... the students ... Moscow University. "To-day, I shall tell ... you ... the development ... nuclear physics which was greatly enriched ... the scientists ... your great country", Niels Bohr said ... the students. He gave ... the students many examples ... contributions made ... our scientists ... world science. "At the beginning ... the 20th century the physicists came up against very great difficulties caused ... the discovery ... the microworld", he continued. The scientist spoke in detail ... the formation ... the modern idea ... the microworld, the development ... quantum physics and the discovery and use ... the tremendous energy ... atomic nuclei. Future physicists, mathematicians, chemists, philosophers who were present ... the lecture delivered ... professor N. Bohr listened ... great attention. ... the end ... the lecture N. Bohr spoke ... the prospects ... physics and ... the great role played ... such instruments as electronic microscopes, radio telescopes and other instruments in the studies ... micro- and macroworlds.

**XVI. Вставьте нужную форму прилагательного и переведите следующие предложения на русский язык:**

1. Liquid nitrogen is (light) than water. 2. Liquid oxygen is not as (light) as liquid nitrogen. 3. Zinc is one of the (cheap) metals. 4. Lead is (heavy) than aluminium. 5. Metals are (good) conductors of electricity.

**XVII. Ответьте на следующие вопросы:**

1. What are the two kinds of transformations described in the text? 2. What do we call physical changes? Give some examples of physical changes. 3. What do changes in the condition of substances mean? 4. What do we call chemical changes? Give some examples of chemical changes. 5. Does a change of composition take place in a chemical change? 6. In what way is it possible to liquefy atmosphere?

**Контрольный текст. Прочтите и изложите устно без перевода:**

**PRODUCTS OF CHEMICAL CHANGES**

Various combinations of different elements produce all the forms of matter common to the earth: water, sugar, salt, and hundreds of thousands of others. These are chemical compounds which are produced by a chemical combination of two or more atoms.

One of the most important and the most known of all substances is water. However, water is not an element, as it may be divided into two entirely different substances. Water is, therefore, an example of a compound. Table salt is a common material, and it may also be divided into other substances, showing that it is a compound. Water is produced by combining hydrogen and oxygen, in the proportion of two atoms of hydrogen and one atom of oxygen. Salt is a compound of the elements sodium and chlorine, one atom of sodium and one of chlorine.

In chemical compounds the atoms are grouped into molecules. A molecule is, then, the smallest individual unit of a compound, and it will always consist of two or more atoms.

When elements go into chemical combinations, their properties will entirely change. For example, sodium is chemically a very active material, and chlorine is an active gas. When the atoms of these two elements combine, they form a mineral substance. As another illustration, hydrogen and oxygen are both gases that combine chemically and form water. The composition of a compound may be shown by means of two methods, known as synthesis and analysis. Synthesis is the process of combining the elements forming the compound; analysis is the breaking down of the compounds into elements.

The very common substance water may be broken down into elements and these may be combined back again forming water. The determination of the masses making up water shows that the mass of water produced is the same as the sum of the masses of the two combining gases, while in the analysis of water the combined mass of the hydrogen and oxygen formed will be the same as the mass of water in the reaction.

### ПОЯСНЕНИЯ К ТЕКСТУ

common to the earth обычно встречающиеся на земле  
table salt столовая соль

the very common substance широко распространенное в природе вещество

## LESSON 6

### Грамматический материал:

Present Participle;  
группа времен Indefinite (passive);  
бессоюзное подчинение;  
словообразование

### УПРАЖНЕНИЯ В ЧТЕНИИ

#### 1. Чтение односложных слов:

fact, face, scar, rare; stop, spoke, sport, spore; speck, Pete, nerve, sphere; since, splice, skirt, spire; rust, fuse, burn, pure; rain, stay, air; leave, means, clear, seen, steer, earth, learn, heard, search; call, stall, walk, chalk; light, might, tight.

2. Чтение двусложных слов с ударением на начальном слоге:

(12—16) number, common, future, hardness, odour, manner, enter, standard, pressure, hundredth, zero, copper, carbon, tungsten, proton, differ, structure, further, instance, outside.

3. Чтение многосложных слов с ударением на третьем от конца слоге:

(29—32) property, density, solubility, ability, electricity, oxygen, soluble, thermometer; similar, industrial, liberate, industry, negative, positive, element, elementary, physical.

4. Чтение наречий, образованных от прилагательных:

similar — similarly, entire — entirely, physical — physically, electrical — electrically, positive — positively, negative — negatively, industrial — industrially.

5. Запомните произношение следующих слов:

colour [ˈkʌlə] — цвет, taste [teɪst] — вкус, arrange [əˈreɪndʒ] — располагать, размещать, arrangement [əˈreɪndʒmənt] — расположение, размещение.

6. Прочтите и переведите следующие предложные словосочетания:

a great number of elements, the common properties of materials, the standard conditions of pressure, the great quantities of heat, the different atoms of substances, the electronic theory of matter, negative particles of electricity.

## ТЕКСТ

### CHEMICAL ELEMENTS

The fact that a limited number of chemical elements compose all the materials people find on earth shows the importance of each of them. Some of the elements are very common on the earth, others are rare. Many of the elements are never seen in pure form by most chemists, so rare are they. In fact, some seventy-five of the elements make up less than one per cent of the earth. However, the future may discover important uses for some of these little known and rare elements.

Elements are characterized by some properties distinguishing them from other substances. The main of these properties are their colour, hardness, odour, taste, density, solubility in water or other liquids, ability to conduct electricity and others. The ability to burn in air and the manner in which an element enters into chemical reactions with other substances are also properties that help to distinguish one element from another. For example, oxygen is a colourless, odourless, tasteless gas with a density at standard conditions of pressure and temperature of about one seven-hundredth that of water. It is soluble in water, and it becomes liquid at about 180° below zero on the centigrade thermometer.

Similarly, these properties determine whether a substance is necessary or useful industrially. Copper is of great value, being a good conductor of electricity. Carbon and hydrogen are also useful because they combine readily with oxygen, i. e. burn, and in so doing liberate great quantities of heat. Tungsten is valuable because of the several important properties it possesses. It is a hard metal which does not melt when it is heated to high temperatures producing white light. It does not rust and is not affected by cold acids. Thus it is very useful and is now considered one of the very important metals of industry.

The particles all the different atoms consist of are neutrons, protons (positively charged particles) and electrons (negatively charged particles); therefore, the only way in which the chemical elements differ from each other in their composition is in the number and arrangement of these particles in their atoms. Similarly, many of the properties of the elements, both physical and chemical, are determined by the number and arrangement of these particles.

### ПОЯСНЕНИЯ К ТЕКСТУ

some seventy-five около семидесяти  
 пяти  
 on the centigrade thermometer по  
 Цельсию

...is of great value имеет большую  
 ценность  
 i. e. (id est) = that is то есть  
 in so doing при этом

### УПРАЖНЕНИЯ

I. Образуйте от следующих существительных прилагательные при помощи суффиксов -ful и -less и переведите на русский язык:

colour, help, use, power, fruit.

II. Образуйте существительные от следующих прилагательных при помощи суффикса -ity и переведите на русский язык:

electrical, similar, dense, rapid.

III. Найдите в тексте существительные, соответствующие следующим словам, и переведите их на русский язык:

hard, to react, to compose, valuable, important, to arrange, industrially.

IV. Учитывая значение суффиксов -able, -ible, -uble, переведите следующие прилагательные на русский язык:

soluble, valuable, considerable, possible, incomparable, understandable, indestructible, uncreatable, unbelievable, reliable, attainable, dependable, inexhaustible, unsuitable, desirable, practicable.

V. Переведите на русский язык следующие группы слов одного корня:

to vary — variety — variation — various — variable; to change — a change; industry — industrial — industrially; to conduct — conductor; to value — the value — valuable; hard — hardness; to consider — consideration — considerable — considerably.

VI. Найдите в тексте антонимы к следующим словам и переведите на русский язык:

few, small, unlimited, common, positively.

VII. Переведите на русский язык, обращая внимание на выделенные слова и выражения:

1. Solids greatly resist compression. **In fact**, it is impossible to compress them at all. 2. **Whether** we live on land or at sea we spend our entire existence at the bottom of a very great atmospheric ocean. 3. Hydrogen and oxygen exist in nature **both** separately **and** in combination with other substances. 4. The protons and electrons are so small and they are **so far apart** that the atom is nearly all empty space. **In fact**, the matter in the atom constitutes only about one thousand-millionth of the whole space occupied. 5. The ocean of air, **as well as** the ocean of water, is material, as we understand and use this word. 6. In the process of ionization some of the molecules of the substance are divided into two parts. **In so doing**, one of the parts carries with it one or more electrons from the other. 7. The gravitational force between two bodies gets smaller as the bodies **get farther apart**. 8. **According to** the present theory the electrons move in orbits around the nucleus of an atom.

VIII. Дайте краткие утвердительные и отрицательные ответы на следующие вопросы:

1. Do you know the properties of oxygen? 2. Have you any books on chemistry? 3. Are there any chemists in the laboratory?

IX. Проанализируйте следующие предложения и переведите их на русский язык:

1. We live at the bottom of the ocean of air. It is not so dense as water; but its weight is not inconsiderable and the pressure it exerts is almost 15 pounds per every square inch on the surface of our bodies. 2. The number of electrons an atom loses or receives is called its valence. 3. In physics we say work is done only when a body is moved against a resistance or force. 4. Even at the lowest temperatures we can obtain the common gases do not liquefy and freeze if they are kept at low pressure.

X. Определите функцию Present Participle и переведите предложения на русский язык:

1. A substance resisting all ordinary or chemical efforts to decompose it into simpler substances is an element. 2. Being a good conductor, copper is often used in industry. 3. Having a high melting point tungsten is widely used for the production of electric lamps. 4. The changes affecting the composition of materials are chemical changes. 5. Adding heat we can change the state of a substance. 6. A molecule is a compound consisting of two or more atoms. 7. Heating a substance we cause a more rapid motion of its molecules.



#### XI. Переведите на английский язык:

1. Радио было изобретено Поповым. 2. Молекулы твердых тел сильно притягиваются друг к другу. 3. Энергия может преобразовываться из одного вида в другой. 4. Вольфрам считается очень ценным материалом. 5. Атом можно разделить на еще меньшие частицы. 6. В XIX столетии было открыто строение материи. 7. Современная теория космических ракет была разработана Циолковским. 8. На конференции будет сделано несколько интересных докладов. 9. Где используется вольфрам? 10. Когда было изобретено радио? 11. Будет ли новая электростанция построена в этом году?

#### XII. Поставьте *some, any, no* или их производные и переведите предложения на русский язык:

1. There are ... important works in the field of chemistry in our library. 2. Have you ... books on your speciality? 3. Is there ... in the laboratory now? 4. Did you write ... about your experimental work? 5. For many centuries man did not know ... about the structure of matter. 6. Tsiolkovsky wrote ... works which are referred to by many scientists. 7. We shall not go ... to-morrow because we must prepare for the examinations.

#### XIII. Объясните употребление *some, any, no* и переведите на русский язык:

1. **Some** of the materials found in the crust of the earth are very important. 2. **Some** substances may exist as crystals of different forms depending upon the conditions under which they are produced. 3. **No** part of the earth is more necessary to life than our atmosphere. 4. Without an atmosphere there will be **no** clouds, **no** rains, **no** running water and **no** wind. 5. **No** two substances expand alike. 6. Forces acting on a body are in balance when they produce **no** change in the motion of the body. 7. Three forces cannot be in balance if the sum of **any** two is less than the third or if the difference between **any** two is greater than the third. 8. Not long ago iron and steel were the only materials used in the construction of **any** machine. 9. By adding 80 calories of heat, one gram of ice is converted into the liquid state. This addition of the 80 calories does not cause **any** change in temperature.

#### XIV. Определите функцию Participle и переведите на русский язык:

1. Power is the ratio of an amount of work performed divided by the time taken by the performance. 2. A given volume of space is able to hold any number of different gases at the same time. 3. It is known that the atom in the main consists of three particles: the proton and the neutron forming the nucleus with a positive charge and the electrons having a negative charge. The anti-electron, called positron, was discovered in 1932. 4. The stars cannot be seen in the daytime because of the brightness of the sun. 5. The attraction between molecules of a liquid is much less than it is in solids, permitting them to move far away from one another. 6. It is possible to mention thousands of physical and chemical changes taking place in nature.

**XV. Ответьте на следующие вопросы:**

1. How many chemical elements do you know? 2. What is the cause of chemical changes? 3. What is a chemical element? 4. Are all the elements common on the earth? 5. What are the properties of oxygen? 6. Why are copper, carbon and tungsten so valuable?

**XVI. Переведите на русский язык:**

1. It is the electron motion which causes the wave known as radiation. 2. It is by radiation that the earth receives its heat from the sun. 3. It was on September 17, 1957, that the Soviet Government celebrated the 100th anniversary of the birth of their rocket pioneer K. Tsiolkovsky.

**Контрольный текст. Прочтите и изложите устно без перевода:**

**STRUCTURE OF MATTER**

To understand the electronic theory, it is necessary to have a clear understanding of the structure of matter. In elementary physics we are taught that matter consists of very small particles called molecules. These molecules are the smallest physically divisible parts of matter — physically divisible because they can be further subdivided by other means into smaller particles, for instance, by chemical means.

A molecule of water consists of three of these particles: two of hydrogen and one of oxygen. These smaller particles are called atoms. A molecule of water is, therefore, made up of three atoms. Similarly, any substance can always be subdivided into atoms. In some elements, the atom is the same as the molecule.

The atom is still further divisible into smaller kinds of particles which are nothing but particles of positive and negative electricity. Each atom has a nucleus electrically positive and consisting of particles of which the main are the proton, and the neutrons. Outside the nucleus and very far apart from it move electrons, which are negative particles of electricity. All the protons and electrons are the same in all kinds of atoms and the properties of matter are dependent on the way in which they are arranged.

The atom as a whole is neutral, since in any atom there are as many protons as there are electrons, so if one of the electrons leaves the atom, it becomes positively charged.

**ПОЯСНЕНИЯ К ТЕКСТУ**

for instance например  
which are nothing but particles кото-  
рые являются не чем иным, как  
частицами

as a whole в целом  
as many ... as столько же ... сколько

## LESSON 7

### Грамматический материал:

некоторые особенности пассивных  
конструкций в английском языке;  
словообразование

### УПРАЖНЕНИЯ В ЧТЕНИИ

#### 1. Чтение односложных слов:

space, turn, seem, dream, first, rose, found, serve, life, aim, paid, use, quite, clear, due, true, laid, born, burn;

(2—5) work, world, word, worst, worth, worm; blind, find, bind, mind, kind, grind; flight, light, bright, sight, fight, right; last, past, fast, pass, ask, class.

#### 2. Чтение двусложных слов с ударением на конечном слоге:

(12—16) propose, refer, connect, consist, provide, begin, began, begun, remain, became, suggest, return, combine, depend, produce, result, research.

#### 3. Чтение двусложных слов с ударением на начальном слоге:

(13—16) teacher, science, order, rocket, engine, forward, number, publish, early, learner, spaceship, surface, human, method, latest, banner, labour, lifetime, project, later, effort, founder, thinker, poet, enter, struggle, culture, during, progress, grammar, problem.

#### 4. Чтение многосложных слов:

(29—32) century, technical, development, influence, organism, numerous, principle, outstanding, natural, practical, reality, classical; chemistry, university; formulate, decorate, recognize, organize, multiply, occupy;

(30) theory, scientist, diagram, society, series, period, radio, genius, appreciate;

(30) continue, examine, develop, establish, consider, discover, distinguish, deposit.

#### 5. Чтение слов, оканчивающихся на -tion:

(30) solution, communication, publication, condition, attention, connection, edition, application, realization, conversation, foundation, education.

#### 6. Запомните произношение следующих слов:

travel ['trævl] — путешествие, путешествовать, cosmic ['kɒz-mɪk] — космический, idea [aɪ'diə] — идея, basis ['beɪsɪs] — основа, design [dɪ'zain] — проект, проектировать, advantage [əd'vɑ:ntɪdʒ] — преимущество, create [kri:'eɪt] — создавать.

#### 7. Прочтите и переведите следующие словосочетания:

the Russian scientist, the natural sciences, the literary language, the same year, Moscow University, the democratic thought, a found-

ed theory, the other questions; a solution of the problem, the development of science, the surface of a planet, the life of an organism, the aims of the development, the design of a spaceship, the structure of a rocket.

## TEKCT

### KONSTANTIN TSIOLKOVSKY — SPACE TRAVEL PIONEER

At the end of the last century Konstantin Tsiolkovsky, a teacher living in Kaluga, turned to science in order to find a technical solution to a problem which in those days seemed but a dream, the problem of flight into cosmic space.

At the time when man first rose into the air, he proposed rockets for interplanetary communication. In his work "The study of cosmic space by rocket engines" which is often referred to by many scientists everywhere in the world, K. Tsiolkovsky put forward a scientifically well founded theory of cosmic flights. The ideas presented in this work served as basis for the development of the science astronautics.

In 1911—1926 a number of publications were published by K. Tsiolkovsky, which continued his early work. The scientist studied the conditions for the take-off of a spaceship from the surface of a planet and the influence of air resistance on the motion of the rocket, examined questions connected with the life of the human organism in cosmic space and formulated a number of principles the theory of rockets is based upon. Many other questions connected with the aims and methods of developing astronautics were paid attention to in some of his latest works. For example, such problems as the design of a spaceship consisting of several rockets and the advantage of using liquid fuel were dealt with by the scientist.

As early as 1895 K. Tsiolkovsky proposed the idea of creating artificial satellites of the earth. The necessity of such satellites for interplanetary flights is now recognized by all specialists in astronautics. The importance of such satellites as observatories is also quite clear.

The Soviet Government decorated the outstanding scientist with the Order of the Red Banner of Labour, provided him with everything necessary for fruitful work. Some of his ideas were so far in advance of his age that they were not fully understood and appreciated during his lifetime. In later years Tsiolkovsky's works were published in editions he could only dream of in his day. The practical application of the results of his numerous researches began.

Realization of many of the projects due to Tsiolkovsky became possible only in our days. His dream that "mankind must not remain eternally on earth" is now a reality. Tsiolkovsky understood that to realize his dream the efforts of all peoples were necessary.

## ПОЯСНЕНИЯ К ТЕКСТУ

**In order to** для того чтобы  
**pay attention to** уделять, обращать  
внимание

**... were far in advance of his age** да-  
леко опередили его время  
**the projects due to Tsiolkovsky** проек-  
ты, разработанные Циолковским

## LIFE AND WORK OF LOMONOSOV

(Dialogue)

**Teacher:** Last time we spoke about the great Russian scientist, the space travel pioneer, Tsiolkovsky. To go on with our series of conversations on the development of Russian science, to-day we are going to speak about another great scientist of ours.

Now, who will suggest a name?

**Student 1:** May I suggest the great Russian scientist Lomonosov?

**Student 2:** Yes, Lomonosov was the founder of natural science in Russia. He was a materialist thinker and poet who laid the foundations of the Russian literary language and education.

**Teacher (to the students):** When was Lomonosov born and where did he get his education?

**Student 3:** He was born on November 8th, 1711. In January 1731 he entered the Slavonic-Greco-Latin Academy where he studied classical languages.

**Student 4:** At the beginning of 1736 he was sent, as one of the most outstanding students, to the University classes at the St. Petersburg Academy of Sciences, and in the autumn of the same year to the University at Marburg where he studied for three years.

**Teacher:** And where did he work after his return to Russia?

**Student 1:** Lomonosov returned to Russia in 1741 and became assistant professor of the physics class, and in August 1745, professor of chemistry at the St. Petersburg Academy of Sciences.

**Student 2:** You know, he had to work under very difficult conditions, because from the first years at the Academy he carried on a struggle for the development of Russian science and culture.

**Teacher:** Who may tell us why Moscow University was named after Lomonosov?

**Student 4:** Moscow University was named after Lomonosov because it was due to him that Moscow University was founded in 1755. During the second half of the 18th century it became the centre of progressive scientific, atheistic and democratic thought in Russia.

**Student 3:** It's also very interesting to know that he carried on a lot of scientific research in almost all branches of science, and was the author of many scientific works, among them a scientific grammar of the Russian language.

## ПОЯСНЕНИЯ К ТЕКСТУ

**last time** в прошлый раз  
**we are going to speak** мы поговорим

**a lot of scientific research** большая  
научно-исследовательская работа

## УПРАЖНЕНИЯ

I. Образуйте прилагательные от следующих существительных путем прибавления суффиксов -ic, -al, -ous и переведите их на русский язык:

а) science, cosmos, basis, history, hero, economy; б) province, technique, practice, chemistry, physics, industry, origin; в) number, gas, variation, fame, courage.

II. Найдите в тексте синонимы к следующим словам и переведите их на русский язык:

outer space, foundation, purpose, a few, man-made, to supply, ahead of, entirely, use.

III. Найдите в тексте антонимы к следующим словам и переведите их на русский язык:

the beginning, late, landing, inhuman, disadvantage, natural, fruitless, near, to finish.

IV. Переведите на английский язык следующие группы слов одного корня:

решать (вопрос) — решение; открывать — открытие; основывать — основатель — основание; развивать — развитие; исследовать — исследование; влиять — влияние; связывать — связь; сопротивляться — сопротивление; конструировать — конструирование — конструктор; специальный — специалист — специальность; необходимый — необходимость; применять — применение — применимый; число — многочисленный.

V. Найдите в тексте эквиваленты следующих слов и выражений:

для того чтобы, решение проблемы, ссылаться на, выдвигать, ряд, взлет, уделять внимание, например, еще в 1895 г., впереди, благодаря, осуществлять.

VI. Переведите на английский язык, пользуясь словами и выражениями из текста:

1. Для того чтобы запустить первый искусственный спутник, наши ученые должны были решить много важных проблем. 2. Специалисты изучили условия взлета, а также посадки ракет. 3. Ученые всего мира ссылаются на работы К. Циолковского в области космонавтики. 4. К. Циолковский уделял большое внимание вопросу об искусственных спутниках земли, а также вопросу о важности применения жидкого топлива. 5. Еще в 1895 г. он выдвинул идею об искусственных спутниках земли и ряд других важных проблем в области теории космических полетов.

VII. Переведите на русский язык следующие словосочетания:

space flight, rocket motion, air resistance, spaceship design, gold medal, Soviet Government, flight theory, planet surface, fuel supply, energy transformation, rocket propulsion theory, space flight dangers.

**VIII. Переведите на русский язык, обращая внимание на значение слова but:**

1. The atmosphere is not a uniform envelope of gases around the solid earth, **but** has a complicated physical structure. 2. Air is not a compound **but** a mixture of various gases. 3. Nothing **but** the study of outer space can give us the answer to the question of what laws operate in the universe. 4. Mendeleyev not only arranged all known elements in a table **but** he also predicted the undiscovered elements. 5. In liquids and solids pressure reduces the volume **but** little. 6. The mass of the antielectron is equivalent to that of the electron, **but** it has a positive charge.

**IX. Переведите на русский язык следующие предложения, обращая внимание на особенности страдательных оборотов:**

1. Heat is radiated by the sun to the earth, but the land, the sea, and the air are affected differently by this radiation. 2. The positive particle in the nucleus was given the name of the "proton". 3. We were shown a number of experiments illustrating the presence of high-energy particles in the cosmic radiation. 4. The scientists of the world are confronted with the problem of interplanetary flights. 5. The modern scientific forecasts of weather can be fully relied upon. 6. Light may be thought of as some factor that is capable of affecting the eye. 7. The neutron is completely unaffected by a magnetic field. 8. The theory which K. Tsiolkovsky arrived at was based on experimental work. 9. We live at the bottom of an ocean of air, and our lives are constantly influenced by the change and movement of this gas. 10. In mechanics the study of kinematics is followed by the study of dynamics. 11. Friction is an important force that must be dealt with in nearly all motion. 12. A gas may be looked upon as the vapour of a liquid with a very low boiling point or very great vapour pressure. 13. Anthracite coal is the purest, the densest, the hardest of all varieties of coal, because of the high pressure and the heat it was subjected to. 14. Lead is very slightly acted upon by the oxygen of the air. 15. Single atoms of oxygen are seldom met with. 16. Atoms of zinc may be looked upon as composed of electrons and zinc ions. 17. When iron, zinc, nickel and many other metals (in the molten condition) are allowed to cool (and "freeze"), they solidify in crystalline form. 18. If a gas at any pressure is permitted to expand, its temperature falls. 19. The early works by Tsiolkovsky were followed by a number of very important works in the field of astronautics.

**X. Дайте анализ следующих предложений и переведите их на русский язык:**

1. In solidifying some metals liberate the same amount of heat they absorb in melting. 2. Living, as we do, at the bottom of an ocean of air, we find some objects will rise in that air. 3. Fuels are substances we burn in order to provide heat. 4. The considerable pressure and increased temperature sea plants were subjected to contributed to the formation of petroleum. 5. Mercury is the only

common metal that is liquid at ordinary temperatures. It is much heavier than iron and many other metals we consider heavy. 6. A luminous body is visible because of the light it sends to the eye. 7. Stars shine by means of the light they generate and not by reflected sunlight as planets and satellites do. 8. Common salt, almost anyone knows, is a pure chemical compound called sodium chloride or (NaCl). 9. We may say force and motion always go together, one is a cause, the other a result.

XI. Напишите предложения, используя следующие слова: work, answer, name, use а) как существительные и б) как глаголы.

XII. Вставьте вместо пропусков something, anything или nothing и переведите следующие предложения на русский язык:

1. There is ... on the table. It is a book. 2. If it is dark, you cannot see ... . 3. Is there ... in your bag? Yes, there is ... . That is an English magazine. 4. What is there in an empty box? There is ... .

XIII. Заполните пропуски и переведите следующие предложения на русский язык:

1. Tsiolkovsky proposed rockets for interplanetary flights earlier ... other scientists. 2. Our investigations are not so successful ... those of our colleagues. 3. There are ... letters in the word **artificial** than in the word **space**. 4. There are ... letters in the word **flight** than in the word **resistance**. 5. Aluminium does not weigh so much ... iron. 6. Liquids conduct heat worse ... metals. 7. Silver is one of ... conductors of heat.

XIV. Напишите по-английски следующие числа:

$\frac{1}{2}$ ;  $\frac{3}{4}$ ;  $\frac{2}{5}$ ;  $\frac{4}{9}$ ;  $\frac{2}{100\ 000}$ ; 0.1; 3.045; 25.108.

XV. Переведите на английский язык следующие предложения:

1. Студентам показали интересные эксперименты по преобразованию энергии. 2. наших аспирантов обеспечивают всем необходимым для исследовательской работы. Им дают возможность вести исследования под руководством профессоров института. 3. На работы Циолковского ссылаются многие ученые. 4. За первым космическим полетом последовало много других полетов. 5. Когда все было подготовлено к эксперименту, послали за инженером.

XVI. Определите, какой частью речи является выделенное слово, и переведите каждое предложение на русский язык:

1. The first **cause** of weather **changes** is the variation in the temperature of the atmosphere. 2. In the tropics the weather **changes** more from day to night than from summer to winter. 3. **Change** in air pressure is the chief **cause** of winds. 4. Heating **causes** chemical **changes**. 5. Different reactions **cause** chemical changes. 6. We widely **use** rubber in combination with other substances. 7. A list of the **uses** of rubber will occupy many pages. 8. **Man** widely **uses** aluminium, a light, easily worked metal. 9. We **man** our meteorological stations by trained meteorologists and their assistants. 10. It was



shown that different degrees of **heat** produce different **results**. 11. When we **heat** water, it **changes** into steam. 12. Not all water that falls as rain or that **results** from the melting of ice and snow runs off. 13. Although oxygen is the most commonly occurring element carbon **forms** the largest number of compounds of any element. 14. Different substances — combinations of the elementary **forms** of matter are called compounds.

**XVII. Переведите на английский язык следующий диалог:**

— Когда жил и работал Циолковский?

— Циолковский жил и работал в конце девятнадцатого и в начале двадцатого столетия.

— В какой области науки работал Циолковский?

— Циолковский работал в области астронавтики и аэродинамики.

— В какой работе Циолковский выдвинул идею космических полетов?

— Он выдвинул идею космических полетов в работе «Изучение космоса с помощью ракетных двигателей».

— Что изучал великий ученый?

— Он изучал условия взлета космических кораблей, влияние сопротивления воздуха на движение ракеты и многие другие проблемы.

— Когда Циолковский впервые высказал мысль о создании искусственных спутников земли?

— В 1895 году.

— Как оценило деятельность Циолковского Советское правительство?

— Советское правительство уделяло большое внимание его работе, обеспечивало его всем необходимым для плодотворной работы и наградило выдающегося ученого орденом Трудового Красного Знамени.

**XVIII. Расскажите текст на английском языке по следующему плану:**

1. At the end of the 19th century K. Tsiolkovsky decided to solve the problem of cosmic flights. 2. His discoveries are the foundation of the modern theory of rocket propulsion. 3. He studied a number of problems connected with the development of astronautics. 4. In 1895 he put forward the idea of building artificial satellites. 5. The Soviet Government highly appreciated his work and provided him with everything necessary for fruitful work.

**XIX. Ответьте на следующие вопросы:**

1. What problem was K. Tsiolkovsky interested in at the end of the 19th century? 2. Did K. Tsiolkovsky propose rockets for interplanetary communication? 3. In what work did K. Tsiolkowsky put forward the theory of cosmic flights? 4. What questions were paid attention to by K. Tsiolkovsky? 5. In what way did the Soviet Government help K. Tsiolkovsky in his work?

Контрольный текст. Прочтите и изложите устно без перевода:

### MORNING OF A NEW ERA

The event took place in the morning. The spaceship entered the orbit. It had everything necessary for the spaceman's safe return. The spaceship carried instruments that helped the pilot to determine his position on the orbit at any time.

Two-way radio communication was constantly carried on with the pilot during the preparations for the take-off and during the flight itself.

This event is symbolical in the fact that a Soviet man was the first space pilot, that the first spaceship in which Yuri Gagarin made his flight, was named "Vostok" (East), and also that the flight was made in the morning. That morning started mankind on a new era.

For all times to come, April 12, 1961, will now be linked up with Gagarin's space flight which was made in 108 minutes. At the beginning of the 20th century, mankind was shown the road to the stars by a man of genius. Tsiolkovsky. His works deal with the principles of space science, one of whose brilliant triumphs was Gagarin's flight.

Konstantin Tsiolkovsky's words, "The earth is a cradle of wisdom, but we cannot always live in a cradle", have come true.

### ПОЯСНЕНИЯ К ТЕКСТУ

two-way radio communication двусторонняя радиосвязь  
this event is symbolical in the fact that это событие является символическим в том отношении, что...

for all times to come April 12, 1961, will be ... во все времена 12 апреля 1961 г. будет ...  
his works deal with в его работах изложены

## LESSON 8

### Грамматический материал

Present Perfect (active, passive);  
повелительное наклонение;  
возвратные и усилительные местоимения;  
предлоги времени;  
словообразование

### УПРАЖНЕНИЯ В ЧТЕНИИ

1. Чтение двусложных слов с ударением на конечном слоге:

(12—16) expect, construct, repay, repaid, become, produce, unite, address, create, appear; affair, profound, entire, mankind.

2. Чтение двусложных слов с ударением на начальном слоге:

(13—16) era, human, conquer, training, pilot, fighter, province, open, toiler, system, landlord, common, better, finest, standard, higher, triumph, slogan, progress, science, peaceful, outer, symbol;  
(13) rapid, finish, visit, limit, liquid, planet, rivet.

### 3. Чтение многосложных слов:

(29—32) history, possibility, humanity, communist, confidence, capital, victory, economy, cultural, monopoly, superiority, proletariat, industry, obvious, industrial, ability, technology, quality, democracy;

(30) society, theory, realize, victorious, Soviet, genius;

(30) consider, remember, establish, continue, discover, inhabit.

### 4. Чтение слов, оканчивающихся на -tion:

exploration, exploitation, education, population, nation, relation, automation.

### 5. Запомните произношение следующих слов:

wonder ['wʌndə] — удивляться, восхищаться, wonderful ['wʌndəfʊl] — удивительный, govern ['gʌvən] — управлять, decisive [dɪ'saɪsɪv] — решающий, pleasure ['plezə] — удовольствие.

### 6. Прочтите и переведите следующие предложные группы:

of a new era, of the Soviet people, in human history, of the world history, of the entire world, to the entire population, in the whole world, for the first time, with the rapid progress, with great pleasure, in a space unit.

## ТЕКСТ

### FIRST IN SPACE — FIRST ON EARTH

Wednesday, April 12, 1961 can be considered as the beginning of a new era. The whole world wondered at the achievements of the Soviet people in the exploration of cosmic space yet the whole world expected it. For we knew that the first man in space would carry the Red Flag of Socialism. That is a new age in human history. Now man will conquer the planets. No longer bound to earth, the whole cosmos has become his province. Wonderful possibilities have opened up.

Started 1917.— It has been said that Yuri Gagarin has been the first where no human being has ever been before. True, but the Soviet Communists have always done that. They started it on November 7, 1917, when the Great October Socialist Revolution opened a new era for humanity. They started mankind on an entirely new road in order to construct a Communist society, a society without exploitation.

On November 18 Lenin made a call to the Russian people: "Comrades toilers, remember that you yourselves are now governing the state. Nobody will help you unless you unite and take all the affairs of State in your hands".

How well they have repaid his confidence. Not only did Gagarin and his spaceship go round the earth, the world Socialist system has now become the decisive force of world history. And it is because the Soviet people got rid of the capitalists and landlords and have constructed socialism that they have achieved their victories.

They are first in space because they are first on earth. We have always known that when common people get rid of capitalism they will run society much better than capitalism can ever do. Their planned Socialist economy has put them in front of the entire world. The Soviet people have been given the shortest working day, the finest free health service, better housing conditions, the finest education and cultural standards in the world. Why? Because care for ordinary men and women is their aim. And nowhere is this seen more than in education. The Socialist society has opened schools, institutes and universities to the entire population.

The greatest educational and scientific achievements have produced the most advanced nation in the world, while in capitalist countries secondary and higher education is the monopoly of but a few.

Decades and centuries will pass, the borders of the unknown will be moved farther and farther back, spaceships will travel far out into interplanetary space. But for ever humanity will remember the "Vostok" spaceship and the great date — April 12, 1961. The greater the number of man's successes in conquering outer space the more vivid will that first date be. For this is the beginning of the great road, the first page, the first sentence in the great book of man's conquest of space.

## ПОЯСНЕНИЯ К ТЕКСТУ

the whole cosmos has become his province он овладел всем космосом  
 Lenin made a call Ленин обратился с призывом

they have repaid his confidence они оправдали его доверие  
 get rid of избавляться от

## DIALOGUE

On the appointed day at a fixed time the automatic cargo transport craft was launched. The space flight programme included a docking of the craft with the orbital space laboratory where Soviet cosmonauts were working. On the third day of the flight the docking took place.

On this occasion the Head of the Space Training Centre named after Y. Gagarin was interviewed by one of our newsmen and here are the answers to the questions put to him.

Newsmen: Will you please give me some information as to the launching of the latest cargo ship.

Head: With great pleasure. Great success has been achieved in space research by the Socialist countries. Successful international cosmic flights are good examples of cosmic flight programme development. We can also give examples of regular automatic cargo ship trips to space. They supply the orbital stations with fuel, technological equipment, instruments, food, etc.

Newsmen: And what did the latest cargo ship carry to the station?

Head: Oh, it is impossible to tell you about everything. The list would be very long. I shall only mention fuel for the engine, water, food, and several necessary instruments. It has also supplied the cosmonauts with objects of personal use such as clean linen, suits, lamps, new videorecordings, camera film and mail.

Newsmann: How long did unloading take place?

Head: A lot of time. To avoid a mess all the things brought in containers and boxes must be instantly arranged in the place planned for them which is a very complicated job.

Newsmann: And is this process practiced back on earth?

Head: Certainly. In fact, it appears more complex than it seemed.

Newsmann: Can you give me a picture of the cosmonauts' day when unloading takes place?

Head: They do unpacking for about two hours after breakfast. Then they have dinner and an hour's rest. Again two hours of unloading which is followed by two hours of physical training to keep fit.

Newsmann: How are the cosmonauts feeling? They have been in orbit for over a month now.

Head: They are feeling well. The Flight Control Centre is keeping track of their health.

Newsmann: And what about the spaceships?

Head: All the systems aboard the spacecraft are in perfect order.

Newsmann: Thank you for your information. It was very interesting. Good-bye.

## ПОЯСНЕНИЯ К ТЕКСТУ

docking стыковка  
on this occasion по этому поводу  
named after Y. Gagarin имени Ю. Га-  
гарина  
here are эд. вот  
as to относительно  
objects of personal use предметы лич-  
ного пользования

to avoid a mess чтобы избежать пу-  
таницы  
in fact действительно  
it appears эд. оказывается  
to keep fit быть в форме  
is keeping track of следит за  
in perfect order в полном порядке

## УПРАЖНЕНИЯ

I. Образуйте существительные при помощи суффикса -ity от следующих прилагательных, переведите на русский язык:

possible, human, productive, rapid, electric.

II. Найдите в тексте синонимы к следующим словам и переведите их на русский язык:

to begin, to wait, to connect, way, power, to reach, purpose.

III. Найдите в тексте существительные, соответствующие следующим словам, и переведите их на русский язык:

to begin, historic, to toil, confident, victorious, to educate, to achieve, economic.

IV. Найдите в тексте прилагательные, соответствующие следующим словам, и переведите их на русский язык:

to wonder, to decide, culture, education, humanity, possibility, entirely.

V. Переведите на русский язык и выучите следующие группы слов одного корня:

to wonder — wonder — wonderful; to explore — explorer — exploration; to conquer — conqueror — conquest; true — truth; to construct — construction — constructive; to exploit — exploiter — exploitation; to unite — unity — unit — union; to decide — decision — decisive; to consider — consideration — considerable — considerably; to care (for) — care — careful — careless — carefully — carelessly.

VI. Найдите в тексте антонимы к следующим словам и переведите их на русский язык:

to shut, after, untrue, never, to end, badly, uncommon, worse, behind, longest, backward.

VII. Переведите на русский язык, обращая внимание на выделенные слова:

1. It probably rains on Venus all the time **for** its skies have never cleared and we have never been able to take a look at its surface. 2. Magnesium is a very light metal **for** which we find more and more uses. 3. It has been known **for** a very long time that matter is composed of atoms and that every material consists of mixtures or combinations of a limited number of atoms. 4. In the struggle **for** peace and independence the Communists are always in the first ranks. 5. The proton is as big as the electron **but** its weight is, comparatively speaking, tremendous. 6. The weight of all the protons is always less than the whole weight of the atom. The **only** exception to this is hydrogen whose nucleus contains **but** one proton. 7. We cannot **but** be impressed with the importance of electricity, not **only** as an aid to our comfort, **but** also as an important factor in the structure of the whole universe.

VIII. Переведите на русский язык следующие предложения со сказуемым в Present Perfect:

1. Each new launching of artificial satellites has been connected with the solution of fundamentally new technical and scientific problems. 2. Mankind's dream about cosmic flights has come true. 3. The Soviet man has made humanity's age-old dream of flying into outer space a reality. 4. Our country has developed into a powerful socialist state and has made great achievements in all fields of industry, technology and science. 5. Our country has shown the way into space. 6. Soviet scientists, engineers, technicians and workers have given the possibility to perform the first manned cosmic flight. They have done this in the name of world peace, in the name of happiness of all nations. 7. The march of social history has quicken-

ed. Rapid changes have taken place since the day of the Great October Socialist Revolution. 8. Our country has reached a high stage of development, and Lenin's aim of total electrification has been realized. 9. The future of astronautics will be a logical continuation of what has already been achieved. 10. According to the law of conservation of energy, the energy present in the universe has always existed. 11. The visible side of the moon has been studied ever since Galileo invented the telescope.

**IX. Поставьте глагол в скобках в Past Indefinite или Present Perfect и переведите на русский язык:**

1. On April 12 mankind (to enter) a new era — the era of mastering space. 2. The spaceship "Vostok I" (to be equipped) with everything necessary for the astronaut's safe flight and return to earth. 3. This year some new artificial satellites (to be launched). 4. During the nineteenth century a great development of science and industry (to take place). 5. Since the Great October Socialist Revolution our country (to make) great progress. 6. It is interesting to note that the first steam engine (to be used) more than 2,000 years ago in Greece. 7. Our scientists (to place) automatic devices on the moon. 8. This month important observations (to be made) in cosmic space.

**X. Определите различные функции to have и переведите предложения на русский язык:**

1. An electron is very small and it has a very small mass. 2. In the application of electronic instruments the engineer must have a knowledge of their characteristics. 3. The first cosmic flight shows man's abilities have no limit; man has only to use his intelligence in order to create conditions under which his talents can develop. This is exactly what the Soviet Union has done in establishing the socialist system. 4. The studies of the Venus's atmosphere have shown that it contains too little water vapour and oxygen, but it has a high carbonic content.

**XI. Подчеркните сказуемые в следующих предложениях и переведите на русский язык:**

1. Put a lump of sugar into a glass of water and allow it to stand. 2. Before beginning an experiment carefully read the instructions in order to understand what you will do. 3. Remember that it is much more convenient to use the decimal fractions than common. 4. Let us see how an early model of a cyclotron was constructed. 5. Consider an example of energy transformation. 6. Let them analyze the results of the experiment. 7. Take a handful of air, and you will hold billions of atoms. Now let us look at your handful of atoms. You can't see an individual atom, for every atom is very small. Suppose that you take a look at just one of the atoms you hold in your hand. What will you see?

**XII. Переведите на русский язык, обращая внимание на возвратные и усиительные местоимения:**

1. When a person warms himself at an open fire, he feels a direct heat which acts rapidly and at a distance. 2. Although metals differ greatly among themselves, any kind of metal is a much better conductor of heat than any other kind of material. 3. Rubber by itself has a very limited use, but combined with other substances it is very important. 4. We ourselves live at the bottom of an air ocean. It is not so dense as water, but as we know its weight and pressure are not inconsiderable. 5. Solids sink in liquids less dense than themselves. 6. The method in which the rocket itself reported details of its trajectory was used in Lunnik III. 7. When heat is added the motion of molecules becomes more rapid. This motion naturally affects the molecules themselves.

**XIII. Вставьте один из предлогов, обозначающих временные отношения: on, at, in, from, to, after, before, since, during:**

... Wednesday, April 12, 1961, ... 9. 07 a. m. Moscow Time, the sputnik-spaceship "Vostok" was launched into space with a man on board. The spaceship flew around the earth and returned safely ... 10.55. a. m. The first man to fly into space was a Soviet man. Yuri Gagarin. ... April 12, mankind entered a new era — the era of mastering space. Not so many years have passed ... the first Soviet artificial earth satellite Sputnik I was put into orbit. It was ... October, 1957. And what great successes has our country made ... then. ... the morning of the 12th of April (the same day) the people learnt about this great event from the news over the radio. ... two days Y. Gagarin came to Moscow and ... noon a meeting took place in the Red Square.

The courageous Soviet flier Y. Gagarin was born ... March 9, 1934 in Smolensk. ... the autumn of 1941 he started school. He studied at school, then at a vocational school. ... the vocational school he entered a technical industrial school and graduated from it ... 1955. ... 1955 ... 1957 he studied at the Orenburg Flying School and finished it ... 1957. Soon he became a candidate for the Soviet space flights. According to him he felt very well ... the flight. He knew it would be successful. He also felt well ... the flight. Never will people forget April 12, 1961.

**XIV. Вставьте much или many, little или few, объясните их употребление и переведите следующие предложения на русский язык:**

1. Scientists made ... experiments before the launching of the first spaceship. 2. Gagarin spent ... time, preparing for the flight. 3. ... people will dare to fly into outer space. 4. Atomic power stations need ... fuel.

**XV. Переведите на английский язык:**

1. Великая Октябрьская социалистическая революция открыла новую эру в истории человечества. 2. Советский народ избавился от капиталистов и помещиков и создал совершенно новое государ-



ство для трудящихся. 3. Советский народ всегда боролся за мир. 4. В апреле 1961 г. Ю. Гагарин совершил первый космический полет. 5. Человек завоевал космос; он уже не привязан к Земле. 6. Советский человек стал первым космонавтом. 7. Наша страна достигла огромных побед в деле завоевания космоса. 8. В 1957 г. был запущен первый искусственный спутник. 9. В этом году было запущено несколько метеорологических спутников. 10. На этой неделе нашими аспирантами был проведен интересный эксперимент.

**XVI. Ответьте на следующие вопросы:**

1. What day marked the beginning of a new era in human history?
2. What society did the Soviet people establish in 1917?
3. What call did Lenin address to the Russian people in November 1917?
4. Thanks to what have the Soviet people achieved their victories?
5. What has put the Soviet country in front of the entire world?

**Контрольный текст. Прочтите и изложите устно без перевода:**

**THE GREAT OCTOBER SOCIALIST REVOLUTION**

The Great October Socialist Revolution was the beginning of a new era in the history of mankind. It established the dictatorship of the proletariat and created a new type of state — the Soviet Socialist state — and a new type of democracy — democracy for the working people.

The Soviet power nationalized the industry, railways, banks and the land. It got rid of the capitalists and landlords and led the country on the road of socialism.

For the first time there appeared in the world a state which put forward the slogan of peace and began to realize new principles in relations between people and countries.

Socialism has created all possible conditions for the rapid progress of science. The achievements of Soviet science clearly show the superiority of the socialist system, the unlimited possibilities of scientific progress and the growing role of science under socialism. The country of victorious socialism has started the era of atomic energy for peaceful aims and has shown the way into outer space. The man-made satellites of the earth and the sun, powerful space rockets and interplanetary spaceships, atomic power stations and the flights round the earth achieved by Soviet citizens have become symbols of the creative energy of coming communism.

**ПОЯСНЕНИЯ К ТЕКСТУ**

for the first time впервые, в первый  
раз  
put forward выдвигать

## LESSON 9

### Грамматический материал

Past, Future Perfect (active, passive);  
согласование времен;  
словообразование

### УПРАЖНЕНИЯ В ЧТЕНИИ

#### 1. Чтение односложных слов:

(4, 6, 21) mind, kind, find, blind, wind, bind; child, mild, wild; old, cold; right, might, fight, sight; talk, walk, chalk; road, load, broad; launch, pause, fault.

#### 2. Чтение двусложных слов с ударением на конечном слове:

(12—16) direct, restore, approach, conduct, address, attempt, result, arrive, observe, connect, perhaps, apart; profound.

#### 3. Чтение двусложных слов с ударением на начальном слове:

(13—16) person, welfare, other, ruin, modest, notice, whether, seldom, district, contrast, legal, seaport, dirty, traffic, entrance, comrade;

(13) carry, marry, narrow, mirror, squirrel, sorry, lorry, current.

#### 4. Чтение многосложных слов:

(29—32) typical, delegate, superiority, responsibility, economy, simplicity, occupy, influence, assassinate, individual, political, commercial, poverty, economical;

(27) understand, correspond, introduce, undergo, interrupt, reconstruct, subdivide.

#### 5. Чтение слов, оканчивающихся на -s и -ed:

turn — turns — turned; talk — talks — talked; direct — directs — directed; interest — interests — interested; launch — launches — launched; notice — notices — noticed; occupy — occupies — occupied; conduct — conducts — conducted; address — addresses — addressed; attempt — attempts — attempted; produce — produces — produced; depend — depends — depended.

#### 6. Запомните произношение следующих слов:

real [riəl] — действительный, shoulder ['ʃouldə] — плечо, comfort ['kʌmfət] — комфорт, movement ['mu:vmənt] — движение, museum [mju:'ziəm] — музей, modest ['mɒdist] — скромный.

#### 7. Прочтите и переведите следующие словосочетания:

my outstanding recollection, his whole mind, his comradely approach, their tremendous responsibility, profound understanding, the workers' districts;

the eyes of the world, the economy of the country, a picture of the struggle, the results of the experiment, the movement of the city, the lives of the delegates, some material on London, the flats in the houses.

TEKCT

## THE GREATEST LESSON LENIN TAUGHT ME

*(Recollections of an English Communist)*

My outstanding recollection of Lenin was of a man whose whole mind and being centred on the revolutionary struggle. He was entirely different from anyone I had ever met before.

Lenin was, of course, the greatest revolutionary genius of all times. The eyes of the whole world were turned on him. Yet he was without any kind of superiority. He had a real comradely approach to workers and peasants. He understood them so well and could talk to them in the language they understood.

I was a typical worker — a delegate from the Clyde Workers' Committee — and he met me like a simple comrade and not as a very important person at all.

He gave little or no thought to himself and all his thoughts were directed toward the welfare of others. He was greatly interested in how the children had been cared for and that those in need got attention. At the same time he carried on his shoulders a tremendous responsibility. There were the battles on the various fronts against the interventionists who had launched war against the young Soviet State.

There was the battle on the home front to restore the country's war-ruined economy.

In Smolny Institute where he had his H. Q. (headquarters) he lived in the most modest comfort, in accordance with the simplicity characteristic of his nature. The only "luxury" I noticed in the bedroom and sitting-room he occupied in the Smolny was a little mirror. His wife Krupskaya looked after him like a mother.

His genius lay not only in the fact that he had a profound understanding of Marxism and the clearest idea of how the revolutionary struggle had to be conducted — he was able to make his listeners feel as he felt whether he talked to you man to man or addressed a mass meeting.

One of the things which had a tremendous influence on Lenin was the execution of his elder brother who had been a member of a revolutionary terrorist organization which had attempted to assassinate the tsar.

Lenin realized that individual actions of this kind, however heroic, seldom produced good results. And as he said: "We will find a better way".

Perhaps the greatest lesson he taught me was that the solution of every social and political question depended on whether it ad-

vanced the interests of the working class or the bourgeoisie. He taught me, too, that no revolutionary could stand apart from social and political life.

### ПОЯСНЕНИЯ К ТЕКСТУ

the eyes ... were turned on him глаза  
были устремлены на него  
at all совсем, вообще  
he gave little or no thought to him-  
self о себе он думал мало или сов-  
сем не думал  
he was interested in он интересовал-  
ся  
that those in need got attention чтобы  
с вниманием относились к тем  
нуждающимся

home front внутренний фронт  
his genius lay not only in the fact  
that его гениальность заключалась  
не только в том, что ...  
however heroic какими бы героически-  
ми они ни были  
whether it advanced the interests за-  
щищало ли оно интересы

### LONDON

(Dialogue)

Teacher: We've just read about Lenin's life in London. Last time I asked you to look through some material on London so you could get an idea of what it looks like at present. Now we are going to have a talk about the capital of Britain in general.

Student 1: London is the political, economical and commercial centre of Britain. Today it stretches for nearly 30 miles from north to south and for nearly 30 miles from east to west. This is the area known as "Greater London", with a population about nine million.

Student 2: The "City of London" is a very small part of London, it is only one square mile in area, and the number of people who live in the "City" is only about ten thousand.

Teacher (addressing another student): London is also a seaport, isn't it?

Student 3: Oh, yes, London is one of the greatest seaports; it has the largest system of docks in the world. This is the East End of London which is very important to the country's commerce.

Student 1: You've forgotten to mention that London is divided into two parts by the river Thames which flows from west to east and connects the docks of London with the sea.

Teacher: And who is going to tell us about a much more important division of the city?

Student 4: This is the East End and the West End parts of London. In the West End, where the rich people live, are the finest parks and biggest squares, the best theatres, cinemas and concert halls, large museums, big hotels, the largest shops and restaurants.

Student 5: Here are also the National Gallery and the British Museum where Lenin collected material for his famous work "Materialism and Empirio-Criticism".

Student 3: The streets in the West End are clean and wide with big blocks of flats and splendid houses.

**Student 6:** The East End of London is a great industrial area. The working people live here. The streets are narrow and dirty with poor houses. Lenin liked to walk here and study the workers' life. He noted the contrasts between the West End and the East End.

**Student 2:** Those who come to learn about London's history will find much to interest them in the City which is the business centre of London. In this area most of the streets are narrow and traffic is often very slow. Here you can see an entrance to the Subway, which leads to the Underground Railway or "Tube" as they call it.

**Teacher:** You will, please, remember also that Lenin first came to London to continue the illegal publication of "Iskra" which was produced in the building now known as Marx House, across the road from the Morning Star Building. The small room where Lenin worked in those days still stands and is kept as it was then.

### ПОЯСНЕНИЯ К ТЕКСТУ

to look through просмотреть  
get an idea получить представление  
we are going to have a talk мы по-  
говорим  
at present в настоящее время  
East End Ист Энд (восточный район  
Лондона)  
the Thames Темза  
who is going to tell us кто расскажет  
нам  
West End Вест Энд (западный район  
Лондона)

National Gallery Национальная галерея  
British Museum Британский музей  
you will, please, remember запомните,  
пожалуйста  
across the road напротив (через ули-  
цу)  
Morning Star Морнинг Стар (англий-  
ская рабочая газета, орган Комму-  
нистической партии Англии)

### УПРАЖНЕНИЯ

I. Подчеркните суффиксы, определите, к какой части речи относится каждое слово, и переведите на русский язык:

recollection, entirely, different, superiority, important, attention, tremendous, responsibility, interventionist, social, listener, execution, terrorist, organization, political.

II. Переведите на русский язык и выучите следующие группы слов одного корня:

to recollect — recollection, to struggle — struggle; to differ — difference — different; superiority — superior; to approach — approach; great — greatly; to care (for) — care — careful — careless — carefully — carelessly; to vary — variation — variety — various — variable; to restore — restoration; to occupy — occupation; to conduct — conductor — conduction.

III. а) Определите время сказуемого и переведите на русский язык:

1. After Lenin had come to London in 1902, the first thing he did was to learn English. 2. Lenin and Krupskaya had never heard an Englishman speak English before they came to London. 3. When they had come to London, they found that they could not understand

a word and nobody understood them. 4. When Lenin's mother learned that Alexander had been arrested, she went to St. Petersburg at once. 5. By the end of the seventies the Soviet Union had brought electric power to every part of our country. 6. When careful studies of the transformation of one form of energy into another had been carried out, the law of the conservation of energy was stated. 7. After the body has been heated, it will get larger in size. 8. Before 1932, two fundamental particles had become well established as a result of numerous experiments. These were the electron and the proton. 9. By the end of the year all the experiments necessary for the completion of our research will have been made. 10. Before the first human astronaut went into space, much work had been done with the sputniks, carrying dogs and small animals. 11. Tsiolkovsky had already developed the theory of space flights in pre-revolutionary Russia, the first man to do so. 12. The smallest positive particle is the hydrogen atom after it has lost an electron. This elementary positive particle is called a proton.

**б) Переведите следующие предложения на русский язык, обращая внимание на значение слов "after" и "before":**

1. After the Civil War our country was faced with a tremendous task — to restore the country's war-ruined economy. 2. After the Civil War had ended, our country was faced with a tremendous task — to restore the country's war-ruined economy. 3. After the English Communist had come to Leningrad, he was received by Lenin. He was greatly impressed by Lenin's approach to workers and peasants. 4. After his visit to Leningrad the English Communist wrote about his meetings with Lenin and about his impressions of this great man. 5. Before the Great October Socialist Revolution Lenin, persecuted by czarist police, had to live abroad. 6. Lenin knew the English language before he came to England. 7. Before the delegate from the Clyde Workers' Committee met Lenin, he had already known about the simplicity so characteristic of Lenin's nature. 8. Before his meeting with Lenin the delegate from the Clyde Workers' Committee had already known about the simplicity so characteristic of Lenin's nature.

**IV. Употребите глаголы, данные в скобках, в Past Indefinite, Present Perfect или Past Perfect, переведите каждое предложение на русский язык:**

1. Since 1897 much (to be learned) about the structure of atom. 2. After Becquerel (to make) a great number of experiments, he discovered the phenomenon of radioactivity. 3. In 1898 the Curies (to discover) a new substance which they (to receive) during their experiments. They found that it (to be) much more active. 4. By the end of 1898 the Curies (to obtain) the element radium. They announced that they (to discover) it in December 1898. 5. In 1969 people (to mark) the 100th anniversary of the discovery by Mendeleev of the periodic law of chemical elements. 6. After we (to construct) a number of new power stations, our country will get cheap

electric power. 7. In 1761 M. V. Lomonosov, with the aid of a telescope, (to discover) a luminous rim around Venus. He explained that this phenomenon (to be caused) by the existence of an atmosphere around Venus. 8. Observations showed that the luminous rim (to be) really the planet's atmosphere lit up by the sun. It (to be observed) in 1882, and will not be seen again until 2004. 9. Man (to achieve) great successes in the field of studying the structure of the atoms. 10. Scientists (to discover) a number of new elementary particles.

**V. Определите функции глагола to have, переведите каждое предложение на русский язык:**

1. It has been proved by many experiments that when energy is changed from one form to another the whole amount of energy remains unchanged. 2. The cyclotron has been of great help to the development of human knowledge in the field of nuclear physics. 3. In the cyclotron particles of energy up to a billion electron volts and more have been achieved. 4. Beta particles have a smaller mass than alpha particles. 5. Engineers had carried out experimental work long before they proceeded with the design. 6. After you have performed one or more experiments, you will have an understanding of the theoretical discussions in the book. 7. Many scientists had to leave tsarist Russia because they were given no help by the government. 8. The tomorrow of which Lenin dreamt has arrived.

**VI. Объясните употребление времен и переведите следующие предложения на русский язык:**

1. In 1920 Lenin said that the Asian and African people would play a great role in the solution of important international problems. 2. It was during World War I that Lenin said all the colonies both Asian and African would be freed. 3. At a press conference the Soviet cosmonauts were asked whether they carried out everything programmed by scientists. 4. During his experiments the French scientist Becquerel noticed that uranium emitted radiations when it was acted upon by sunlight. 5. At the beginning he knew very little what results he would get from his experiments. 6. M. Curie decided to learn whether any other elements gave off rays like uranium. 7. During the nineteenth century it was discovered that any of the forms of energy could be transformed into any other. 8. It was found that chemical changes could produce electric currents. 9. At the beginning of this century it was believed that ionization was caused only by radioactive materials in the earth's crust. 10. Scientists all over the world noted that our country had made great successes in the development of science. 11. Engineers found that the application of synthetic materials had greatly improved the quality of the product made. They claimed it would also make the product considerably cheaper. 12. Experiments proved that great economy could be realized by using automation.

VII. Определите, какой частью речи является выделенное слово, и переведите следующие предложения на русский язык:

1. Lenin gave little or no **thought** to himself and all his **thoughts** were directed toward welfare of others. 2. Lenin always **thought** that a revolutionary could not stand apart from social and political life. 3. The Soviet Union has achieved great **results** in the field of space research. 4. Friction **results** in a loss of velocity when water flows through pipes. 5. The success of our country in the field of space research results from the moral, political and labour enthusiasm of our people.

VIII. Переведите на русский язык, обращая внимание на выделенные слова и выражения:

1. In designing a lighting system, **whether** for a house, an office, or a factory, uniformity of illumination is very desirable. 2. To the electrician the most important question is **whether** a solid is a conductor of electricity or not. 3. The person most **in need of** the telescope is the astronomer. In some cases the objects of his study are very far away. **That is why** his telescopes must be large and powerful. 4. Many metals are found in pure state **as well as** in combination. 5. The energy principle is not limited to solids. It applies to liquids **as well**. 6. Magnetic properties of materials **are of great value** in the construction of telephone, telegraph, radio equipment. 7. More than a century ago the Russian scientist Mendeleyev discovered that the chemical properties of elements repeated themselves at regular intervals — **that is** periodically. He concluded that there were missing elements **yet** to be discovered, and he predicted accurately the properties **that** some of these elements were to possess when they were discovered. 8. **Any** form of energy may be expressed quantitatively in any unit of energy.

IX. Переведите на русский язык:

1. Lenin's mother showed herself capable of great courage. 2. Lenin's mother taught herself Swedish because she planned to go to a medical college in Sweden. 3. The Soviet Union and other Socialist countries are in friendly relations with countries that have freed themselves from colonial oppression.

X. Переведите на английский язык:

A. 1. После того как Ленин был арестован за участие в революционном движении студентов, его исключили из университета. 2. Мать Ленина очень заботилась о партийных товарищах Ленина, об их детях и помогла собрать деньги на памятник Федосееву, который умер в Сибири. 3. Ленин возвратился из-за границы к началу апреля 1917 г. 4. Ленин говорил, что Октябрьская революция освободит миллионы трудящихся и даст им возможность развивать свои творческие способности. 5. К концу первой пятилетки период реконструкции окончился, и наша страна перешла к индустриализации. 6. К началу второй мировой войны наша страна уже была одной из самых крупных индустриальных держав.



Б. 1. В начале XIX столетия химики впервые создали органические соединения. С тех пор они изобрели много способов получения химических соединений и много узнали о строении материи. Они изучили строение гигантских молекул-полимеров и создали много интересных и полезных соединений. После того как были созданы органические соединения, химики-органики продолжали работу по созданию новых соединений. К середине XIX столетия ученые уже синтезировали сахар. 2. Радиоастрономы сделали много важных открытий с того дня, когда были впервые обнаружены радиосигналы из космоса. 3. Искусственные спутники дали важные данные о вселенной. 4. В прошлом году был успешно запущен ряд искусственных спутников. 5. В этом году было проведено много научных экспериментов, связанных с изучением явлений на солнце. 6. К концу прошлого года был сконструирован новый мощный радиотелескоп. 7. Газеты сообщили, что на севере нашей страны строятся несколько электростанций и что они будут введены в действие в будущем году. Когда строительство будет окончено, этот район будет полностью обеспечен электроэнергией.

#### XI. Ответьте на следующие вопросы:

1. What was Lenin's approach to the workers and peasants?
2. How did Lenin meet the author of this article?
3. Where was Lenin's headquarters at the time of the October Revolution?
4. What was one of the things that had a tremendous influence on Lenin?
5. What was the lesson that Lenin taught the writer of this article?

#### XII. Расскажите текст по плану:

1. Lenin, the great revolutionary genius of all times.
2. Lenin always cared for the welfare of others.
3. The Soviet state had to fight against interventionists and on the home front.
4. Lenin lived very modestly.
5. Lenin taught that no revolutionary could stand apart from social and political life.

Контрольный текст. Прочтите и изложите устно без перевода:

#### LENIN IN LONDON

Lenin loved London. The first thing he did when he arrived here in 1902 was to learn English. He and his wife Krupskaya knew the language before they came and had even translated books from English into Russian, but they had never heard an Englishman speak English.

Later N. Krupskaya wrote that when they had arrived in London, they could not understand the language and nobody understood them. Lenin soon began to take English lessons from an Englishman to whom he himself gave Russian lessons.

He spent much time studying in the British Museum reading-room. But in London, as in all other places, it was people who interested Lenin most of all.

Krupskaya wrote that Ilyich studied living London. Lenin liked

going about town. He liked the movement of this big commercial city, the squares, the little streets, inhabited by the London working people. In the workers' district Lenin and Krupskaya went on foot and observing the contrasts in richness and poverty, Ilyich said in English: "two nations!"

Those were difficult days for Lenin and his wife, for all illegal communications with Russia were on Lenin, while Krupskaya helped with the correspondence.

When Lenin was in London for the Fifth Congress of the Party in 1907, Maxim Gorky saw how simply Lenin lived and how greatly he cared for the smallest details of the lives of the delegates to the Congress.

Lenin's rooms in the Kremlin, today a museum, were in accordance with that simplicity so characteristic of his nature.

### ПОЯСНЕНИЯ К ТЕКСТУ

he spent much time он проводил много времени

he liked going about town он любил ездить по городу

go on foot ходить пешком

## LESSON 10

### Грамматический материал

Present Continuous (active, passive);  
словообразование

### УПРАЖНЕНИЯ В ЧТЕНИИ

#### 1. Чтение двусложных слов с ударением на конечном слоге:

(12—16) convert, revolve, produce, depend, define, result, conduct, require, include, remain, connect.

#### 2. Чтение двусложных слов с ударением на начальном слоге:

(13—16) progress, standpoint, common, current, matter, fuel, effort, process, proton, cooling, order, nature.

#### 3. Чтение многосложных слов:

(29—32) electricity, energy, generate, satellite, million, positive, insulate, comparison, battery, operate, actual, nuclear, experiment; theory, material.

#### 4. Чтение групп слов:

connect — connection — connected — unconnected, electric — electricity — electrify, nature — natural — unnatural, common — commonly — uncommon, theory — theoretical, compare — comparison — comparative, economy — economic — uneconomic.

#### 5. Слитное чтение предложений:

much has been written, electricity has been produced, questions have been asked, satellites have been launched, experiments have been made, sources of electricity have been used up, some processes have been carried out.

### ТЕКСТ

#### DIRECT CONVERSION OF ENERGY TO ELECTRICITY

Our life is revolving around electricity and its many uses. We have come to take it for granted. Much has been written on the progress achieved in producing electricity. Most cases have dealt with direct conversion of energy to electricity. What are such processes? Are they new? Will one of the methods be used in place of the present ones for generating electricity? Will the cost of electricity be less? These and other questions will be answered and answers will depend very much on whether one is considering electricity from the standpoint of the few watts for a satellite in space or the millions of watts for even a small city.

First let us be sure we all understand what electricity is and the common means by which it is produced. We now define electricity or electric current using the atomic theory according to which all matter is made up of tiny particles or atoms. Atoms contain electrons which are negatively charged, protons which are positively charged and neutrons which have no charge. The electrons are in the outer part of the atom and are free to move from one atom to another. When these electrons move in one direction an electric current results. A good conductor of electricity is a material in which the electrons readily move from atom to atom. An insulator or poor conductor on the other hand is a material in which the electrons are more strongly bound to the atom and, therefore, do not move freely. Although the electrons pass from one atom to another, the conductor is not changed greatly by the process. For example, a 60 watt lamp requires the "passing" of  $3 \cdot 10^{18}$  electrons per second. Although this is a tremendously large number it is small in comparison to the number of electrons in an inch of even the thinnest wire.

Common sources of electricity are batteries and power plants. Energy is converted into electricity, and the chief energy source is heat from fuel. But the heat is not directly converted into electricity, it is first used to generate steam which turns the turbine operating an electrical generator. Electricity flows through transmission lines to houses, factories, etc.

Now the generation of electricity by this process is very uneconomic. Actually only about 40 per cent of the heat in the fuel including nuclear energy is converted into electricity, while the remaining part is generally lost in the cooling process. There has been a lot of effort and thought given to other means for generating electricity and experiments are being carried out at present in order to raise

the efficiency of energy conversion. There are some processes which are more efficient, as high as 80%. These are generally connected with direct conversion of energy into electricity in thermionic, magnetohydrodynamic, thermoelectric and thermophotovoltaic energy converters. We have pointed out that matter is electronic in nature: "line up" the electrons so they will pass from one atom to another and an electric current will flow.

## ПОЯСНЕНИЯ К ТЕКСТУ

our life is revolving around electricity  
наша жизнь неразрывно связана с электричеством

we have come to take it for granted  
мы начали принимать это как должное

most cases have dealt with в большинстве случаев мы имели дело с  
these questions will be answered на эти вопросы будут даны ответы  
from the standpoint с точки зрения  
first let us be sure сперва удостоверимся

according to согласно, соответственно

are free to move могут свободно двигаться

on the other hand с другой стороны  
in comparison to по сравнению с

there has been a lot of effort and thought given to other means... много усилий было затрачено на разработку других способов

line up выстроить в ряд

## УПРАЖНЕНИЯ

I. Подчеркните суффиксы в следующих словах, переведите каждое из них на русский язык:

electricity, conversion, atomic, negatively, direction, conductor, readily, insulator, greatly, electrical, economic, generation, electronic, converter.

II. Сгруппируйте следующие слова и выражения в синонимические ряды:

use, much, conversion, in place of, to generate, usual, to be made up of, readily, poor, quantity, power plant, energy, to be converted, for instance, chief, etc., actually, generally, to connect, to raise, at present, a lot of, bad, application, usually, power, common, instead of, to consist of, to produce, to increase, now, in fact, main, number, and so on, easily, power station, to be transformed, to join, for example, transformation.

III. Сгруппируйте следующие слова в антонимические пары и переведите на русский язык:

many, much, direct, new, small, common, negatively, charge, outer, conductor, poor, thin, uneconomic, cool, to raise, little, inner, old, uncommon, non-conductor, indirect, few, to lower, good, economic, warm, thick, positively, large, discharge.

IV. Найдите в тексте существительные, соответствующие следующим словам, и переведите на русский язык:

to convert, electric, to cost, to charge, to direct, to conduct, to insulate, to compare, to generate, efficient.

V. Найдите в тексте прилагательные, соответствующие следующим словам, и переведите на русский язык:

direction, to present, electricity, economy, electron.

VI. Переведите на русский язык, обращая внимание на значение слова "one":

1. Heat may be transferred from a high-temperature region to one of lower temperature but never from a low-temperature region to one of higher temperature. 2. The transfer of heat from one region to another occurs in many commonplace processes. 3. The flow of heat may occur in one or more of three essentially different ways. 4. When studying heat transmission one must know the laws of the three ways of heat transmission. 5. One should remember that convection currents cannot be set up in solids because the molecules of solids are not free to move from point to point. 6. A kettle half full of water can be brought to the boiling point in half the time required for a full one. 7. Unless one knows the weight of the object and its heat capacity, in addition to knowing the temperature one cannot tell us how much heat the object contains.

VII. Переведите на английский язык, используя слова и выражения из текста:

1. В данном тексте речь идет о преобразовании энергии в электричество. 2. В начале первой пятилетки наша страна вырабатывала лишь пять миллиардов киловатт-часов электрической энергии. 3. Согласно атомной теории все вещества состоят из крошечных частиц — атомов. 4. Электроны заряжены отрицательно, а протоны — положительно. 5. Все металлы являются проводниками электрического тока. 6. Пластмассы обычно являются изоляторами. 7. Эффективность прямого преобразования энергии в электричество очень высока, она достигает иногда 80%. 8. Для того чтобы повысить КПД преобразования энергии, необходимо непосредственно преобразовывать энергию в электричество. 9. Много усилий было затрачено на усовершенствование процессов преобразования энергии.

VIII. Дайте краткие утвердительные и отрицательные ответы на следующие вопросы:

1. Have you made any successes in your research work? 2. Will you be able to finish your work in time? 3. Is this an atomic power station? 4. Has this article dealt with direct conversion of energy into electricity? 5. Are these power stations supplied with atomic fuel? 6. Is this experiment being made in your laboratory?

IX. Переведите на русский язык:

1. Space research — this most complex branch of science — is being developed rapidly in our country. 2. In the Soviet Union great achievements are being made in the development of productive forces. 3. Prospects of new research successes are being opened up by the Soviet people. 4. Automation is being widely used in space re-

search. 5. Weather sputniks, sputniks for radio and television and a number of other interplanetary devices are being built now. They are equipped with sunpowered batteries and various accurate instruments. 6. Our scientists are preparing programmes for automatic devices. 7. They apply all the experience they are gaining from sputniks in the preparation of these programmes. 8. Experiments are going forward constantly in great laboratories in order to raise the efficiency of energy conversion.

X. Определите функцию глагола-to be в следующих предложениях и переведите каждое из них на русский язык:

1. In our scientific age great progress is being made in the study of outer space. 2. Zinc is the cheapest metal with a strong tendency to lose electrons. 3. Electronics is becoming very important to engineers working in various branches of industry. 4. Tremendous energy is liberated when the atom is split. 5. Automation is to be introduced into all production processes which is of decisive importance in the rapid economic development of our country. 6. Within the hydrogen atom there is, of course, a strong force of electric attraction. It is this force of attraction which holds the atom together. 7. The nucleus of the atom is in its centre.

XI. Определите функции выделенных слов и переведите предложения на русский язык:

1. The amount of **heat** a body contains is something quite different from its temperature. 2. When **heat** waves from the sun reach the atmosphere, they speed up the motion among the gaseous molecules. A transformation of radiant energy into **heat** energy **results**. 3. More **heat** is required to boil a big vessel than a small one. 4. When we **heat** a substance, its molecules are speeded up. 5. **Land** **heats** up more quickly than water but loses its **heat** by radiation more rapidly. 6. The lowest pressure in summer is found over Asia, the largest **land** mass. 7. Several thousand meteors **land** on the surface of our planet daily. 8. The barometer **drops** rapidly as the storm **approaches**. 9. The **approach** of the storm can be determined by the **drops** of the barometer. 10. The thermometer has not always had its present **form**. 11. Oxygen is essential to all **forms** of life. 12. Uranium 235 **forms** the basis for all nuclear reactor fuel. 13. Scientists discussed the **results** of their experiments. 14. The flow of electrons in one direction **results** in an electric current. 15. Electrons easily **flow** from atom to atom in conductors of electricity. 16. We can **change** water into steam by heating. 17. The **change** of the state of the substance took place on heating. 18. Shop production cuts **costs** considerably. 19. Aluminium **costs** considerably more poundage than steel, but it calls for only about a fifth as much poundage as will be needed for a steel structure.

XII. Переведите на русский язык следующие словосочетания:

fuel source, satellite functions, energy conversion, protest meetings, film show, school age, night shift, production process, motor

industry, iron rust, air masses, wind direction, water vapour, surface weather conditions, cellulose plastics industry, city water supply, manned space flight program.

**XIII. Прочтите и запишите по-английски следующие числа:**

3.725, 14.810,  $\frac{11}{15}$ ,  $\frac{3}{125}$ ,  $\frac{1}{4}$ ,  $\frac{1}{2}$ , 0.115, 0.0003, 0.375,  $5^2$ ,  $3^3$ ,  $7^5$ .

**XIV. Переведите на английский язык:**

В нашей стране достигнуты выдающиеся успехи во всех областях науки и техники. 2. В Советском Союзе строится большое количество электростанций. 3. Сейчас проводятся важные наблюдения в области прямого преобразования энергии. 4. В настоящее время наши ученые решают проблему увеличения КПД преобразования энергии. 5. Советские инженеры, ученые, рабочие разрабатывают и строят ракеты, искусственные спутники земли и космические корабли. 6. С именем Ленина на устах все коммунистические и рабочие партии ведут борьбу за мир, демократию, социализм и счастье человека. 7. Советские наука и техника развиваются очень быстро. 8. Развитие производительных сил, экономики и культуры играет решающую роль в развитии исследований космоса. 9. Перед советскими учеными стоит много важных задач. 10. В настоящее время автоматизация производственных процессов играет огромную роль во всех областях промышленности.

**XV. Объясните употребление времен и переведите на русский язык:**

When Gagarin heard that the signal was given for starting, he exclaimed cheerfully, "Well, up we go!" Later, at a press conference Y. Gagarin said he was very happy that his motherland was the first in the history of mankind where a manned flight to outer space was performed. He also said he wanted to fly to Venus, to Mars, to do some real flying. He hoped he would be permitted to do so.

**XVI. Ответьте на следующие вопросы:**

1. What is electricity? 2. How is electricity produced? 3. How is electricity defined in terms of the atomic theory? 4. What is a conductor of electricity? 5. What is an insulator? 6. What are the common sources of electricity?

**Контрольный текст. Прочтите и изложите устно без перевода:**

### THE ELECTRON

It has been known for a very long time that matter is composed of atoms and that every substance consists of mixtures or combinations of a limited number of atoms. Each atom is considered as the smallest piece of the substance, which can exist independently. No further subdivision of a chemical element can be made without completely destroying its identity.

Seeing an atom has been, however, impossible, not even under the most powerful microscopes; but one can get very near to seeing

\* trace след

them by photographing the traces where atoms have been. Atoms are electrically neutral, having no electric charge in their normal state.

The electrical nature of atoms is only seen when one starts breaking them into pieces, electrons and others. There are dozens of ways of liberating electrons from atoms and no matter how it is done, no matter from what material they are obtained, each electron is like every other electron.

An electron is very small and it has a very small mass, many times smaller than the atom it came from; its most important property is that it is electrically charged. This property accounts for negative electric charges. But there is another kind of electric charge we call positive and the usual form it takes is called the proton. The size of the proton is almost the same as that of an electron, many times smaller than an atom, but its weight is comparatively speaking tremendous, being about two thousand times that of an electron. It makes up nearly the whole weight of the atom it belongs to.

And here one must note a remarkable fact. The amount of electricity on any proton is exactly the same as that on an electron.

All the atoms, no matter how many electrons they may possess, are electrically neutral. They must contain therefore as many protons as electrons; as many units of positive charge as units of negative charge. The weight of all the protons is always less than the weight of the atom. Only in hydrogen the nucleus contains but one proton. The difference in weight is made up by neutrons. This is the role of the neutrons, inside the central nucleus of each atom.

### ПОЯСНЕНИЯ К ТЕКСТУ

without completely destroying its identity не разрушив его полностью как вещество

one can get very near to seeing them можно почти видеть их

no matter how независимо от того, как

is like every other похож на любой другой

this property accounts for этим свойством объясняется

about two thousand times that of an electron приблизительно в две тысячи раз больше, чем весит электрон

as many ... as столько же ... сколько

the difference is made up by neutrons разница компенсируется нейтронами

## LESSON 11

### Грамматический материал

Past, Future Continuous (active, passive);  
словообразование

### УПРАЖНЕНИЯ В ЧТЕНИИ

#### 1. Чтение двусложных слов с ударением на начальном слоге:

programme, party, shortage, follow, problem, standard, speedy, method, number, district, service, proper, centre, public.



## 2. Чтение многосложных слов:

(29—32) continuous, construction, expansion, modernization, industry, introduction, population, cultural, efficient, productivity, automation, communist, mechanical.

## 3. Чтение групп слов:

possible — impossible — possibility — impossibility, produce — product — productivity — productive, work — working — worker — workable, equip — equipment, industry — industrial, culture — cultural, public — publicity.

## 4. Слитное чтение словосочетаний:

the living conditions of our people, the housing problem in our country, the construction of new houses, the building of housing blocks, the cultural establishments of our city, an efficient organization of building work, the introduction of advanced methods, the proper use of construction equipment.

# TEXT

## THE HOUSING PROBLEM

Housing is one of mankind's biggest social problems. Under capitalism, with its inevitable division of society into oppressors and oppressed, into rich and poor, it was, and remains an exceedingly acute problem, an insoluble problem.

The October Revolution fundamentally altered the approach to this problem in our country.

The Programme of the Communist Party set forth by the great Lenin and adopted at the 8th Party Congress said: "...To strive by all means to improve the housing conditions of the working masses, to rebuild old houses and build new ones corresponding to the new living conditions for the working masses".

Guided by that programme our country was and is continuously improving the Soviet people's housing and living conditions.

The Communist Party and the Soviet Government have drawn up a programme for solving the housing problem in our country, so as to overcome the housing shortage in the shortest time possible. And we have all the material resources for achieving it.

The ways and means of solving the housing problem in the U.S.S.R. are as follows:

Intensive construction in order to eliminate the housing shortage.

Expansion and modernization of the building materials industry and introduction of new building machines.

Improvement of the designing of houses, the working out of economical standard designs, the use of more prefabrication, and the building of large housing blocks by speedy methods.

The most rational use of construction equipment and provision for its proper maintenance.

The Soviet Union holds the first place in the world in the number of flats which are being built per thousand of the population. We are not simply building houses with all modern conveniences but whole districts with their own public service and cultural establishments and shopping centres.

Elimination of the housing shortage which is being realized at present is a problem of great importance. It will be calling for an efficient organization of building work, a steady rise in labour productivity and a reduction of building costs, mechanization and automation of the work, the use of better and cheaper building materials; the introduction of advanced methods of communist work, and proper use and maintenance of construction equipment.

### ПОЯСНЕНИЯ К ТЕКСТУ

**under capitalism** при капитализме  
**guided by that programme** руковод-  
ствуясь этой программой  
**so as to overcome** для преодоления  
**the ways and means** пути, способы  
**... are as follows** являются следующие-  
ми

**hold the first place** занимать первое  
место  
**public service and cultural establish-  
ments** коммунальные и культурные  
учреждения  
**shopping centre** торговый центр  
**a problem of great importance** очень  
важная задача

### DIALOGUE 1

**Petrov:** I hear you are going to move into a new flat.

**Krylov:** Yes, we are keen to have a new flat at last.

**Petrov:** What sort of a house is it going to be?

**Krylov:** Oh, a fairly big one, nine stories high.

**Petrov:** Do you mean a block of flats?

**Krylov:** Yes, of course. It'll be a block of flats with three se-  
parate flats on each floor.

**Petrov:** And I suppose you'll live on the top floor, won't you?

**Krylov:** No, we shall live on the bottom one.

**Petrov:** I shouldn't like to live on the ground floor. I prefer  
the first floor.

**Krylov:** You see, if we live on the ground floor, it will be the  
very thing for the children.

**Petrov:** Whereabouts will it be?

**Krylov:** It is in a quiet newly built district, in Darnitsa, with  
its own public service and cultural establishments and shopping  
centre.

**Petrov:** Have you got the plans of your flat?

**Krylov:** Yes, I have. Care to have a look at them?

**Petrov:** I'd love to.

**Krylov:** Here they are. What do you think of them?

**Petrov:** I can't make head or tail of plans of houses.

In the plan it doesn't look like a house at all.

**Krylov:** You don't know what you're talking about. Just wait  
till you see it when it's ready. We find the flats very well planned.

Petrov: Have the workmen begun?

Krylov: They began some time ago. They have already laid the foundation. Taking into consideration that many parts are prefabricated, I hope that by the end of the year, we shall have moved into the new house.

Petrov: What does it mean "prefabricated"?

Krylov: This means that as much of the building work as possible is done not on the building site but in factories where mass production methods can be used. The parts are taken to the site and put together there. This is a speedy method of work.

Petrov: I'm looking forward to seeing your new house.

## ПОЯСНЕНИЯ К ТЕКСТУ

move into a new flat вселиться в новую квартиру

we are keen to have мы очень хотим иметь

at last наконец

fairly big довольно большой

block of flats многоквартирный дом

top floor верхний этаж

bottom floor нижний этаж

ground floor первый этаж

it will be the very thing это как раз то, что нужно

whereabouts will it be? в каком же месте он будет?

care to have a look? хотите посмотреть?

I'd love to я очень хотел бы

I can't make head or tail я совершенно не разбираюсь

just wait вот подождите

lay the foundation укладывать фундамент

take into consideration принимать во внимание

are prefabricated являются сборными

we shall have moved into мы уже вселились

as much ... as possible как можно больше

mass production methods методы массового изготовления

put together соединять, собирать

I'm looking forward to seeing я надеюсь, что скоро увижу

## DIALOGUE 2

Petrov: How many rooms will you have?

Krylov: We'll have three rooms. A bedroom for ourselves, a bedroom for children, and a dining room combined with the living room. We'll also have a kitchen, a bathroom, and a W. C. next to it. The bedrooms will be on the south with windows looking on to a garden.

Petrov: What about furniture?

Krylov: We'll mostly have built-in furniture. The wardrobes will be built into the walls of the bedrooms. Most of the kitchen furniture is also to be built-in. And we'll also have built-in bookshelves in the living room.

Petrov: That's an excellent idea. The built-in furniture saves space and it'll cost you much less to furnish the flats, won't it?

Krylov: Yes, there'll be plenty of space in the kitchen for labour-saving devices: a refrigerator, a washing machine and a vacuum-cleaner. In general, the modern buildings do help us to live and work in comfort. They do save a lot of unnecessary work. There are all modern conveniences there. There is central heating, gas, electricity, cold and hot water supply and what not.

**Petrov:** Will you buy new furniture?

**Krylov:** Yes, we'll buy some pieces of furniture. We need a dressing table and two beds for the bedroom, and a cupboard, a table, some chairs and armchairs for the dining-room. We have a good sofa, a TV set and a radio-set.

**Petrov:** You will have a telephone, won't you? Where would you like to have that placed? In the living room?

**Krylov:** No, not in the living-room. Can you think of having a broadcast of an opera interrupted by the ringing of the telephone? And then having to turn the wireless off, or turn it low, while one of us carries on a telephone conversation?

**Petrov:** Yes, you're right. I hadn't thought of that. If the telephone is not in the living-room, one of you can go on listening to the broadcast or seeing the TV program.

### ПОЯСНЕНИЯ К ТЕКСТУ

next to рядом  
on the south с южной стороны  
look on to the garden выходить в сад  
what about ... а как с...  
built-in furniture встроенная мебель  
is also to be built in будет также  
встроенной  
save space экономить площадь (место)  
plenty of space много места  
labour-saving devices устройства, облегчающие труд человека  
do. help us действительно дают нам  
возможность  
save a lot of work в значительной  
мере экономить труд

and what not и т. п., и многое другое  
where would you like that placed? где  
вы хотите его поставить?  
can you think of having a broadcast  
interrupted... можно ли представить  
себе, чтобы радиопередача прерывалась.  
having to turn the wireless off быть  
вынужденным выключать радио  
turn it low сделать его тише  
carry on a conversation вести разговор  
go on listening продолжать слушать  
TV program телевизионная передача

### УПРАЖНЕНИЯ

I. Переведите на русский язык следующие группы слов одного корня:

to divide — division — divisible — divisibility — indivisible — indivisibility; to oppress — oppressor — oppression; to solve — solution — soluble — insoluble; to improve — improvement; to eliminate — elimination; to achieve — achievement; to expand — expansion; to introduce — introduction; to design — design — designer; to speed up — speed — speedy; to maintain — maintenance; efficiency — efficient; to reduce — reduction; to organize — organizer — organization; to continue — continuation — continuous — continual — continuously — continually.

II. Найдите в тексте синонимы к следующим словам и переведите их на русский язык:

very, to change, to reach, building, up-to-date, increase, to require, decrease, inexpensive, apartment.

III. Найдите в тексте антонимы к следующим словам и переведите их на русский язык:

rich, soluble, out-of-date, increase, expensive, improper.

**IV. Найдите в тексте английские эквиваленты для следующих словосочетаний:**

современные удобства, предприятия бытового обслуживания, требует эффективной организации.

**V. Переведите на английский язык:**

1. В Советском Союзе строится огромное количество жилых домов для трудящихся. 2. Коммунистическая партия и Советское правительство всегда стремились и стремятся улучшить жилищные условия трудящихся. 3. Рост производительности труда помогает решить проблему жилья. 4. Сборные конструкции ускоряют строительство. 5. Решение жилищной проблемы требует эффективной организации строительных работ. 6. Мы строим дома со всеми современными удобствами. 7. В наших вновь построенных районах есть коммунальные и культурные учреждения и торговые центры.

**VI. Переведите следующие предложения с Present, Past и Future Continuous:**

1. Electronics is becoming increasingly important in all branches of production. 2. The Soviet scientists are successfully solving important problems of mathematics, chemistry, electronics, medicine and biology. 3. More and more is being learnt about outer space and the conditions for life there. 4. During the flight the astronaut will be observing the earth and the sky. 5. During the work on his discovery the scientist observed that a small electrical current was flowing. He rightly concluded that some electrons were moving through the vacuum. 6. Numerous new instruments are being used in many branches of science and technology. 7. Within several years nuclear power plants will be generating a great amount of electrical power. 8. The day will come when spaceships will be flying to the planets in the solar system and their satellites.

**VII. Поставьте нужное время (Present Indefinite или Present Continuous) и переведите следующие предложения на русский язык:**

1. Our cosmonauts always (to do) their morning exercises. 2. They (to do) them now. 3. We see the cosmonauts on the cosmodrome. They (to train). 4. The cosmonauts generally (to train) in the morning. 5. They never (to get up) late. 6. It is seven o'clock. They (to get up). 7. They take the lift when they (to go up) to the ship. 8. Look at the ship. The cosmonaut (to go up) to the ship.

**VIII. Переведите следующие предложения на русский язык, обращая внимание на время сказуемого:**

1. Our country's successes in the construction of hydropower stations have been universally recognized. 2. The weight of the atom is almost entirely concentrated at its centre, in the nucleus. 3. Electrons can be evaporated off metals, like steam from water. 4. Recently scientists and engineers have found an increasing number of ways in which electronic conduction can be guided and controlled

for useful purposes. 5. Interplanetary travel is becoming a reality in our epoch. 6. If a piece of material is struck by rays of light, electrons will leave the material. 7. There have been many theories to explain the nature of heat. The ancients had an idea that heat which they called "caloric" was a fluid which could be added to or taken from a body. 8. The future of astronautics will be a logical continuation of what has already been achieved. 9. Two methods of reproducing sound in motion pictures have been found. 10. Nearly all properties of matter are affected in some degree by temperature changes. 11. Automation is being introduced in building work. 12. The new block of flats was being built at the time of our holidays.

**IX. Напишите следующие предложения во всех временах, добавив соответствующие обстоятельства времени:**

1. We solve important problems in the field of physics. 2. He writes articles on the development of science and technology.

**X. Переведите следующие предложения на русский язык, обращая внимание на функции глагола to be:**

1. When a structure or a machine is to be built, suitable materials are to be chosen for the parts. 2. Every element is made up of minute particles, which are called atoms. 3. Burning is simply the combination of a substance with oxygen in the air. 4. One of the great problems of the mechanical engineer is to eliminate friction in a machine. 5. It is the cyclotron that can be used to produce very high speed positively charged particles of enormous energy. 6. A study of the motions of the objects is necessary if we are to understand them and to learn to control them. 7. Many important observations are being made by our cosmonauts. 8. Every large industry has research laboratories where there are many opportunities to observe the experiments which are being performed. 9. A great number of new blocks of flats were built in our city. 10. Automation is finding wider application in all branches of industry.

**XI. Поставьте глаголы, данные в скобках, в соответствующем времени и переведите следующие предложения на русский язык:**

1. Before the first astronaut went into space, much work (to be done) with the sputniks. 2. The problem of improving the housing conditions of our people (to be set forth) for the first time at the 8th Party Congress. 3. The development of science and technology (to open up) infinite possibilities for conquering the forces of nature. 4. On April 12, 1961 the sputnik-space ship "Vostok" (to be launched) into space with a man on board. It (to be followed) on August 7, 1961 by another flight performed by H. Titov. 5. We (to build) many houses this year using prefabrication. 6. A new block of flats with all modern conveniences (to be built) at present. 7. This block of flats (to be built) when we came to the city. 8. By the end of the year it (to be finished).

XII. Поставьте сказуемое главного предложения в прошедшем времени и измените соответствующим образом время придаточного предложения: переведите каждое предложение на русский язык:

1. We are informed that many scientists are working at the problem of radioactivity. 2. Newspapers write that atomic radiation is very harmful, and that, therefore, the stopping of H-bomb tests will Committee reports that every nuclear test contaminates the world greatly contribute to human health. 3. The United Nations Scientific by radioactivity and increases the danger to human life. 4. Scientists announce that they have discovered important properties of radioactive substances. 5. People are sure that soon a spaceship will fly to other planets.

XIII. Прочтите и напишите по-английски следующие количественные числительные; образуйте от них порядковые, где это возможно:

25, 9, 7, 11, 12, 240,  $10^2$ ,  $4^4$ ,  $5^{11}$ ,  $20^3$ .

XIV. Напишите предложения, в которых используются следующие слова а) как существительные, б) как глаголы:

load, take, off, land, man.

XV. Определите функцию выделенных слов и переведите каждое предложение на русский язык:

1. The modern kinetic molecular theory of heat **states** that heat is the energy of motion of molecules. 2. In the solid **state**—ice—the molecules of water **form** a hard rigid mass of small volume. 3. Oxygen is essential to all **forms** of life. 4. A **motor** car can travel with a speed of 100 km. per hour. 5. When you **motor** across a busy road, be very careful. 6. An electric **motor** changes electrical energy into mechanical. 7. The electrons outside the nucleus **can** only move in orbits. 8. The liquid fuel was put in a **can**. 9. We use electric currents to produce very strong magnets. 10. The basis of our modern civilization lies in the **use** of machinery. 11. We can **place** a rocket on correct trajectory by means of an automatic system. 12. The motion of gases from **place** to **place**, as a result of their molecular energy, is called a diffusion process. 13. Space rockets **house** the instruments necessary for making observation of outer space. 14. In the nearest future each **house** both in town and in the country will have electric lighting. 15. In the progress of **means** of communication, 1875 was an important year, it brought the invention of the telephone. 16. Increased heat **means** increased motion of molecules. 17. The great space achievement is a **triumph** for humanity. 18. If all progressive people unite in their struggle for peace, peace will **triumph**.

XVI. Поставьте вопросы к выделенным словам:

1. **Yes**, our country is continuously improving the Soviet people's housing and living conditions. 2. The Communist Party and the Soviet government have drawn up a **program** for solving the housing

problem. 3. The Soviet Union holds first place in the world in the number of flats built per thousand of the population. 4. No, the housing problem cannot be solved under capitalism.

**XVII. Переведите следующий диалог на английский язык:**

Две приятельницы встречаются в новом районе Киева.

А н я: Здравствуйте! Разве вы живете в этом районе?

В а л я: Да, мы живем здесь уже несколько месяцев; мы переехали на новую квартиру в январе.

А н я: На какой улице вы живете?

В а л я: Мы живем вблизи Днепра, а вы?

А н я: Мы живем в районе станции метро.

В а л я: У вас большая квартира?

А н я: Три комнаты, кухня, ванная, в общем все современные удобства. А у вас?

В а л я: У нас две комнаты. Ведь у нас небольшая семья. Ну и, конечно, тоже есть все удобства: электричество, газ, водопровод, лифт и мусоропровод (refuse chute).

А н я: В вашем старом доме не было водопровода, не правда ли?

В а л я: Да, теперь я счастлива, что живу в такой хорошей квартире. Благодаря метро требуется не много времени, чтобы добраться до центра города.

А н я: Я очень рада, что мы с вами встретились. Обязательно приходите посмотреть нашу квартиру.

В а л я: Спасибо, приду обязательно. Надеюсь, что и вы навестите нас.

**XVIII. Ответьте на следующие вопросы:**

1. What are the decisions of the Central Committee of our Party concerning the housing problem? 2. What are the ways and means of solving the housing problem in the USSR? 3. What kind of new districts are being built at present? 4. What will the programme for the elimination of the housing shortage call for?

**Дополнительные тексты: Прочтите и перескажите:**

**MOSCOW UNDER CONSTRUCTION**

Great changes — social, economic and in urban planning — have come about in post-Revolution Moscow during the years of Soviet power. V. I. Lenin was the initiator of Moscow's socialist transformation as he dreamed of our capital becoming a city well-planned architecturally and comfortable to live in.

V. I. Lenin was greatly pleased with the idea of building big housing developments in the South-West, the healthiest part of the city. He advised urban planners to give more attention to green areas.

Lenin's ideas have become reality. Housing and other facilities



are built on a mass scale in the outskirts; even the concept of outskirts has radically changed: amenities there are as good as in the centre. The central districts are reconstructed and rebuilt all the time. At present a lot of modern new buildings and structures can be seen in the city.

Moscow — with its old and new residential areas, bright and airy, with its splendid streets, bridges and parks, with new public buildings, and with the world's best Metro — is becoming better and more beautiful from day to day. Moscovites are turning our capital into a model Communist city making use of the latest in urban planning, in science and technology.

Moscow now is leading all the major cities in the world in the volume and rates of housing construction. For many years in a row we have built more than 100,000 flats annually which means that about half a million Moscovites have better living conditions every year. All modern post-war apartment buildings have running water, indoor plumbing and gas, central heating, bathrooms, hot water, etc. At the same time, rent in our country is very low, only about 4—5 per cent of the income of the head of the family.

Moscow is the cleanest and greenest of all the world's capitals. Parks, parklets, gardens, boulevards, etc. cover over 30 per cent of its territory. Around the city there is a protective belt of forest-parks which is a real fresh air tank. A great amount of work has been done to eliminate air pollution and control industrial sewage which resulted in considerably purer and healthier air, water bodies and the entire city in general. Other environmental protective measures have been taken as well, in particular preference is given to electrically-driven public transport, above all the Metro.

Moscow is under construction all along — many new multi-storeyed houses, buildings and structures of all kinds, are and will be erected on a large scale raising Soviet people's standard of living, providing better conditions for work, life and leisure.

#### ПОЯСНЕНИЯ К ТЕКСТУ

great changes have come about  
большие изменения произошли  
give more attention (to)  
уделять больше внимания  
from day to day  
изо дня в день  
make use of the latest ed.  
использовать новейшие достижения

for many years in a row  
много лет подряд  
which resulted in considerably purer  
and healthier air  
в результате чего воздух стал значительно чище и здоровее  
all along  
все время

#### THE HOUSING PROBLEM IN CAPITALIST COUNTRIES

The absolute majority of the millions of inhabitants of the capitalist world today, the working masses, have housing difficulties.

In the United States the housing conditions of the working people are particularly tragic. According to the Democratic National Committee, 15,000,000 Americans live in slums, 13,000,000 houses are below standard, and 7,000 city houses are in such a condition as to be unsuitable for living.

The Negro population of the United States is subjected to particularly inhuman exploitation. There is racial discrimination in housing too and today, as one hundred years ago, Negroes can live only in some special districts. Rents in Harlem, New York's Negro district, are much higher than in the districts inhabited by whites.

The housing is at its worst with the working people of New York. Two hundred and sixty thousand families, or about one million persons, are homeless. New York, the city with the largest population in the world, is a city of acute class contradictions.

In other capitalist states the housing conditions of the working people are no better. They are not improving but are continuously growing worse, while the capitalists, on the other hand, build palaces and live in luxury.

And so, on the one hand, there are the luxurious palaces and villas standing in parks and gardens, and, on the other hand, the slum districts with no facilities, no gas or electric lighting.

The difficult housing conditions of the working people can be really improved only when the social system that determines them is reshaped from the bottom up. The experience gained in housing construction in our country was strikingly demonstrated in building the Olympic Village. This comfortable self-contained housing development is an example of the best way a residential area and its services can be planned. Schools, kindergartens, the polyclinic — a seven-story building equipped with the most up-to-date medical apparatuses — shops, service establishments, the cinema, concert hall with 1200 seats, and sport facilities are all just several minutes' walk from any home.

The Village erected for the 22nd Olympic Games (Moscow, July 19 — August 3, 1980) has not become a dead monument to the Olympics. Its project provided everything both for the Olympic demands and for post-Olympic life in the Village. That is why schools and kindergartens were included in the project though they were not needed for the Olympics. All its 36 different structures are and will be used for the benefit of the Soviet people. According to a Moscow City Soviet decision all its 3,438 flats have been distributed among Moscow factory and office workers, World War II veterans and government employees.

The Village is linked to the nearest Metro Station (Yugo-Zapadnaya) by bus and it has already become a big residential area like many others.

#### ПОЯСНЕНИЯ К ТЕКСТУ

is at its worst находится в наихудшем положении  
on the one hand с одной стороны

on the other hand с другой стороны  
from the bottom up с самого низа

## LESSON 12

### Grammar:

прямая речь;  
косвенная речь;  
сложные предложения;  
бессоюзное подчинение придаточных предложений;  
словообразование

### READING DRILLS

#### 1. Two-syllable words with the stress on the first syllable:

(13—16) recent, science, structure, process, fuel, peaceful, purpose, study, power, number, welfare, active, sulphur, prospect, effort, sudden, giant.

#### 2. Two-syllable verbs with the stress on the second syllable:

(12, 10) explain, effect, release, produce, prepare, create, supply, obtain, compare, control, exhaust, exist, bombard, achieve, install.

#### 3. Many-syllable words:

(29, 31) miraculous, property, physicist, energy, chemical, discovery, electricity, synthesis, element, experiment, utilize, humanity, irrigate, electrify, accelerate, significance, technology, organize, capacity;

(30) nuclear, nucleus, scientist, experience, radio, sodium, genius, society.

#### 4. Groups of words:

to exhaust — exhaustible — inexhaustible; to control — controllable — uncontrollable; to achieve — achievable — unachievable; to use — usable — unusable; to suit — suitable — unsuitable; to obtain — obtainable — unobtainable; to solve — solvable — unsolvable; to change — changeable — unchangeable.

#### 5. Memorize the pronunciation of the following words:

suitable ['sju:təbl] — подходящий, пригодный, source [sɔ:s] — источник, improve [im'pru:v] — улучшать, desert ['dezət] — пустыня, course [kɔ:s] — течение, русло, isotope ['aɪsətu:p] — изотоп, believe [bi'li:v] — верить, wealth [welθ] — богатство.

#### 6. Read and translate the following word-combinations:

the recent achievements of science, the true structure of atoms, the important discoveries of scientists, the tremendous energy of fission, the new way to synthesis, the inexhaustible sources of energy, the water level of seas, the peaceful use of energy, the radioactive isotopes of elements, the recent developments of physics, the new age in technology.

## TEXT

### THE PEACEFUL ATOM

The recent achievements of science in nuclear physics are truly brilliant. Scientists have not only explained the structure of the atomic nucleus but have also found ways of splitting it. The discoveries of physicists have a very great effect on science and on the life of mankind.

Tremendous energy is released when the atomic nucleus is split. This energy is millions of times greater than that produced by ordinary chemical reactions, say, by combustion processes.

Uranium, which easily lends itself to nuclear fission, is a kind of "fuel" the world has never known before.

Atomic energy in the Soviet Union is used for peaceful purposes. It has been used in the creation of the world's first atomic power station to supply electricity to Soviet industrial plants and in the building of the first atomic ice-breaker "Lenin". This has been followed by the atomic ice-breaker "Arctica" — the first in world history to reach the North Pole.

Following its discovery, atomic energy was used in two directions — for peaceful purposes in the Soviet Union, and for preparing a new war in the imperialist countries.

The Soviet Union created the world's first atomic power station, which supplies electricity to Soviet factories, and built the atomic ice-breaker "Lenin".

Scientists have not only studied the reaction of atomic nucleus fission but they have opened the way to the fusion of atomic nuclei. The heavy atoms of uranium and a number of other transuranium elements proved the most suitable where energy has to be obtained from fission, but in the case of energy obtained from fusion it was found that the use of the lightest atoms of hydrogen was extremely profitable. These reactions give incomparably more energy than the reaction of fission, but they are very difficult to control.

In many countries scientists are experimenting on nuclear fusion reactions in controlled installations.

When this problem is solved it will give mankind an inexhaustible source of energy, for there are atoms of heavy hydrogen in the molecules of water of seas and oceans. But here we again come up against the question of how these new sources of energy will be utilized.

Used for peaceful purposes only, atomic and, in the near future, thermonuclear energy, will fundamentally improve the life of all nations.

This energy will be turned to the welfare of humanity. It can be used "to warm up" the Far North, to irrigate deserts, and to electrify regions far from other sources of power. Used for peaceful purposes, this energy will improve the life of man, control the water level of seas, change the direction of ocean currents and the course of rivers, and so on.

The peaceful use of atomic energy means more than the solution of power problems. Another peaceful application of atomic energy deals with the radiations of radioactive substances. That radioactive substances or, to use the more common term, radioactive isotopes find a growing application in industry, agriculture, medicine and scientific research is common knowledge.

The invisible radiations radioactive isotopes are giving out are becoming a means for control and automation in industry; they act as catalysts in chemical processes, and are a powerful factor in biology and medicine. Finally, these same radiations may be used for making small-size, long-lived sources of electric current.

These are only a few of the known ways of using atomic energy for peaceful purposes.

At our universities, research institutes and scientific laboratories we are working to develop the peaceful uses of nuclear power and we believe these efforts will help to accelerate the building of a communist society in our country and to bring happiness to ordinary people throughout the world.

### COMMENTARY

as well as a также  
which easily lends itself to fission ко-  
торый легко поддается расщепле-  
нию

we come up against the question мы  
сталкиваемся с вопросом

### DIALOGUE

Teacher: To continue our talk on the peaceful uses of atomic energy it would be interesting to speak about the new sources of energy and their potential uses.

Student 1: The world is now well aware of the fuel shortage arising from the great expenditure of energy and the exhaustion of the natural oil and coal resources.

Student 2: It certainly is a serious problem.

Teacher: And who knows what sources of energy could be used to replace the dwindling supply?

Student 3: One can foresee that in the next century three long-term sources of energy such as fusion, fission and solar energy will be available.

Student 2: I should like to hear some more about what nuclear fusion is.

Student 1: Let me try. Nuclear fusion is the process in which light nuclei collide, fuse together to form heavier ones and release energy. It takes place in high-temperature matter, as in the sun.

Student 4: Controlled nuclear fusion offers a prospect of a major new source of energy from the light elements on earth, one that is practically unlimited and which, if it is successfully developed, could be used for large-scale central generation of electricity.

**Teacher:** True. Controlled nuclear fusion is potentially a final solution to the energy problem. It is a feature which it has in common with both nuclear energy from fission reactors and solar energy.

**Student 3:** And what are the advantages of fusion over fission?

**Student 2:** I suppose the fuel is more abundant, and no fission products are produced; besides, the amount of fuel in the reaction zone is safe. Nonetheless, fusion does have some disadvantages, such as control of impurities in plasma, as well as some others.

**Student 1:** To what temperature must the plasma be heated?

**Teacher:** Something in the range of from 50 to 500 million degrees.

**Student 3:** A very high temperature, indeed.

**Teacher:** As a matter of fact, studies have been undertaken in most countries to solve the engineering problems connected with future fusion reactors, especially in the case of plasma temperature. And now let's say a few words about solar energy.

**Student 4:** Could I say a few words? Solar energy is yet another source of energy worth speaking of, as it is abundant and does not spoil the environment. It is not so easy to use for central electricity generation as its heat varies in time and place (Northern and Southern countries). It is much more promising for localized and individual use.

**Teacher:** And so, to sum up, let's say that all these sources of energy are still in the research stage and scientists are looking for ways to solve the problem of producing and harnessing these forms of energy most effectively.

## COMMENTARY

is well aware of хорошо знает  
dwindling supply истощающиеся за-  
пасы  
long-term рассчитанный на длитель-  
ное время

offer a prospect открывать перспек-  
тиву  
large-scale в широких масштабах

## EXERCISES

**I. Underline the suffixes and translate the following words into Russian:**

achievement, truly, atomic, tremendous, combustion, peaceful, easily, direction, solution, improvement, existence, fission, electricity, irrigate, electrify, artificial, radioactive, extremely, progressive, disarmament, accelerate, happiness.

**II. Find in the text synonyms for the following words:**

to break up, humanity, liberate, usual, readily, to provide, to make better, to apply, energy, aim, etc., emit, speed up, all over the world, several, method.

III. Write antonyms to the following words and translate them into Russian: near, old, after natural, uncommon, unable, impossibility, unhappiness.

IV. Find in the text English equivalents for the following words and word-combinations:

подаваться, решать проблему, русло реки, и так далее, во всем мире, управляемая термоядерная реакция.

V. Translate the following sentences into English using the words from the text:

1. В начале XX столетия физики нашли способ расщепления атома. 2. Ученые научились создавать элементы искусственным путем. 3. Во время процесса расщепления атома выделяется огромная энергия. 4. Уран легко поддается расщеплению. 5. Советский Союз использует атомную энергию в мирных целях. 6. Использование атомной энергии в мирных целях улучшит жизнь человека. 7. Уже решена проблема создания искусственных радиоактивных изотопов. 8. Если будет решена проблема управляемой термоядерной реакции, человечество получит неисчерпаемое количество энергии.

VI. Write questions to which the words in bold type in the following sentences are the answers.

1. **Yes**, the XXth century physics has solved many important problems. 2. Many scientists work on the problem of **controlled fusion**. 3. **No**, I do not know anything about the latest achievements in this field. 4. **Uranium** is mostly used as an atomic fuel. 5. The engine of the atomic ice-breaker is powered **by atomic energy**. 6. **Yes**, we visited the atom city — Dubna. 7. **No**, I haven't seen the atomic ice-breaker "Lenin". 8. The world's first atomic power station was put into operation in the Soviet Union **in 1954**. 9. Atomic power stations can be built **in the very regions where power is to be used**.

VII. Turn the sentences from indirect to direct speech. Don't forget quotation marks and question marks where necessary.

1. Foreign tourists said that they wanted to visit Dubna — atom city. 2. They said that they had heard much about Dubna and they hoped that they would be shown the city. 3. One of them asked whether many foreign scientists had already visited Dubna. 4. The Director answered that the Dubna Research Institute had already received many foreign delegations. 5. He was asked what the capacity of the accelerator was. 6. He answered that its capacity equalled 10 billion electron volts. 7. The foreign tourists also asked when the first atomic power station had been put into operation. 8. They asked if we could tell them about the advantages of atomic power stations.

VIII. Turn the following sentences into indirect speech:

The tourist: What new source of energy was discovered in the 20th century?

**The Soviet scientist:** The new source of energy is atomic power.

**The tourist:** Can you tell me what the capacity of your atomic power plants will be?

**The Soviet scientist:** It will range from two to two and a half million kilowatts.

**The tourist said to the Soviet scientist:** "Your country has great achievements in the peaceful uses of atomic energy".

**IX. Rewrite these sentences as indirect questions using the words given in parentheses:**

1. When did scientists discover the way of splitting the atom? (Can you tell me). 2. Can our scientists create elements artificially? (Do you know). 3. Where is atomic energy used for peaceful purposes? (Please tell me). 4. What is an atomic reactor made of? (Do you know). 5. Do our scientists work on the solution of the problem of controlled fusion? (Can you tell me).

**X. Translate the following sentences into English:**

A. 1. Газеты сообщили, что в Советском Союзе строится несколько новых атомных электростанций. 2. Ученый сказал, что он работает в области мирного использования атомной энергии. Он сказал, что проделал огромное количество опытов для того, чтобы окончить свою работу. 3. Профессора спросили, где используются изотопы. Он ответил, что изотопы используются в сельском хозяйстве и во многих отраслях науки; он сказал, что в будущем они найдут еще большее применение.

Б. 1. Группе иностранных ученых предложили посетить атомный город — Дубну. 2. Им рассказали о работе ученых многих стран над проблемами использования атомной энергии в мирных целях. 3. Они поедут туда завтра; им покажут новый ускоритель частиц и другие машины. 4. После посещения этого исследовательского центра их попросят рассказать о своих впечатлениях. 5. К концу месяца они напишут статью об этом. 6. В Советском Союзе проблеме мирного использования атомной энергии уделяется большое внимание. 7. О достижениях СССР в этой области много говорят во всем мире. 8. На труды советских ученых часто ссылаются зарубежные ученые.

**XI. State the kinds of the subordinate clauses:**

1. At the end of the last century the general point of view was that physics had been brought to its last stage of development. But what actually happened was that one remarkable discovery followed the other. 2. What practical value radioactive substances may have in the future is yet to be demonstrated. 3. The problem which greatly interested the scientists was how protection could be given against radioactive rays. 4. How thermonuclear reactions can be controlled is a very important problem. 5. Not a few scientists and medical men lost their lives before it was found out how protection could be



given against radioactive rays. 6. That the discovery of radioactivity is connected with the names of the French scientists of the end of the nineteenth century Henry Becquerel and Pierre and Marie Curie is common knowledge. 7. That some substances, such as uranium, radium, thorium, etc. emitted radiations was noticed at the end of the 19th century. 8. That the discovery of radioactivity has led to finding out the structure of the atom is quite evident. 9. The thing that drew the attention of scientists was that a cold material was giving out radiations that acted in the same way as light. 10. When the neutron was discovered all those who had been studying the structure of the atomic nuclei breathed a sigh of relief (вздыхнули с облегчением) for now it was seen that we had found that elementary particle which was needed for understanding how the nuclei were built up. 11. Whether other substances but uranium possessed the property of emitting radiations was of great interest to scientists. 12. The problem which greatly interested the scientists was whether other elements besides uranium possessed the property of emitting radiations. 13. Following Roentgen's discovery, the X-rays were thoroughly investigated to determine whether they were waves or particles. 14. In America where both the Fahrenheit and Centigrade scales are used, it is often necessary to find what reading on one scale corresponds to a given reading on the other.

**XII. State the functions of the words in bold type; translate each sentence into Russian:**

1. **That** water boils when sufficiently heated is well known to everybody. 2. Scientists determined **that** radium was breaking down into a number of elements the last of which was lead. 3. It was after extensive experiments **that** scientists came to the conclusion **that** the central nervous system was highly sensitive to radiation. 4. One of the peaceful applications of atomic energy is to move a steam or gas turbine **that** rotates an electric generator, thus converting atomic energy into electricity. 5. It is chiefly because of the gamma rays it emits **that** radium is so important in the treatment of diseases. 6. A very important problem confronting our scientists is **how** thermonuclear reactions can be controlled. 7. For a long time scientists thought **how** the colossal energy stored in the atomic nucleus could be harnessed. 8. **How** the Curies discovered the phenomenon of radioactivity is a well-known fact. 9. At the beginning of their experiments the Curies knew very little **what** results they would get from their experiments. 10. **What** we call weather is determined very much by the amount and condition of water vapour in the air. 11. **What** we call radioactivity is the property of emitting radiation possessed by some substances. 12. At first the Curies did not know **whether** their experiments would be successful. 13. The chief thing they were interested in was **whether** there were many substances possessing the property of radiation. 14. **Whether** radium radiations were more active than pitchblend (свинцовый блеск) from which it was obtained was not known at first.

**XIII. Define what conjunctions could be inserted in the following joined clauses:**

1. The Curies found polonium was many times more active than uranium. 2. In 1898 they announced they had discovered the element radium. 3. They claimed radium radiations were a hundred thousand times more active than pitchblend from which it was obtained. 4. It is established there are three varieties of radiations from radioactive atoms. 5. The discovery of the radiations radioactive substances emit was of the greatest importance for research work in the field of the structure of the atom. 6. The application the radioactive isotopes are finding in different fields of life is of growing importance. 7. The properties of a composite matter are always quite different from those of the elements it consists of. 8. We can now calculate how many atoms there are in 1 gramme of any element we choose by making use of our knowledge of the relations between the atomic weights of the elements.

**XIV. Translate the following dialogue into English.**

— Какой новый мощный источник энергии был открыт учеными в начале XX столетия?

— Этот новый источник энергии — атомное ядро.

— Долго ли работали ученые над раскрытием тайны атома?

— Да, они работали больше столетия.

— Как иногда называют наш век?

— Его называют атомным веком.

— В чем преимущество атомной энергии?

— Атомная энергия очень дешевая и ее запасы неограниченны.

— Где используется атомная энергия в Советском Союзе?

— Мы вырабатываем электроэнергию на атомных электростанциях, мы также используем атомную энергию в атомных ледоколах. Есть много примеров мирного использования атомной энергии.

— А знаете ли вы, что такое изотопы?

— Конечно. Это элементы с такими же химическими свойствами, как и у естественных элементов, но они обладают свойством радиации. Применение изотопов также является примером мирного использования атомной энергии в нашем народном хозяйстве.

**XV. Answer the following questions:**

1. What are the achievements of science in nuclear physics? 2. By what process is the splitting of the atomic nucleus accompanied? 3. For what purposes can atomic energy be used? 4. For what purposes is the atomic energy used in the Soviet Union? 5. What improvements in the life of man can the peaceful use of atomic energy bring?

**XVI. Retell the text according to the following plan:**

1. The XXth century science has great achievements in the field of nuclear physics, 2. Atomic energy can be used in two directions.

3. Peaceful uses of atomic energy can radically change the life of man. 4. Soviet scientists are working to develop the peaceful uses of atomic energy.

Supplementary Text. Read and retell:

### SOLAR ENERGY

Our sun, although it is not the largest star in our universe, is a gigantic body. If we make a non-stop flight around it in an airplane at a speed of about 300 km per hour, it will require 565 days to go around it at the equator. The diameter of the sun is 1,391,000 km, that is, 19 times that of the Earth. The sun has a surface temperature of about 6,000°C.

Modern research into the atom indicated that under certain conditions matter itself may be transformed into energy. It is now thought that the source of the sun's energy results from nuclear fissions and is practically unlimited.

The earth's surface receives energy from the sun in enormous quantities. But only half of the energy that strikes our atmosphere ever reaches the earth's surface, while the rest is reflected and absorbed by the air.

What can be done with this vast amount of power? Let us briefly review how man utilizes the sun's energy.

Man has used and is still using solar energy through photosynthesis as one of his sources of heat and power. Another way to use solar energy is in the solar machines, still another is the use of solar heat for cooking and house heating. The future will undoubtedly bring us a lot of new applications of solar energy.

### COMMENTARY

non-stop flight беспосадочный полет  
it is now thought в настоящее время  
предполагают

### LESSON 13

#### Grammar:

понятие о сослагательном наклонении;  
условные предложения;  
инверсия в условных предложениях;  
словообразование.

### READING DRILLS

#### 1. Two-syllable words with the stress on the first syllable:

(13—16) reason, science, detail, vapour, surface, enter, contact, radar, rocket; (13) planet, habit, liquid, tropics, value.

#### 2. Two-syllable verbs with the stress on the second syllable:

(12, 10) combine, depend, survive, produce, require, contain, inquire, observe, supply, exist, subject, destroy, revolve, protect.

### 3. Many-syllable words:

(29, 31) oxygen, habitable, evident, practical, atmosphere, maximum, probable, every, animal, diameter, velocity, satellite, astronomer, continuous, continual.

### 4. Derivative words:

dependent — independent, practical — impractical, probable — improbable, possible — impossible, effective — ineffective, sufficient — insufficient, necessary — unnecessary, habitable — uninhabitable, suitable — unsuitable, known — unknown, observable — unobservable, able — unable, protected — unprotected.

### 5. Word-combinations and prepositional groups:

stone bodies, various sizes, the earth's surface, several metres, the whole weight, considerable size, continual period, effective methods, smaller planets;

with the cosmic rays, of the space travellers, from the nuclear fuel, in an atomic rocket, over a long period, below the boiling point, of planetary heat, for the remoter planets;

by any form of life, with a large quantity of water, after spectroscopic observation of the stars, before the exact measurement of the temperature, with all the food in the world.

## TEXT

### ARE THE PLANETS HABITABLE?

Ever since it was known that the planets were bodies more or less like the earth, people have asked: "Are there living things on them, too?". This is a hard question to answer, but by combining the resources of most of the sciences, we can give a rather good answer.

The success achieved in the development of rocket-space technology, beginning with the first artificial satellites and automatic stations to the Moon and other planets greatly influenced the development of almost all the branches of science and technology. For a very short period of time the flights of space apparatus, the probing of the planets atmospheres, the soft landing of automatic stations on the planets surfaces have provided so much information never obtained before.

The modern level of the development of space technology has opened the road to the direct experimental solution of the basic problem — whether there is life on other planets or not.

First let us consider life on our earth. All living things are absolutely dependent on water. Moreover, this water must be liquid — neither ice nor gaseous water vapour, but ordinary liquid water. Nothing grows while it is frozen. And no living thing would survive if the water were boiled out of it. Hence it is necessary that the tem-

perature on a habitable planet should be above freezing part all the time, and below the boiling point all the time.

Light is necessary too. Practically all the food in the world is produced by green plants. Plants get the energy they require for their growth from sunlight.

There is good reason to believe that the vast store of oxygen in the air has all been supplied by plants. If there were no plants, there would be no food to eat, nor oxygen-containing air to breathe.

If we inquired whether other planets were habitable, we should then try to find out whether their temperatures were suitable for life, whether they had water and atmosphere on them, and if so, whether oxygen and carbon dioxide were present.

Measurements of planetary heat have shown that on Mercury, which is the nearest planet to the Sun, there is a great difference between the day and night temperatures which are  $350^{\circ}\text{C}$  and  $-175^{\circ}$  respectively. This planet is evidently uninhabitable by any form of life known to science. For the remoter planets the temperatures range from  $150^{\circ}$  to  $200^{\circ}\text{C}$  below zero. Biological experiments carried out by space apparatus completely disprove the existence of highly developed living organisms on these planets., but they give hope that there are probably microorganisms on them. The Moon, which has been explored both by automatic vehicles and by man shows no trace of atmosphere or water. Physical conditions are entirely unsuitable for the existence of living protein on the Moon and therefore it also is a dead world.

Now only Venus and Mars are left for consideration. Venus has a large quantity of carbon dioxide (97%) in her atmosphere, but too little oxygen and water vapour. The maximum surface temperature is about  $300^{\circ}\text{C}$  which is an unsuitable environment for the existence of life.

Mars has a thin atmosphere, so that we can see the surface clearly. The planet has seasons like our own, and the heat measurement indicates that in the tropics the temperature rises to about  $27^{\circ}\text{C}$  above freezing and falls below freezing ( $-70^{\circ}\text{C}$ ) every night.

Spectroscopic observations show that there is about 95% of carbon dioxide in its atmosphere. They indicate, too, that there is very little oxygen and water vapour (0.1%, about 1% respectively) on Mars. Whether animal life has ever existed on Mars and whether it has been able to survive has not yet been established. Though the majority of scientists who, with the help of space apparatus, have explored the planet's physical conditions came to the conclusion that life is possible on Mars.

The data obtained recently on the Moon, Venus and Mars considerably widen our conceptions of these heavenly bodies — ideas which have been formed throughout the history of observations and the development of astronomy. The ultimate result of all this is the progress in studies of nature.

## COMMENTARY

ever since с тех пор как  
living things живые существа  
this is a hard question to answer на  
этот вопрос трудно ответить  
are left for consideration остаются для  
рассмотрения

above freezing выше точки замерза-  
ния  
thin atmosphere разреженная атмо-  
сфера  
below freezing ниже точки замерза-  
ния

## EXERCISES

I. Underline the suffixes and translate the following words into Russian:

habitable, suitable, clearly, primitive, gaseous, evidently, dependent, measurement, observation, hardly.

II. Find in the text synonyms for the following words and translate them into Russian:

difficult, in the first place, usual, therefore, also, to provide, to ask, obviously, perhaps, to show, to learn.

III. Find in the text antonyms to the following words and translate them into Russian:

habitable, solid, below, unnecessary, thick, much, now, possible, suitable.

IV. Find in the text English equivalents for the following words and expressions:

с тех пор как, более или менее, прежде всего, ни...ни, следовательно, фактически, есть все основания полагать, в настоящее время, теперь остается рассмотреть.

V. Translate the following sentences paying attention to the meaning of the words in bold type:

1. The phenomena of nature are of great importance **since** weather is one of the chief elements in man's life. 2. **Since** the appearance of airplanes weather conditions have played a very important role in aviation. 3. **Since** the atomic structure became known, many chemical processes were understood. 4. Much has changed in the development of atomic energy **since** 1932. 5. **Since** helium is an inactive gas, it will **neither** burn **nor** explode. 6. **Since** an atom is electrically neutral, it must have an equal number of positive and negative charges. 7. The time is not far off when the problem **whether** there is life on Mars will be settled at last. 8. The average distance between molecules is very great compared with their size, and they move **about** very quickly. 9. The alpha particles can travel **about**  $2\frac{3}{8}$  in. in air before they are stopped.

VI. Write out of the text all conditional sentences and translate them into Russian.

VII. Translate the following conditional sentences into Russian:

1. If the sun got its energy from ordinary chemical processes, such as the burning of coal and oil, it would not last for more than several thousand years; if that had been the case, the sun would

have cooled off to a dead star long ago. 2. Provided the alchemists could have produced temperatures equal to millions of degrees or if they had known how to accelerate particles, they would have succeeded in transforming the elements. 3. If we could transform all the energy of a gallon of gasoline into the motion of a car and none of it into heat, we could travel four hundred miles and there would be no need of a cooling system. 4. If it were possible to live on the moon, people would be able to jump about six times as high as they could on earth. 5. Unless there were some inexhaustible reservoirs of energy in the sun, life on earth could not exist. 6. If there were no atmosphere, the surface of the earth would become very, very hot by day and too cold at night. 7. The earth would now be a cold, dead mass if the heat of the sun could not reach it. 8. If we could capture all the energy of sunlight falling on 1 square yard of surface on the earth in 1 second and convert it completely into mechanical energy, it would be equivalent to more than 1 horsepower. 9. If there were atmosphere and water on the moon it would not probably be a dead world. 10. If you look at the horizon immediately after sunset, you will often see a very bright star, Venus. 11. Travelers will probably have to take a reserve of oxygen with them, if they fly to Venus. 12. Had our research been successful, we should have been able to investigate the composition of Mars' atmosphere. 13. Could our observations have been supported theoretically, they would have done much to advance our knowledge in the field of radioactivity. 14. Were it possible to squeeze matter together until the nuclei touch one another, then the entire earth could be compressed to the size of a football. 15. Many accidents could have been prevented had the principles of physics been known and properly applied.

**VIII. Use the verbs in brackets in the required tense and translate the following sentences into Russian:**

1. If we (to be able) to see the molecules in a bottle of oxygen gas, we should be surprised by the chaos and confusion. 2. Provided a piece of radium (to be brought) near a charged electroscope, the leaves will come together, thus showing the loss of charge. 3. If we not (to raise) the temperature, the pressure would not increase. 4. If we had had time enough, we (to repeat) our experiment. 5. If we (to solve) the problem of controlled thermonuclear reactions, we could use oceans of fuels. 6. If scientists could reach still higher temperatures necessary for fusing together small nuclei, the problem of controlled fusion (to be solved).

**IX. Use inversion where possible and translate the following sentences into Russian:**

1. If you had asked a reputable scientist in 1930 whether large-scale atomic energy were possible, his answer would have been "probably not". 2. Provided all the data of the experiment had been important, they would have been tabulated. 3. If friction could be

entirely eliminated, a body set in motion on a level surface would continue to move indefinitely. 4. If we discover that the moon is appreciably radioactive it will provide further proof of the hypothesis of the moon's origin. 5. Unless the temperature rises, the speed of the motion of the molecules will not increase. 6. If we could compare the energy to be found inside the atom with other known power sources, the enormous store of the energy of the atom could be fully appreciated.

**X. Translate the following sentences into Russian paying attention to the meanings of "if" and "provided":**

1. A column of warm air will weigh less than a column of cold air if both are the same height and cross section. 2. It would have saved you a lot of time if you had prepared for your experiment more carefully. 3. Starting an experiment we must first determine if the substance is a compound or simply a mixture. 4. An answer to the problem if the moon and other planets have their magnetic fields is of great importance for modern science. 5. The success of the Soviet cybernetic installations, which **provided** the launching of Soviet sputniks, rockets and spaceships is known throughout the world. 6. **Provided** we use the necessary instruments, the measurement will always be correct. 7. Automation **provided** the control of not only individual machines, but also of whole shops and even factories. 8. The General Assembly of the International Astronomical Union **provided** for the holding of two symposiums. 9. Lightning protection is **provided** by the installation of lightning conductors. 10. **Provided** we are given due time, we shall be able to continue our investigations. 11. Our astronauts will fly to other planets **provided** all the preparatory work is completed. 12. **Provided** equal spaces are travelled by an object in equal intervals of time, the motion is uniform.

**XI. Translate the following sentences into English:**

1. Если бы не было воды, света и кислорода, на Земле не было бы жизни. 2. Если бы не было атмосферы, мы не могли бы дышать, на Земле было бы очень жарко и тысячи метеоритов и метеоров бомбардировали бы нашу планету. 3. Если бы все расчеты были закончены, мы смогли бы полететь на Марс. 4. Если бы Марс не был так близко от Земли, он бы не привлекал такого большого внимания астрономов и других ученых. 5. Если бы не было спутников и космических кораблей, мы не имели бы той ценной информации о вселенной, которой мы располагаем.

**XII. Answer the following questions:**

1. What are all living things absolutely dependent on? 2. Where do plants get the energy they require for their growth? 3. By what is practically all the food in the world produced? 4. By what is the vast store of oxygen in the air supplied? 5. What have measurements of planetary heat shown? 6. Does the moon show any trace of atmosphere? 7. Is the moon a dead world? 8. What is the composition of



the atmosphere of Venus? 9. What is the maximum surface temperature of Venus? 10. Can we see clearly the surface of Mars, and why? 11. Has Mars seasons like our own? 12. What do spectroscopic observations of Mars show? 13. Is it possible to find out at present whether animal life has ever existed on Mars?

**Supplementary Text. Read and retell:**

### SPACE FLIGHT DANGERS

The earth is subjected to continuous bombardment by meteors. During a year several thousand meteors land on the earth's surface.

Meteors are iron or stone bodies of various sizes, some of them are several metres in diameter before entering the earth's atmosphere. The whole weight of all meteors reaching the surface of the earth in a day is from 10 to 20 tons, and their velocities outside the atmosphere are between 10 and 70 kilometers a second.

A spaceship could be destroyed should it come in contact with a meteor of considerable size. Microscopic meteors might also destroy a spaceship if they bombarded it for a long time. This is especially dangerous for artificial satellites revolving around the earth over continual periods of time.

Effective methods of protecting the spaceship from the meteorites have not yet been worked out. However, some progress has been made in this field.

When the spaceship gets beyond the Martian orbit it will face another danger — that of coming in contact with one of the smaller planets or asteroids revolving round the sun, chiefly in the space between the orbits of Mars and Jupiter. The astronomers have already discovered about 2,000 such planets. In order that the ship should not come in contact with these planets radar equipment could be used. This is a difficult problem, however, because of the tremendous velocities at which meteors travel in space.

Ultra-violet rays from the sun and so-called cosmic rays continuously pass over interplanetary space. But these rays would be dangerous to man only if they acted during sufficiently long periods of time. The lives of the travellers in an atomic rocket would also be endangered by radioactive radiations from the nuclear fuel and special shields\* will have to be provided for protection.

### COMMENTARY

land on the earth's surface попадают  
на поверхность Земли  
gets beyond the Martian orbit выйдет  
за пределы орбиты Марса

it will face another danger встретится  
с другой опасностью  
in order that для того чтобы  
because of из-за, вследствие

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\* shield экран, защита.

## LESSON 14

### Grammar:

употребление should, would;  
глаголы долженствования;  
словообразование

### READING DRILLS

#### 1. Two-syllable words with the stress on the first syllable:

(13—16) failure, structure, product, rocket, engine, member, service, constant, science.

#### 2. Two-syllable verbs with the stress on the second syllable:

(12, 10) select, prevent, require, equip, obtain, combine, become, compare, provide, avoid.

#### 3. Many-syllable words:

(29—32) possibility, economical, developments, valuable, typical, industry, industrial, natural, polymer, property, similar, substitute, occupy, utilize, indicate; destruction, deformation, condition, construction, consideration, insulation, application, automation.

#### 4. Derivative words:

destruction — destructible — indestructible, to deform — deformation — deformable — undeformable — deformability, economy — economical — uneconomical — economically, effect — effective — ineffective — effectiveness, important — unimportant — importance, responsible — irresponsible — responsibility, possible — impossible — possibility — impossibility:

#### 5. Memorize the pronunciation of the following words:

thorough ['θʌrə] — тщательный, полный, tremendous [tri'men-dəs] — колоссальный, sufficient [sə'fɪʃənt] — достаточный.

### TEXT

#### KNOWLEDGE OF THE PROPERTIES OF ENGINEERING MATERIALS IS VERY IMPORTANT

An airliner crashes into a mountain, a train is wrecked\*, a bridge fails, and the loss of life and the cost of destruction may sometimes be the responsibility of the engineer. To avoid these possibilities, engineers must not only know how to determine the stresses and deformations in structures and machines under a variety of possible loading conditions, but they should also know how well the selected material of construction is to resist the loading.

In our daily lives we are constantly faced with the importance of finding suitable engineering materials. A complete knowledge of

\* to be wrecked терпеть крушение.

the properties of engineering materials would not only be required by engineers to prevent failure of structures and machines, but such knowledge would be also necessary in order that these materials should be made use of most economically. In recent years, the fact that some materials are available in insufficient quantities and the more effective use of new substitute materials required that a more thorough consideration of material properties be made. The science of engineering materials has led to the development of many alloys having much greater resistance to various loading conditions.

For many products made of nonmetallic materials such as, for example, the tremendous amount of things manufactured using plastics, a consideration of engineering properties might be very important. It is often required that we should get information on the properties of materials subjected to most severe conditions of temperature, corrosion, etc.

These conditions should be taken into account in the design of such constructions as gas and steam turbines for ships, rockets etc., jet engines, and various equipment for atomic power stations.

The development of materials required for the construction of the many machines, structures and products used in our modern civilization is provided by many kinds of engineers and scientists. In selecting the most suitable material and in the determination of the sizes of the required members, the designer might utilize the services of a materials engineer.

## - COMMENTARY

crashes into a mountain врезается в  
 гору  
 the cost of destruction убытки от ава-  
 рии  
 the loss of life ... may sometimes be  
 the responsibility of the engineer за  
 гибель людей иногда несет ответ-  
 ственность инженер  
 under a variety of possible loading  
 conditions при различных возмож-  
 ных условиях нагрузки  
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portance of finding мы постоянно  
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 том по материалам

## EXERCISES

I. Find in the text nouns corresponding to the following words; translate them into Russian:

destructive, responsible, possible, various, resist, considerable, produce, to fail, to lose, to design.

II. Find in the text adjectives corresponding to the following nouns; translate them into Russian:

day, suitability, availability, severity, effect, metal, importance.

**III. Find in the text verbs corresponding to the following nouns:**

determination, resistance, requirement, utilization, usage, knowledge.

**IV. Underline the suffixes in the following words and translate these words into Russian:**

airliner, engineer, designer, utilize, structure, constantly, effective, greatly, resistance, necessitate, special, equipment, corrosion, appearance, classify.

**V. Find in the text synonyms for the following words:**

to use, to demand, difficult, number, power plant, full, besides.

**VI. Find in the text English equivalents for the following words and word-combinations:**

имеющийся в наличии, в недостаточном количестве, для того чтобы, ряд, учитывать, наиболее подходящий материал.

**VII. Translate the following sentences into English:**

1. Ряд сплавов являются коррозиестойкими. 2. При проектировании нужно учитывать свойства материалов, из которых строится сооружение. 3. Для того чтобы предотвратить разрушение здания, нужно в совершенстве знать свойства материалов. 4. Если вы хотите быть хорошим инженером-строителем, обращайтесь большое внимание на изучение свойств материалов, из которых строятся сооружения. 5. Инженеры должны уметь определять напряжения и деформации в сооружениях и машинах, испытывающих воздействие самых различных нагрузок.

**VIII. Write out of the text the sentences with the Subjunctive mood, translate them into Russian.**

**IX. State the form of the Subjunctive mood in the following sentences, translate them into Russian:**

1. It is necessary that an engineer should know the properties of engineering materials. 2. It is required that many new alloys having great resistance to various loading conditions be developed. 3. It is important that the designer utilize the services of a materials engineer. 4. It is necessary that the number of machines at our plant should be increased. 5. The engineer demanded that the materials which are to be used in the construction should be tested. 6. The designer proposed that a new corrosion resistant alloy be utilized in the structure. He wished that a thorough test of this alloy would be made. 7. We propose that the designer use new substitute materials in the construction of the new machine. 8. Engineers must know how the selected material will resist loading conditions lest any accidents should happen. 9. Lest the structure should fail, the engineer should have a complete knowledge of the properties of engineering materials. 10. The new alloy must be thoroughly tested that we may use it in our design. 11. An engineer must have a thorough knowledge of the properties of engineering materials so that

he should utilize them properly. 12. It would be important to use the new alloy in the construction of this machine. 13. It would be hard to select the most suitable material without a thorough knowledge of the properties of engineering materials. 14. It would be interesting to develop some new substitute materials.

**X. Translate the following sentences into Russian paying attention to the meaning of "should" and "would":**

1. While making an experiment a physical quantity should be recorded just as accurately as it has been measured. 2. It is desired that the final result of an experiment should be as accurate as possible. 3. Every household should possess several thermometers such as a room thermometer, an out-of-door thermometer and a clinical or "fever" thermometer. 4. We were told we should make experiments under the directions of a skilled instructor. 5. If we had tested this material we should have used it in our construction. 6. I should like to carry on my research work in the field of engineering materials. 7. The designer decided that in selecting the most suitable material he would utilize the services of a materials engineer. 8. Had they applied new methods in production, the result would have been much better. 9. I should like to consider the appearance of the material used for household equipment.

**XI. Translate the following sentences into English:**

1. Вы бы использовали эти материалы более экономично, если бы хорошо знали их свойства. 2. Необходимо, чтобы при строительстве этого здания были использованы новые материалы. 3. Очень важно, чтобы все инженеры принимали во внимание свойства материалов. 4. Если бы вы посоветовались с инженером, вы бы нашли ряд более пригодных материалов.

**XII. Underline the subordinate clauses and state of what kind they are, translate the sentences into Russian:**

1. If one were to examine the stars on a clear, moonless night, he would soon discover that not all the visible stars are of the same degree of brightness. 2. In a mixture of gases each gas exerts the same pressure that it would exert if the other gases were removed. 3. It should be remembered that wind direction and wind velocity vary greatly with elevation above the surface. 4. Water will not flow in a pipe unless there is a difference in pressure or water level. 5. If we were to make a journey in the plane to the nearest star, we should have to travel constantly for about 144,186 centuries. 6. Could we make a non-stop flight around the sun in an airplane at a speed of about 300 km p. h., it would require 565 days to encircle it at the equator. 7. Should the pressure of a gas be doubled, the volume would become half provided the temperature is not permitted to change. 8. Since air is not a compound but a mixture of the various components, each component behaves as if the other were absent. 9. The atmosphere is very necessary for life and growth. Without it we should be unable to breathe, we should be bombarded

by cosmic rays, meteors and meteorites, to mention only a few things. 10. It was Tsiolkovsky who suggested that rudders be placed in the stream of gas emitted from the nozzle so that the direction of the rocket's flight in space may be changed. 11. It is important that space observatories orbiting the earth should function. 12. Further flights by unmanned spaceships to Venus and to Mars will be tried in order that these planets should be thoroughly studied. 13. It is very important that man fly in space as it is man that really explores the full riches of space. 14. More than eighty years ago metallic aluminium was so precious that it could have been sold for 140 dollars a pound, had there been a pound available.

**XIII. Write questions to which the words in bold type are the answers:**

1. The engineer must know well **the properties of engineering materials**. 2. Engineers and scientists develop new materials **for the construction of machines, structures and products in our modern civilization**. 3. The science of engineering materials has led to the **development of many alloys**.

**XIV. Translate into Russian paying attention to the verbs of obligation:**

1. The chief heat-producing elements of all fuels are carbon and hydrogen, so their chemistry must be studied first. 2. We should remember that convection currents cannot be set up in solids because the molecules of solids are not free to move from point to point. 3. In every case where work is done, two factors are to be considered. One is the force applied, and the other is the distance through which the force acts. 4. We have already seen that in any case we have to deal with in everyday life friction is always present to some extent. 5. One ought to be careful when experimenting with inflammable materials.

**XV. Answer the following questions:**

1. What must engineers know in order to avoid destruction of structures? 2. For what purpose is a complete knowledge of the properties of engineering materials necessary for engineers? 3. Are all materials available in sufficient quantities? 4. What is an alloy? 5. What are the properties of alloys? 6. Who provides the development of materials of construction? 7. Whose services might the designer utilize in selecting the most suitable material?

**Supplementary Text. Read and retell:**

#### LOOKING INTO THE FUTURE OF SCIENCE. AGE OF SYNTHETICS

With the tremendous amount of electricity available it would be possible to obtain great quantities of various metals, since there are vast sources of raw materials. However, the most typical materials of the future should be the products of organic synthesis, the so-called polymers, that is the various synthetic materials. These materi-

als, developed by chemists in the past few decades, will occupy a very important place in industry, construction and the home. This does not mean that natural materials should lose their importance. On the contrary, if combined with synthetic materials, they might become even more valuable.

Synthetic plastics will often take the place of metals in machine-building and in many respects their properties are higher than those of metals. However, polymer materials would not be able to compare with metals as electricity and heat conductors; or with iron in respect to magnetic properties. On the contrary, ordinary polymers are better insulators of electricity, and some of them provide the best heat insulation. There is a possibility, however, of synthesizing polymers which are conductors, though weak, of electricity.

Soviet scientists discovered that some polymers possess truly remarkable properties which in some respects are similar to the properties of iron, although in a much weaker form. So far industrial application has not yet been reached. But further research along such lines could result in the development of materials with sufficient electrical conducting and magnetic properties to make them important in automation, electronics and the creation of new types of transistors.

### COMMENTARY

raw materials сырье  
to take the place of заменять  
in respect to в отношении  
on the contrary наоборот  
so far до сих пор

along such lines в этом направлении  
might result in the development of  
materials могло бы привести к раз-  
работке материалов

## LESSON 15

### Grammar:

the Participle (forms and functions);  
словообразование

### READING DRILLS

#### 1. Two-syllable words with the stress on the first syllable:

(13—16) factor, human, burning, substance, happen, reader, carbon, crystal, thousand, fragment, carry, triumph, lower, easy, nature, liquid, order, compound, volume, enter.

#### 2. Two-syllable verbs with the stress on the second syllable:

(12, 10) discuss, supposé, combine, unite, produce, occur, compose, explain, control, decrease, increase, proceed, react, remain, compare, approach.

#### 3. Many-syllable words:

(29, 32) chemistry, chemical, molecule, energy, interest, velocity, catalyst, union, general, definite, indefinite, influence, generate, agitate, accelerate;

imagine, discover, develop, consider, continue, examine;

(27) overcome, introduce, undergo, understand, represent, correspond, reconstruct.

**4. Words ending in -ed:**

discussed, started, generated, agitated, combined, united, produced, interested, composed, discovered, carried, explained, occurred, increased, decreased, lowered, controlled, proceeded, accelerated, approached, stopped, considered, required.

**5. Memorize the pronunciation of the following words:**

agency ['eidʒənsɪ] — воздействие, фактор, pressure ['preʃə] — давление, ideal ['aɪdiəl] — идеальный, dissolve [dɪ'zɒlv] — растворять.

**6. Read and translate the following word-combinations and sentences:**

to discuss reactions, to light a match, to agitate the molecules, to combine with oxygen, to be composed of atoms, to break into fragments, to control the rate, to use catalysts, to increase the velocity;

it is generally known, it is very important, it is greatly accelerated, it is easily combined, it is hardly probable, it is entirely stopped;

the temperature is increased, the reaction is started, the match is lighted, the velocity is slowed down, the rate is controlled, the change is accelerated.

**TEXT**

**THE TIME FACTOR IN CHEMISTRY**

**Taylor:** Since we are going to discuss chemical reactions, perhaps we should first make clear what a chemical reaction is?

**Clark:** All right. Suppose we start a chemical reaction. I'm going to light this match. The friction of the match on the box will generate heat, the heat will agitate\* the molecules in the tip of the match which then combine with the oxygen in the air, lighting the match. The lighting of the match is a chemical reaction. The utilization of sugar in the human body is another example of burning in which oxygen unites with different substances producing a release of energy just as it happens in the burning match.

**Taylor:** I imagine that you have been interested to learn, as I have, of the wide range of speeds at which chemical reactions occur.

**Clark:** Yes, I have. And I think that our readers would be interested, too, if we gave them an example or two of the speeds at which chemical reactions occur.

**Taylor:** All right. A molecule of sugar, for example, is composed of atoms of hydrogen, oxygen and carbon. Each of these

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\* agitate приводить в движение.



atoms is continually vibrating, and the molecules are vibrating in the sugar crystal at the rate of a thousand billion times a second.

Clark: That will seem an unimaginable speed to most of our readers. It is remarkable that the sugar molecules, for example, vibrating a thousand billion times a second, are able to hold together at all.

Taylor: True, and as we have discovered, sometimes a molecule does break into two fragments, having been struck with enough violence to overcome the electrical bond that holds its atoms together.

Clark: At this point it seems essential that the reader should know that each of the two fragments carries an electron which holds them together. And it is these electrons that are responsible for the attraction of one element to another.

Taylor: Now, why don't you go on to explain that chemists are able to speed up or slow down the rate of chemical reactions? Our knowledge of how to control the velocity at which chemical changes occur is one of the triumphs of chemistry.

Clark: Let me point out first that heat is a form of motion. For if the temperature goes up the agitation\* of the molecules is increased.

Taylor: So raising the temperature, we speed up the rate of reaction. And what if we lowered the temperature?

Clark: The fact is that if we decreased the temperature, the reaction would proceed at a lower rate. But there are agencies other than heat that are used to control the rate of chemical change. You have spent much time studying catalysts. I think the readers would be very much interested in an explanation of catalysts.

Taylor: A catalyst is an accelerator of chemical change and it will start a chemical union between substances that seem entirely different to one another. Apparently what happens is that the catalyst makes the molecules come together more easily.

Clark: And many probably know that much of our chemical industry is dependent upon this action of catalysts. And nature can still give us many lessons on the way she uses catalysts in living systems.

## COMMENTARY

make clear выяснять  
just as точно так же, как  
you have been interested to learn, as  
I have вам, как и мне, было интересно узнать  
are able to hold together at all вообще  
могут удерживаться вместе  
at this point it seems essential здесь,  
очевидно, важно  
are responsible for обуславливают

why don't you go on to explain почему же вы не объясните  
let me point out first я сперва укажу  
the fact is that дело в том, что  
other than heat кроме тепла  
makes the molecules come together заставляя молекулы соединяться  
nature can give us many lessons on  
the way she uses... природа может  
научить нас многому в отношении  
того, как она использует...

\* agitation беспорядочное движение.

## EXERCISES

**I. Underline the suffixes in the following words, state to what part of speech each word belongs, translate them into Russian:**

utilization, different, continually, vibrate, remarkable, violence, attraction, accelerator, unimaginable.

**II. Translate the following groups of words of the same root into Russian:**

to discuss — discussion; to light — lighting — light — lighten;  
to combine — combination; to unite — union — unity — unit; to  
release — release; to vibrate — vibration, to discover — discovery;  
to attract — attraction; to explain — explanation; to know — know-  
ledge; to lower — low; to change — change; to depend — depen-  
dence — dependent.

**III. Find in the text synonyms for the following words:**

as, probably, to begin, use, liberation, to occur, speed, force, to  
continue, to accelerate, to decelerate, to rise, completely, evidently.

**IV. Find in the text antonyms to the following words:**

repulsion, to slow down, to decrease, rapid.

**V. Find in the text English equivalents for the following words and expres-  
sions:**

мы собираемся, сначала, выяснить, точно так же как, большин-  
ство, обуславливать.

**VI. Translate the following sentences into English using the words of the  
text:**

1. Этот химик собирается продемонстрировать несколько хими-  
ческих реакций. 2. Во время горения кислород соединяется с раз-  
личными веществами, выделяя энергию. 3. Химические реакции  
происходят с различной скоростью. 4. Катализаторы ускоряют хи-  
мические реакции. 5. Прожде чем приступить к опыту, давайте сна-  
чала обсудим, какие вещества вступают в реакцию. 6. Что обуслов-  
ливает притяжение одного элемента к другому?

**VII. Translate the following sentences into Russian:**

1. Let us discuss some chemical reactions. 2. Imagine what would  
happen if we decreased the temperature of the reaction? 3. Suppose  
the temperature is decreased from 98° Fahrenheit to 32° Fahrenheit,  
will then the speed of the reaction slow down? 4. Let us decrease  
the temperature and check the effect of the decrease on the rate of  
reaction. 5. Consider the action of some catalysts.

**VIII. State the forms and functions of the participles; translate the following  
sentences into Russian:**

1. Discussing chemical reactions we ought first to make clear  
what a chemical reaction is. 2. The heat generated by the friction of  
the match on the box agitated the molecules in the tip of the

match. 3. When combined with the oxygen of the air the match was lighted. 4. While burning different substances combine with oxygen. 5. Having discussed chemical reactions we proceeded to the experiments. 6. Having overcome the electrical bond that holds the atoms together, the molecule breaks into fragments. 7. Raising the temperature we increase the agitation of the molecules. 8. Decreasing the temperature we slow down the reaction. 9. Having spent much time studying catalysts, the scientists now use them widely in chemical industry. 10. The catalysts being used in this reaction accelerate the chemical change. 11. The experiment being made at our laboratory shows the action of catalysts. 12. The temperature used depended upon the substances entering the reaction. 13. The figures following show the dependence of the rate of reaction on temperature. 14. Efforts being made in the development of chemical industry meet with great success. 15. The success achieved in the development of industry resulted in a considerable growth of the well-being of the Soviet people. This does not mean, however, that we can be satisfied with the results obtained. 16. Science has opened out possibilities for the conquest of nature hardly dreamed of a few years ago. 17. The experiments referred to in our article demonstrate the action of catalysts in chemical reactions. 18. The substance acted upon by heat changed its composition. 19. The molecules of a substance affected by a catalyst are changed more easily. 20. This reaction, when completed, will give us a new proof of the use of catalysts in living systems. 21. Sometimes a molecule breaks into two fragments, if struck with enough violence to overcome the electrical bond that holds its atoms together.

**IX. Translate the following sentences using participles where possible:**

1. Проводя опыт, мы повысили температуру до  $98^{\circ}$  Ф; повысив температуру, мы ускорили химическую реакцию. 2. Элементами, образующими сахар, являются кислород, водород и углерод. 3. Изучив свойства некоторых материалов, инженер выбрал те, которые требовались для его работы. 4. Объяснив, что такое химическая реакция, химик приступил к опыту. 5. Опыты, проводимые в нашей лаборатории, связаны с исследованием катализаторов в промышленных процессах. 6. Вещества, используемые для регулирования скорости химической реакции, называются катализаторами. 7. Понижение температуры, замедляющее химическую реакцию, так же, как и повышение температуры, ускоряющее химическую реакцию, используется для регулирования скорости реакции. 8. Понижая температуру, мы замедляем химическую реакцию. 9. Ученым, работающим в области химии, предстоит сделать много важных открытий. 10. Для ускорения реакции нам пришлось применить катализаторы. 11. Вам следовало бы использовать уже существующие сплавы, так как разработка новых сплавов потребовала бы много времени. 12. Для этой работы придется создать новый сплав, более устойчивый к условиям нагрузки. 13. Разрабатывая новые материалы, инженеры должны учитывать много различных фак-

торов. 14. В соответствии с планом, в этом исследовании должны быть использованы специальные материалы, созданные в нашей лаборатории.

X. Write out of the text all the sentences with the Subjunctive Mood and translate them into Russian.

XI. Analyse the following sentences and translate them into Russian:

1. It is important that everybody should know the effect of temperature on the rate of a chemical reaction. 2. If the temperature had been raised, the reaction would have been speeded up. 3. If we used a catalyst in our reaction, the reaction would be speeded up. 4. It is required that everybody who starts a chemical reaction should be careful.

XII. Answer the following questions:

1. Can you give a few examples of chemical reactions? 2. What are the speeds at which chemical reactions occur? 3. What is the rate of vibration of the molecules in sugar crystals? 4. When does a molecule break into fragments? 5. What is responsible for the attraction of one element to another? 6. Is it possible to control the velocity of chemical changes? 7. What is heat? 8. In what way can we speed up the rate of reaction? 9. In what way does the change of temperature affect the rate of reaction? 10. What is a catalyst?

Supplementary Text. Read and retell:

### REACTION VELOCITY

In many cases heat plays an important role, either starting or accelerating a chemical reaction. In general heat is important under conditions where the reacting substances are all in the gaseous state, or where they are all in the liquid state or are all in solution. In order that atoms and molecules should combine and form compounds they must approach so near each other that their attractive forces are great enough to hold them together in compounds. Having heated up two reacting gases, we speed up the atoms and molecules; their force of action becomes greater and their union in compounds takes place or is greatly accelerated. It probably is generally known that hydrogen and oxygen gases may be mixed and they will remain together indefinitely at atmospheric pressure without reacting; when, however, their temperature is increased, they will combine forming a compound.

Substances in solution or in liquid form present an ideal case for chemical reactions. The volume is very compact as compared to the gaseous state, and yet the molecules are free to move. They may come easily in contact with each other and combine. In such cases, having increased the temperature, we greatly accelerate the reaction, speeding up the motion of the molecules so that they approach each other with great forces. Lowering the temperature, we slow down

the molecular motion, and the speed of reaction is decreased or entirely stopped.

On the other hand, when a gaseous substance is dissolved in a solution, any chemical reaction that might occur between the gas and the solution can be slowed down by increasing the temperature.

The speed of a great many reactions may be increased or decreased by what is known as a catalyst. By a catalyst is meant a substance influencing the speed of a chemical reaction but not itself entering into the reaction.

## COMMENTARY

take place происходить, иметь место  
as compared to по сравнению с  
are free to move могут свободно двигаться

a great many очень много  
by what is known as a catalyst так  
называемым катализатором

## LESSON 16

### Grammar:

the Nominative Absolute Participle Construction;  
словообразование.

### READING DRILLS

#### 1. Two-syllable words with the stress on the first syllable:

(13—16) number, human, college, council, parents, hostel, system, extra, active, member, subject, purpose, monthly, textbook, lecture, empty, mural, kitchen, bookcase, supper, concert, entrance.

#### 2. Two-syllable words with the stress on the second syllable:

(12—16) allow, account, appear, require, effect, provide, obtain, apart, direct, complete, prepare, perhaps, research, resort.

#### 3. Many-syllable words:

(29—32) economy, university, industry, phenomena, ministry, cultural, facility, humanity, establishment, technology, technological, instrument, majority, opportunity, technical, medical, medicine, philosophy, philology, history, natural, seminar, cinema, activity; qualify, organize; variety, society, theatre, various, material, period; graduate (n), graduate (v), complicate (adj), complicate (v), delegate (n); delegate (v).

#### 4. Memorize the pronunciation of the following words:

course [kɔ:s] — курс, minute ['mɪnɪt] — минута, building ['bɪl-  
dɪŋ] — здание, comfortable ['kʌmfətəbl] — удобный, комфорта-  
бельный, health [helθ] — здоровье.

5. Read and translate the following word-combinations:

the socialist economy, the qualified graduates, a complicated job, the college courses, the economic councils, their future requirements, the indirect aid, the research establishments, college entrance;

the majority of students, the system of education, the members of society, the sphere of phenomena, the department of philosophy, the period of learning, the number of people, the graduates of universities, the hostel of the institute.

TEXT

MILLIONS OF STUDENTS

Like socialist economy in general, Soviet higher education is planned. Each year the right number and variety of qualified graduates leave the institutes and universities, filling all the needs of Soviet economy.

This, of course, is a very complicated job. College courses take about five or six years — so one has to look into the future and take into account the way the various branches of industry, culture and science will develop. One even has to allow for the appearance of new branches of the economy over that period.

The Ministries and the State Planning Commission work out their future requirements, the job of the Ministry of Higher and Specialized Secondary Education being then to put the plans into effect. Thus, when leaving the institutes and universities, the graduates are provided with work according to their qualification obtained while studying.

Apart from vast sums the state spends on education, it provides a lot of indirect, though very essential aid. For example, factories, cultural and research establishments provide free facilities for students to study production technologies and gain practical experience. Factories hand over equipment of many kinds to schools and colleges free of charge.

College tuition itself is completely free, as are the equipment, aids and instruments. College entrance requires a full secondary education, any Soviet citizen being able to get higher education free of charge.

The vast majority of students being provided with living allowances from the state, they do not have to call on their parents for material help.

The students are provided with well organized dining-halls and hostels and they can get holiday accommodation at special cheap rates at holiday homes, camps and health resorts.

Apart from full-time study there is an extensive system of free evening and correspondence education in the Soviet Union. Part-time and correspondence students are given additional paid vacations of 30 to 40 days and up to four months extra paid leave to prepare their theses and for their state examinations.

The Soviet college gives its students an all-round education, providing all with the opportunity of becoming active members of society.

The humanities, the natural and exact sciences are today penetrating more and more into the sphere of social phenomena, no modern scientist being able to get along without understanding society and man's place in it. In all schools of higher learning, even the technical ones, political economy, philosophy and foreign languages are obligatory subjects. The whole system of higher education is aimed not only at providing the students with a minimum of knowledge, but also at developing them creatively.

### COMMENTARY

the right number необходимое количество  
fill the needs удовлетворять нужды  
college courses take полный курс обучения в институте требует  
look into заглядывать в  
allow for учитывать  
work out разрабатывать  
put into effect осуществлять  
apart from кроме  
free facilities to study возможность бесплатно учиться  
gain practical experience приобретать практический опыт

free of charge бесплатно  
living allowance стипендия  
call on their parents for material help прибегать к материальной помощи родителей  
holiday accomodation возможность провести отдых  
holiday home дом отдыха  
health resort курорт  
to get along without обходиться без  
school of higher learning высшее учебное заведение  
is aimed not only at направлена не только на то, чтобы

### IN THE HOSTEL

(Dialogue)

An extra-mural student, Krylov, who lives in the country, comes back home from Kiev where he took his examinations at one of the Institutes. He meets a friend of his (Petrov) who asks him a number of questions about his life in the city.

Petrov: Where did you live in Kiev?

Krylov: They put me up at one of the hostels of our Institute. The windows of my room were looking on to a big park.

Petrov: How long did it take you to get to the Institute?

Krylov: Not very long, as a matter of fact, not more than ten minutes by bus or about twenty minutes on foot.

Petrov: Are they big buildings?

Krylov: Oh, quite big. Two four-storey buildings with two kitchens with gas cookers on each floor. There are also shower baths with hot water.

Petrov: Are the rooms comfortable?

Krylov: Yes, quite comfortable. There's plenty of light coming in through two big windows. Built-in wardrobes, book-cases, three to four beds, tables, chairs, and loudspeakers.

Petrov: Who does the rooms?

Krylov: The students themselves look after their rooms. They also take turns in cleaning the corridors.

Petrov: Do the students cook their food in the kitchens or have their meals in the dining-hall?

Krylov: They usually prepare their breakfasts and suppers themselves in the kitchen, but as to dinner, they have it in the dining-hall.

Petrov: Where do the students spend their free time? Are there any clubs specially for the students at the Institute?

Krylov: Sometimes they go to the theatre, cinema or to the concert. But as a rule they spend their free time at the students' club where they take part in different amateur activities, study foreign languages, and so on.

## COMMENTARY

extra-mural student студент-заочник  
in the country за городом

take examinations сдавать экзамены  
a number of ряд, некоторое количество

how long did it take you? сколько  
времени вам требовалось?

as a matter of fact фактически

on foot пешком

built-in wardrobes встроенные шкафы  
для одежды

who does the rooms? кто убирает в  
комнатах?

look after смотреть, присматривать за  
they take turns in cleaning они по

очереди убирают  
they have their meals они питаются  
as to что касается

they spend their time они проводят  
время

take part in different amateur activities  
принимать участие в различных кружках художественной самодельности

## EXERCISES

### I. Translate the following groups of words of the same root:

to vary — variety — variation — various — variable — invariable; to appear — appearance — disappear — disappearance; to require — requirement; to add — addition — additional; to divide — division — divisible — indivisible; to create — creation — creator — creative — creatively; able — unable — ability; to know — knowledge; science — scientist — scientific; to lecture — lecture — lecturer; to develop — development.

### II. Find in the text synonyms for the following words and expressions; translate them into Russian:

quantity, to meet the requirements, certainly, complex, work, to take into consideration, field, demand, to put into practice, much, help, huge, to obtain, besides.

### III. Find in the text antonyms to the following words; translate them into Russian:

unlike, wrong, direct, dear, disappearance, old, passive.



IV. Find in the text equivalents for the following words and word-combinations:

конечно; предусмотреть; осуществить; кроме; бесплатно; наглядные пособия; стипендия; иметь возможность провести отпуск; удовлетворять требованиям; стационарное обучение; студенты вечернего факультета; дополнительный оплачиваемый отпуск; всесторонний; обходиться без чего-либо.

V. Translate the following sentences paying attention to the meaning of the words in bold type:

1. When planning the number and variety of **graduates** the Ministry of Higher Education allows for the appearance of new branches of economy. 2. Any Soviet student knows a number of jobs will be in store for him as soon as he **graduates** from his institute or university. 3. Students get medical **aid** free of charge. 4. Professors and assistant professors **aid** students in their research work. 5. These scientists **experience** great difficulties in their work. 6. They gain much **experience** from their research.

VI. Underline all the Nominative Absolute Participle Constructions, state what adverbial relations they express and translate the following sentences into Russian:

1. College courses taking five or six years, the Ministry of Higher Education has to look into the future and take into account the development of the various branches of national economy. 2. College tuition being completely free in the U.S.S.R., any Soviet citizen can get higher education. 3. Holiday accommodation and facilities being cheap, all the students can spend their leave in different camps, rest homes, sanatoria etc. 4. There being an extensive system of free evening and correspondence education in the Soviet Union, a great number of people are part-time or correspondence students. 5. The education in the Soviet Union being an all-round education, the graduates of Soviet schools of higher learning become active members of society. 6. Like the socialist economy in general, Soviet higher education is planned, the right number and variety of qualified graduates leaving the schools of higher learning every year. 7. Vast sums are spent on education in the U.S.S.R., a lot of indirect but essential aid being rendered to schools. 8. College course having been finished, all the Soviet graduates get work according to their speciality. 9. The future requirements having been worked out by the Ministries and the State Planning Commission, the Ministry of Higher and Specialized Secondary Education puts the plans into effect. 10. The Soviet Government pays great attention to the education of young people, students being provided with living allowances, cheap but well organized dining-halls and hostels.

VII. State the forms and functions of the participles in the following sentences and translate them into Russian:

A. 1. Having opened schools and universities to the entire people, the Soviet country could achieve matchless results in the field of science. 2. Schools and universities having been opened to the en-

tire people, the Soviet country could achieve matchless results in the field of science. 3. Graduating from schools of higher learning, all the young specialists get work according to their speciality. 4. The vast sums being spent on education enable our state to provide qualified specialists for all branches of industry. 5. Vast sums being spent on education in our country, our state is able to provide qualified specialists for all branches of industry.

B. 1. Natural radioactivity having been discovered, many scientists became interested in it. 2. Radium having been discovered, scientists found that the effects produced by it were caused by the break-up of its atoms. 3. Many technical and scientific problems having been solved, the first spaceflight could be realized. 4. Technical and scientific problems being solved by our scientists are a great contribution to the development of world science and technology. 5. Having solved many scientific and technical problems, our scientists, engineers and workers could launch the first spaceship into outer space. 6. Being the cheapest metal with a strong tendency to lose electrons, zinc is the most commonly used metal for the production of electric current. 7. Zinc being the cheapest metal with a strong tendency to lose electrons, we commonly use it for the production of electric current. 8. The metals being used in our work possess many important properties, such as light weight, corrosion resistance, etc.

**VIII. Translate the following sentences into Russian paying attention to the use of the participles:**

A. 1. As the radium decomposed, it passed through several stages, forming new substances, and finally the breaking up stopped, lead being the final product. 2. All three forms of water, solid, liquid, gas, are the same substance, one being changed to the other simply by the addition or subtraction of heat. 3. Electrical machines perform a giant's share of the work done today, this share steadily increasing. 4. The gas being compressed, the number of molecules in each cubic centimetre is increased. 5. The modern machines consist of only a small number of kinds of parts — never more than six, these being called the simple machines or the machine elements. 6. Atmospheric air being put under increased pressure, its volume is reduced according to Boyle's law. 7. Temperature remaining the same, the volume of a gas varies inversely with the pressure. 8. By the magic of chemistry useful fibers are produced from coal, air and water, these fibers being nylon, kapron, etc. 9. Large masses of substances are made up of molecules, molecules being made up of atoms. 10 If conductors are connected in parallel, the electron stream splits as it enters the parallel wires, part of it going through one and part through the other. The current in one is independent of that in the other, each current depending on the resistance of its own path. Having passed through parallel wires, the electron streams join each other.

B. 1. The solubility of a gas in a liquid is proportional to the

pressure applied. 2. The magnitude of the charge of the ion depends upon the number of negative electrons transferred. 3. The strength of the magnet increases with the number of amperes flowing. 4. The insertion of an ammeter into a circuit must not change the magnitude of the current flowing. 5. Burning or combustion of any kind is really a chemical reaction in which rapid oxidation takes place due to the combination of the oxygen from the air with the substance burned. 6. In the alloying and tempering of steel the size and character of the crystals formed determine the qualities of the product. 7. The thermometers depend for their operation upon the fact that the liquids used expand more than glass when heated and contract more when cooled. 8. The electric current, consisting of a stream of electrons, can be driven through the conductor; just as water may be forced through a pipe filled with stones. 9. Being heated, a magnet loses some or all of its magnetism. 10. The ion of a metal, having lost electrons, is no longer electrically neutral — it is positive. 11. A falling barometer usually means wind and rain. On the other hand, a rising barometer means descending air current, little, if any, cloud and consequently no rain and no high winds, that is fair weather. 12. Being placed in a liquid, a body will sink until it has displaced its own weight of the liquid. 13. Being electrically neutral, an atom must have an equal number of positive and negative charges. 14. Automation having been firmly established in space research, our spaceships employ automatic instruments in the study of cosmic space.

**IX. Analyse the following sentences and translate them into Russian:**

1. Although found in several natural deposits, graphite is also manufactured. 2. It is possible to divide and subdivide a substance until we finally come to a particle which if further divided would not have the properties of the original substance. 3. We sometimes hold the hand behind the ear as a reflector when listening to a faint sound. 4. We know instinctively that objects will fall if not supported. 5. Gasoline in a dish burns slowly but, if atomised, burns very quickly. 6. Zinc is a brilliantly white metal when first cut, but the surface soon tarnishes to give the common blue-gray colour. 7. When alloyed with aluminium, magnesium makes a useful, light alloy. 8. When put on water, sodium and potassium react most vigorously, decomposing the water to form hydrogen, which often bursts into flame. 9. That water boils, when sufficiently heated, is common knowledge. 10. Experience has taught that objects at rest remain in that condition unless acted upon by outside forces. 11. Magnets lose some of their magnetism when hammered.

**X. Translate the following sentences into Russian:**

1. No excess or deficiency of electrons that man can produce is sufficient to make any noticeable charge on the earth. 2. If we surround a magnetic compass with an iron ring, a magnet outside the ring does not affect the compass; no lines of force get inside the

ring because the iron absorbs them. 3. If no heat were radiated by the earth, the temperature rise would continue indefinitely. 4. No human hand may touch radioactive materials during the separation process. 5. No fissions were observed when slow neutrons bombard ed pure uranium 238.

XI. Write questions to which the words in bold type are the answers:

1. Yes, Soviet higher education is planned. 2. The Ministries and the State Planning Commission **work out their future requirements**. 3. The most outstanding scientists, talented engineers and technicians lecture **at universities and colleges**. 4. No, in the Soviet Union the humanities are not opposed to other spheres of education.

XII. Translate the following text into English:

### ДИАЛОГ

Группа английских студентов уезжает из Советского Союза после краткого пребывания там. Студенты Борис и Виктор приходят на вокзал попрощаться с ними.

Виктор: Добрый вечер. Мы пришли с вами попрощаться.

Борис: Нам бы хотелось побеседовать с вами перед вашим отъездом.

Джон: Добрый вечер. Мы очень рады видеть вас.

Виктор: Интересно, успели ли вы побывать вчера в университете?

Джон: Да.

Борис: А что вы видели во время своего посещения?

Джон: О, мы видели много интересного. Я просто не знаю, с чего начать. Сначала мы побывали в общежитиях, затем в столовой.

Виктор: А вы побывали в лабораториях?

Джон: Да, конечно. Мы видели несколько лабораторий и механические мастерские.

Борис: Что вам понравилось больше всего?

Джон: Мне понравились лаборатории. Видите ли, я изучаю физику, и мне было интересно осмотреть вашу физическую лабораторию.

Виктор. Вы, кажется, интересовались тем, как в Советском Союзе выпускники институтов обеспечиваются работой?

Джон: Да, мы беседовали с ректором университета, и он нам рассказал, что все выпускники обеспечиваются работой по специальности.

Борис: У нас высшее образование планируется. Министерства и Госплан вырабатывают свои требования, а Министерство высшего и среднего специального образования осуществляет эти планы.

Джон: Это очень важно. Ваши выпускники не должны искать работу. Государство заботится о них. А скажите, все ли студенты обеспечиваются стипендией?

Виктор: Большинство.

Джон: У вашей молодежи есть все возможности учиться. Ведь в вашей стране обучение бесплатное, не правда ли?

Виктор: Да, в нашей стране обучение, библиотеки, наглядные пособия — все бесплатное.

Джон: Нашим товарищам в Англии будет интересно узнать обо всем этом. Мы им расскажем все подробно. А сейчас мы должны попрощаться с вами, так как через минуту отходит поезд. Пишите нам часто.

Виктор, Борис: Обязательно. До свидания.

### XIII. Answer the following questions:

1. How is Soviet higher education planned? 2. Why is the planning of higher education a complicated job? 3. With what kind of work are higher school graduates provided? 4. What indirect aid does the state provide in the sphere of higher education? 5. What does college entrance require? 6. What are the educational systems which exist in the Soviet Union besides full-time study? 7. What kind of privileges do part-time and correspondence students get from the government?

### Supplementary Text. Read and retell:

#### FRIENDSHIP UNIVERSITY

The Friendship University was founded in 1960 with the chief purpose of helping the countries of Asia, Africa and Latin America to train their own specialists.

Tuition at the University is free. Besides, the students are given monthly living allowances, free textbooks, free medical aid and free holiday accommodation at holiday homes and camps and health resorts.

The students spend the first year in the preparatory department, studying Russian and subjects from the secondary school course. Students who have not had a regular school education go through a longer preparatory period. Then the student chooses which department he wishes to go to: engineering, history and philology, agriculture, medicine, physico-mathematical and natural sciences, economics, etc. The course is five years for medical students and four years for the others.

Lectures and classes start at nine in the morning. The students have three subjects a day. At three in the afternoon classes end, but many students stay on in the University buildings. Some visit the library (which has more than 80,000 books), others go to study rooms or laboratories (where they will always find a teacher to give them any help they need).

Perhaps the most characteristic thing about the students at the Friendship University is their strong wish to obtain knowledge. They sit up late in the laboratories. The experimental workshops

are never empty; they are in fact a machine-building factory in miniature, they have the facilities for building a motor car, if necessary.

One should not think, however, that the students are interested only in lectures and seminars. They go in for sports, go to theatres, cinemas, clubs. They spend their winter and summer vacations in many different ways.

The graduates will go out into life with their Friendship University diplomas to help their countries in developing their economy and culture.

## COMMENTARY

train specialists готовить специали-  
тов

classes занятия

stay on оставаться, не уходить из

study rooms кабинеты (учебные)

sit up late засиживаться поздно

go in for sports заниматься спортом  
as many as до

## LESSON 17

### Grammar:

the Gerund (Forms and Functions);  
словообразование

### READING DRILLS

#### 1. Two-syllable words with the stress on the first syllable:

(10—13) story, modern, fifty, object, only, ultra, further, method, progress, focus, optics, structure, useful, sample, handful, careful, human, narrow, mirror, common, sunlight, yellow, spectrum, nature, substance, expert.

#### 2. Two-syllable verbs with the stress on the second syllable:

(12—16) assume, suppose, observe, succeed, construct, extend, affect, surprise, conclude, excite, appear, provide, compose, subject, collect, achieve, employ, inform, exist.

#### 3. Many-syllable words:

(29—32) development, theoretical, scientist, property, physicist, visible, obvious, industry, industrial, medical, instrument, particular, optical, telescope, spectroscope, different, significant; previous, theory; illuminate, penetrate, analyze, magnify; accurate (adj.), separate (adj.), separate (v); characteristic, scientific, spectroscopic, electric, electronic.

#### 4. Derivative words ending in -ly:

theoretically, directly, considerably, naturally, physically, extremely, obviously, previously, industrially, chemically, brightly, scientifically, definitely.

**5. Derivative words beginning with un-:**

undeveloped, unimproved, unmagnified, unnatural, unaffected, unsolved, unobserved, unachieved, unseparated.

**6. Memorize the pronunciation of the following words:**

microscope [ˈmaɪkrəskoʊp] — микроскоп, transparent [ˈtræns-  
ˈpɛərənt] — прозрачный, basic [ˈbeɪsɪk] — основной, luminescence  
[ˌluːmiˈnesns] — свечение, люминесценция, improve [ɪmˈpruːv] —  
улучшать, усовершенствовать.

**7. Read and translate the following prepositional word-combinations:**

the latest developments of modern science, the early days of human history, the magnifying power of the electron microscopes, the ultraviolet light of the shining stars, the optical expert of the scientific society, the physical properties of the sun rays, the real existence of the small structures, the exciting ideas of the new theory.

**TEXT**

**THE STORY OF THE ELECTRON MICROSCOPE**

Our story deals with one of the latest developments of modern science, but its beginnings go back some two hundred and fifty years.

In the early days it was assumed that there was no theoretical limit to the magnifying power of microscopes. It was supposed that as lenses became improved, one could see smaller and smaller objects. However, about seventy years ago it was pointed out that it would never be possible to observe directly an object which was considerably smaller than the wave length of the light used to illuminate it.

But, if ordinary light is too coarse, the scientists said, why not use ultraviolet light, it being known that its wave length is only about one-half that of ordinary blue light? The idea was tried and it worked. By making their lenses of special materials which are transparent to ultraviolet light, the optical experts succeeded in constructing an ultraviolet microscope with a magnification of 2500 diameters. This was more than double the power of the ordinary microscope.

Of course it was natural to think of further extending the method and using still shorter wave lengths, there being many rays beyond the ultraviolet. But this time the physical properties of the rays put a stop to progress. For either the waves were absorbed by the lenses, as was the case with the extremely short ultraviolet rays, or the waves were so penetrating that they passed through the lenses without being affected and focusing the rays became impossible.

Research scientists were becoming more and more aware of the existence of many small structures that could best be studied through a microscope, if only a microscope powerful enough could be built. Probably no one was more surprised than the microscopists them-

selves when the solution came not from students of optics, but from atomic physicists studying electrons.

They found that the electron wave length is one hundred times as short as that of visible light. The conclusion was obvious. If a microscope could be built to use a beam of electrons in place of the usual beam of light, it would make visible objects far smaller than anything previously seen. It was an exciting idea which marked the appearance of the new science of electron optics and provided the basic idea for the electron microscope.

A great many electron microscopes are in use today in industrial, medical, and university laboratories. They bring to view the fine structure of every material used in everyday life, being a very useful instrument in the hands of scientists.

## COMMENTARY

our story deals with в нашем рассказе рассматриваются  
go back some two hundred and fifty years уходить в прошлое приблизительно на 250 лет  
in the early days сначала  
the idea was tried and it worked эта идея была испробована и оправдала себя  
the two оба, обе  
as was the case как это было

without being affected не подвергаясь воздействию  
become aware of узнавать о  
one hundred times as short as в сто раз короче  
in place of вместо  
a great many очень много  
are in use используются  
bring to view выявлять, обнаруживать

## EXERCISES

### I. Translate the following groups of words of the same root into Russian:

to limit — limit — limitation; to magnify — magnification; to improve — improvement; to continue — to discontinue — continuation — continual — continuous — continually — continuously; to consider — consideration — considerable — considerably; to lengthen — length — long; to exist — existence; to absorb — absorption; to penetrate — penetration; to pass — passage; to solve — solution; to conclude — conclusion.

### II. Translate the following antonyms into Russian:

always — never; directly — indirectly; often — seldom; to succeed (in) — to fail; short — long; usual — unusual; useful — useless; transparent — opaque.

### III. Find in the text equivalents for the following words and word-combinations:

конечно, положить конец, или...или, как это было с ..., все больше и больше узнавали, гораздо, выявить.

### IV. Translate the following sentences into Russian paying attention to the meaning of the words in bold type:

A. 1. The first manned space flight means **that** we have entered a new epoch, **one** of direct exploration of the universe. 2. The particles of iron are strong magnets; **those** of nickel and cobalt are



weaker ones. Those of most other substances are very weak magnets, if at all. 3. One can communicate by sound only for short distances, for the vibrations quickly weaken and become too weak to hear. 4. In a telephone the apparatus into which one speaks is called a transmitter, and the one from which the sounds come, the receiver. 5. Friction is one means of changing mechanical energy into heat energy. 6. The motion of the wind is always from a place of high to one of low pressure, and its velocity depends on this difference. 7. That sound may be carried by both solids and liquids is well known to everybody. 8. One of the important uses of the transformer is in power transmission. 9. Many facts that can be observed are evidence that a molecule of water is built up of two atoms of hydrogen and one of oxygen. 10. A neutral body is one which possesses equal numbers of protons and electrons. 11. That rubber would combine with sulphur under certain conditions was discovered in 1839. 12. One basis of classification of the elements groups them into metals and nonmetals. As one might expect the first metals that were used by primitive man were those that are found free in nature in large quantities. 13. To one unaccustomed to working with machines, many of those in common use look very complicated. 14. If one were to examine the stars on a clear moonless night, he would soon discover that not all the visible stars are at the same degree of brightness. 15. It is the weight of air that gives rise of atmospheric pressure.

B. 1. Perhaps the greatest advancement since old times has been achieved in the art of communicating ideas. 2. The time is not far off when man will explore the full riches of space. 3. In 1 cc of water there are about 1,250 times as many molecules as in 1 cc of air. In water, therefore, they are less than one tenth as far apart. 4. Thanks to the numerous instruments that have been tested many times a two-way radio exchange can be maintained during space flights. 5. As mercury is commonly used in barometers, air pressure is often recorded in centimetres of mercury. 6. The sun may be considered as the only source of the received energy as that received from other sources is so small that it is negligible. 7. Normal barometric pressure at sea level is about 1.013 millibars as well as 29.92 in. of mercury. 8. Just as the inhabitants of the ocean are subject to pressure and water currents, so are people subject to air pressure and air currents. 9. On the average, over a long period of time and for earth as a whole as much energy is radiated as is received. 10. Constant velocity means not only constant speed but unchanging direction as well. 11. As the atmosphere is principally heated from below, the temperature normally decreases as the altitude increases by several thousand feet. 12. The credit for the first speculations as to the existence of atoms belongs to the Greeks. 13. As far as we know, the oil that we obtain from the earth will not last more than a few centuries at the present rate of consumption. 14. As a result of the universal gravitation every thing on or near the surface of the earth is attracted towards the earth with a force that we call weight.

V. Translate into Russian paying attention to the meaning of the expressions in bold type:

1. One of the advantages of the internal-combustion engine is that no special preparation is necessary to make it ready to run, **as is the case** with the steam engine in which the water must first be brought to boiling under high pressure. 2. After Roentgen had shown that X-rays produce fluorescence in many materials, the question arose whether the opposite might not also be true — that is, whether fluorescent materials might not produce X-rays. Within a year after Roentgen's discovery, the French physicist Becquerel found that **this is not usually the case**. 3. Electricity has come into general use so recently that you might think it was discovered but a few years ago. **Such is not the case**.

VI. Translate into English:

1. Ни обыкновенные, ни ультрафиолетовые микроскопы не могли дать достаточно сильного увеличения. 2. Мы пользуемся либо ультрафиолетовыми, либо электронными микроскопами. 3. Физикам удалось решить проблему электронного микроскопа. 4. Электронные микроскопы дают гораздо большее увеличение, чем ультрафиолетовые.

VII. State the functions of the gerunds and verbal nouns in the following sentences:

A. 1. Studying small structures is accomplished with the help of a microscope. 2. Scientists began working at the problem of magnifying the power of microscopes more than 200 years ago. They were greatly interested in improving the lenses. 3. The experiments of the physicists resulted in making much more powerful microscopes. 4. Doubling the power of the ordinary microscope became possible by means of an ultraviolet microscope. 5. Instead of using ultraviolet light, scientists turned their attention to studying electrons. 6. Using electron microscopes scientists succeeded in bringing to view the fine structure of every material. 7. Upon making a number of experiments atomic physicists solved the problem of building a very powerful microscope. 8. Scientists succeeded in building electron microscopes with a great magnifying power. 9. Building a microscope using an electron beam in place of the usual beam of light provided a means of studying the fine structure of every material. 10. By solving the problem of constructing the electron microscope scientists were able to bring to view the fine structure of every material. 11. By making use of the properties of electrons physicists succeeded in constructing an electron microscope.

B. 1. Upon being heated, the molecules begin moving about very rapidly. 2. Drinking water is a prime necessity for plants and animals. 3. It is simple enough to heat a vessel of water to the boiling point. It is also a simple matter to cool water to its freezing point, but we must have more complex equipment unless the weather is cold enough to do it for us. 4. The most important way of changing

mechanical energy into heat energy is by means of electricity. 5. When an object suddenly starts moving, we understand at once that something has acted or is acting upon it to produce the change. 6. In considering the chemical properties of metals the first thing that must be noted is that they vary widely in degree of chemical activity. 7. Alloys are usually prepared simply by melting two or more metals together and then allowing this liquid mixture to cool and solidify. 8. There are two general reasons why man has tried to make synthetic materials instead of being satisfied with the materials provided by nature. 9. Instruments for measuring electric current, voltage and electrical power and energy all make use of electricity. 10. Although the atmosphere is very useful to us, it also prevents us from finding out many things about the universe. 11. Looking at the universe through the atmosphere is like looking through a distorting lens covered with mist. 12. The Soviet Union was the first country in world history which succeeded in sending a man into space. 13. Space flights have put into effect humanity's age-old dream of travelling into space. 14. By measuring the changes of the paths of satellites we can find out how much atmosphere exists several hundred miles up. 15. Each new launching of artificial satellites has been connected with the solution of fundamentally new technical and scientific problems.

**VIII. State whether the word in bold type is a gerund or a participle and translate the following sentences into Russian:**

1. **Using** a beam of electrons in place of the usual beam of light solved the problem of studying microorganisms. 2. **Using** a beam of electrons in place of the usual beam of light scientists built a microscope with great magnifying power. 3. **Studying** the properties of electrons atomic physicists solved the problem of constructing a very powerful microscope. 4. **Studying** the properties of electrons gave the possibility of constructing a very powerful microscope. 5. **Constructing** an electron microscope became possible after numerous experiments of atomic physicists. 6. By **constructing** an electron microscope scientists succeeded in bringing to view the fine structure of materials.

**IX. State the functions of the ing-forms and translate the following sentences into Russian:**

1. Problem solving is not only a means of testing knowledge; it is, far more importantly, a means of acquiring knowledge in useful forms. 2. The energy stored in a clock spring may keep the clock running for several days, but this supply having been used up, the clock stops, unless more energy is supplied from the outside. 3. There are a number of important points connected with making measurements, tabulating them, and calculating results from them. 4. The speed of sound is affected by temperature, being increased in air by about 11 feet per second for every degree rise in temperature on the Fahrenheit scale. 5. The breathing of impure air produces immediate and very marked ill effects on the body. 6. In describing

magnetic fields, two vector quantities B and H are commonly used; one being given, the other can always be found. 7. The commonest cause of cloud formation is the cooling of ascending air. 8. The changing of one form of energy into another is called a transformation of energy. 9. The expansion of liquids like alcohol and mercury is utilized in constructing thermometers. 10. An important effect caused by increasing and decreasing temperatures is the change from one form of matter to another. 11. The concept of telemetry developed back in the 1800's, with the first practical device being used just before World War I. 12. Depending on the method being used for solving this problem, there exist several types of energy converters.

X. Translate the following sentences into English using the gerunds for the words in bold type:

1. Мы интересуемся **экспериментированием** в области электроники (in). 2. Физикам удалось **достичь** замечательных результатов в **изучении** строения атома. 3. Ученые решили проблему **создания** мощных микроскопов. **Изучение** свойств электронов сыграло в этом большую роль. 4. Их работы привели к **созданию** приборов, очень полезных для **изучения** микроорганизмов.

XI. Answer the following questions:

1. Is there a theoretical limit to the magnifying power of microscopes? 2. What was the reason for using ultraviolet light in the construction of a microscope? 3. What is the magnification power of the ultraviolet microscope? 4. What is the wave length of an electron compared to that of visible light? 5. What is the basic idea of an electron microscope? 6. Where are electron microscopes used?

Supplementary Text. Read and retell:

### SUBSTANCE OF SUN AND STARS

Of what are the shining objects of the sky composed? When man wishes to determine the composition of an ore he gets a sample; then in the chemical laboratory he analyzes it to determine its nature and value. Wishing to learn about the composition of the sun and stars, he can take from them only the light that comes to the earth and analyze it. However, this method is now just as accurate as if he could get a handful\* of the star's or sun's substance and subject it to his analysis. He analyzes the light that comes from these bodies and by careful observation and study learns the story that it has to tell.

The first problem is to get enough light to analyze, particularly in the case of the less bright stars. The human eye is so small that it can observe only a very narrow beam of light. An optical aid

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\* handful горсть

is necessary in order to collect more light and to magnify the far off stars or the sun. This is achieved by the telescope. The essential part of this instrument is a lens or a mirror which is used to focus the rays on the eye or any scientific instruments.

Some types of telescopes are now in use. The more common type is the one that employs a lens for focusing the light rays. After the light has been collected by the telescope, it must be analyzed and studied. Here the spectroscope has given most information. The spectroscope is an instrument that separates into its various colours or wave lengths the light passing through it, a process achieved mostly by means of a transparent prism. Most people have observed the rainbow \* of colours produced when sunlight shines through a prism. Sunlight or any white light is made up of a large number of waves, each of different wave length. In passing through a prism, the waves are separated, these separated waves being what will produce the different colours. A significant fact of nature is that each of the chemical elements — gold, sodium, copper, oxygen, hydrogen, and so on — when brought to luminescence, will always give off a characteristic colour or a definite wave length of light. Sodium, for example, will always give off a definite yellow light which, when passed through the spectroscope, will be separated into its various wave lengths. These wave lengths appear as bright lines in the spectrum, and no other light except that from sodium will show these particular lines. Any light source may have its chemical composition determined by measuring accurately the lines that appear in its spectrum. Here then is a method of determining the composition of the stars and the sun by analyzing the light that comes from those far-off bodies.

## COMMENTARY

learns the story that it has to tell  
узнает, что там происходит  
optical aid оптический инструмент

by means of с помощью  
far-off далекий

## LESSON 18

### Grammar:

Gerundial Constructions;  
словообразование

### READING DRILLS

#### 1. Tho-syllable words with the stress on the first syllable:

(13—18) diode, skyward, column, tiny, focus, nearly, enter, giant, radar, signal, essence, current, almost, servant, rubber, substance, oxide, certain, contact, surface, crystal.

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\* rainbow радуга

**2. Two-syllable verbs with the stress on the second syllable:**

(12—16) control, compute, detect, allow, perform, conduct, reverse, obtain, construct, depend, appear, displace, produce.

**3. Many-syllable words:**

(24—25, 27—33) industry, electricity, electrical, particular, property, evident, original, discovery, primitive, technology; operate, occupy; variety, society, theory, material, aluminium, germanium, selenium, area, radio, period, radiate; examine, develop, discover, continue, remember, consider.

**4. Memorize the pronunciation of the following words:**

dozen ['dʌzn] — дюжина, move [mu:v] — двигать(ся), semi-['semi] — полу-, among [ə'mʌŋ] — между, среди, treasure ['tre-zə] — сокровище, heart [hɑ:t] — сердце.

**5. Read and translate the following prepositional word-combinations:**

hundreds of tiny diodes, millions of radio viewers, the heart of electronic computers, a variety of different jobs, the flow of electric current, the devices of electronic industry, the energy of radioactive radiation, the conductors of electric current, the physics of semiconductors, the number of new electrons.

**TEXT**

**THE SEMICONDUCTOR DIODE**

A seven story high intercontinental missile roars skyward on a column of fire. Within the silvery giant, hundreds of tiny semiconductor diodes control its every movement.

A television camera is focused on a man. Millions of viewers are watching. Between the man and the millions of viewers are dozens of semiconductor diodes — without them the television would not function.

Older than radio itself, semiconductor diodes today are the workhorses of the electronic industry. They form the heart of nearly all electronic computers — the giant electronic brains that can control a manufacturing plant. They make radar possible. Semiconductor diodes detect radio signals and generate those same signals. Their having so many uses allowed them to find their way into every branch of modern science and industry.

What are these devices? How do they work? What are their characteristics? How are they used?

In essence, the answers are simple. First of all, a semiconductor diode is a one-way street for electric currents. Due to its having this very characteristic, it will allow the current to flow freely in one direction, but will block it almost completely in the other. By making use of this characteristic, the semiconductor diode can perform a wide variety of jobs and is one of our most basic electronic servants.

To understand how a semiconductor diode works, let's go back a little and examine electricity itself. An electric current is simply another name for a flow of electrons — the basic electrical charge found in all elements. Electricity flows when electrons move from one atom of a substance to the next.

In some materials, like copper, silver, aluminium and many other metals, the electrons can move easily, and it is because of metals conducting electrons so easily that they are called conductors.

In other materials — glass, porcelain, rubber, and many plastics — the electrons can move only with great difficulty. In fact, only very few electrons can move at all in these substances, even under great electric pressure; and so the flow of electric current through them is blocked. These substances are called insulators.

Between conductors and insulators are many materials which are neither good conductors nor good insulators. The electrons of their atoms are free to move, but are not so free as in a conductor; these substances being known as semiconductors.

Although there exist many semiconductors, only a few are used in electronics. Those most widely used are germanium, silicon, selenium and copper oxide. These particular semiconductors have a strange property. Under certain special conditions, electrons can flow out of them easier than in. Under other conditions, the situation is reversed: electrons come in freely, but have difficulty in getting out.

This strange property making itself evident only upon electrons entering or leaving the semiconductor material, it is useful only when the semiconductor is in contact with a conductor. This contact may be made in two ways: by point contact in which the semiconductor and the conductor make contact at only a single point; and by surface contact in which they meet over a broad area.

The semiconductor diode has traveled a long way since its original discovery. From the primitive crystal it has developed and become one of the most basic, most valuable of our electronic servants.

#### COMMENTARY

roars skyward с ревом взлетает вверх  
dozens of десятки  
to find their way into проникнуть в  
first of all прежде всего  
one-way street улица с движением в  
одну сторону; эд. пропускает элект-  
рический ток в одном направлении  
a wide variety of jobs самые разно-  
образные функции

at all вообще  
neither ... nor ни ... ни  
the situation is reversed происходит  
обратное  
have difficulty in getting out с трудом  
выходят  
make oneself evident проявляться  
has traveled a long way прошел  
длинный путь

#### EXERCISES

I. Find in the text nouns corresponding to the following words; translate them into Russian:

to move, gigantic, to view, to compute, electrical, to direct, various, difficult, to insulate, to conduct.

II. Find in the text adjectives corresponding to the following words; translate them into Russian:

electronics, height, silver, basis, evidence, use.

III. Find in the text verbs corresponding to the following words; translate them into Russian:

detection, generation, performance, examination, mover, existence.

IV. Find in the text synonyms for the following words; translate them into Russian:

very small, to see, almost, to permit, entirely, due to, to do, stream, matter, readily, indeed, field.

V. Find in the text antonyms to the following words; translate them into Russian:

young, narrow, conductor, easy, to flow in, to enter.

VI. Translate the following sentences into Russian paying attention to the meaning of the words in bold type:

1. Upon striking the earth the energy sent from the sun is **either** absorbed **or** reflected, or both. 2. The greatest part of the matter on the earth is not solid but fluid, **either** liquid **or** gas. 3. In emitting a gamma ray the atom loses **neither** mass **nor** electrical charge. 4. Two objects are at the same temperature if **neither** of them imparts heat to the other when they are near each other or in contact. 5. Energy can **neither** be created nor destroyed. 6. Matter can exist in **either** of the three states — solid, liquid or gaseous. 7. When we rub two surfaces together we do work, yet **neither** of the bodies is given **either** kinetic energy **or** an increase of potential energy because of friction.

VII. Find in the text all the sentences with gerundial complexes, state their functions and translate each sentence into Russian.

VIII. State the forms and functions of the gerunds and translate the following sentences into Russian:

1. The semiconductor diode being a very important device of modern science and industry is common knowledge. 2. Television being based on the functioning of semiconductor diodes makes them essential for manufacturing TV-sets. 3. The semiconductor diodes having many important characteristics resulted in their being used in different branches of industry. 4. We know of copper, silver, aluminium and many other metals being good conductors of electricity. 5. The reliable functioning of television depends on the television set being equipped with semiconductors. 6. We know of electrons flowing out of the semiconductor easily under special conditions, this process being reversed under different conditions. 7. We know of the semiconductor diode having traveled a long way since its discovery. 8. In spite of the semiconductor diodes being so important they were little in use at the beginning of the century. 9. The term "semiconductor" has been chosen because of its occupying an



intermediate place between metals, the conductors of the electric current, and insulators, that is, non-conductors.

**IX. Translate into English using gerunds or gerundial complexes:**

1. Ученые начали **работать** над конструированием полупроводниковых диодов в конце XIX столетия. 2. **После того как ученые** провели большое количество опытов, они открыли очень важные свойства полупроводниковых диодов. 3. **То, что полупроводниковые диоды используются** в разных отраслях промышленности, известно всем. 4. Мы должны всячески использовать возможность **применения** полупроводников в радиотехнике. 5. **Не пользуясь** полупроводниковыми диодами, мы не сможем усовершенствовать наш прибор. 6. **Преобразуя** световую и тепловую энергию в электрическую, мы можем пользоваться полупроводниками.

**X. State the functions of the ing-forms and translate the following sentences into Russian:**

1. Only by investigating the ultraviolet rays we shall be able to increase our knowledge of the stars. The only means of doing so is to use rockets and earth satellites. 2. No stable isotopes of any of the transuranium elements are known, the higher elements generally having the greater specific activity. 3. Catalysis is the action of certain, substances that speed up chemical reactions thousand times without themselves being changed. 4. Electronics men have training in the handling of various electronic devices. 5. Getting the most electronics in the least amount of space while minimizing weight and maintaining high reliability is the aim of manufacturers of electronic devices. 6. The region being investigated is the near-earth region called the "magnetosphere". 7. A process of refining petroleum called cracking is one of the greatest triumphs of the petroleum chemist. 8. The graphite in nuclear reactors is called the moderator because of its moderating, or slowing down the speed of the neutrons. 9. Neutrons produced near the surface of a reactor have a good chance of escaping and being lost from the reactor. The nuclear reactor being too small, too many neutrons are lost, and the chain reaction stops. 10. An electric conductor being moved in a magnetic field, an electric current is generated. 11. Magneto-hydrodynamic energy converters being able to produce huge amounts of electric energy makes them an important proposition for the direct generation of electricity. When and if perfected, they may very well eliminate present indirect sources of electrical power, their efficiencies approaching 60 per cent as compared to 40 per cent for conventional power plants. 12. Magneto-hydrodynamic energy converters being able to produce huge amounts of electric energy with greater efficiencies, we can assume that they will find wide application.

**XI. Translate the following dialogue into English:**

1. Где применяются полупроводниковые диоды? 2. Полупроводниковые диоды применяются в телевидении, вычислительных ма-

шинах, р радио и т. д. Они выполняют самые разнообразные функции. 1. Каково основное свойство полупроводниковых диодов? 2. Полупроводниковые диоды пропускают ток только в одном направлении, и это свойство имеет большое значение. 1. Что такое полупроводники? 2. Полупроводники — это вещества, занимающие промежуточное место между проводниками и изоляторами. 1. Какие полупроводники используются в электронике? 2. Наиболее широко используются германий, кремний, селен и окись меди, которые обладают особыми свойствами.

## **XII. Answer the following questions:**

1. Where are semiconductor diodes used? 2. What important characteristics of a semiconductor diode do you know? 3. What do we call an electric current? 4. When does electricity flow? 5. What substances are called conductors? (insulators? semiconductors?). 6. Give some examples of conductors, insulators and semiconductors. 7. What property do semiconductors possess?

## **Supplementary Text. Read and retell:**

### **A POCKET ELECTRIC STATION**

By using radioactive isotopes it is possible to obtain electric energy from the energy of radioactive radiation directly. Very small atomic electric batteries have already been constructed and they have certain advantages over common electric batteries.

Among the different substances in nature, there is a big group of so-called semiconductors which occupy a position between conductors of electric current and non-conductors. These "half" conductors conduct electric current, but do it much worse than metals.

It wasn't so long ago that these substances were like a treasure hidden in the earth, with their properties being hardly known. However, science having made considerable progress during the past years has greatly changed our ideas about these substances. Semiconductors have appeared in modern technology, forming a new and very important field of science, the physics of semiconductors.

It was found that current flow in semiconductors is entirely different from that in metal conductors. When a metal wire carries current, this means that the so-called free electrons are moving within the wire in a given direction. Such free electrons are always present in metals. Not so with semiconductors. Depending upon certain conditions, there may or there may not be free electrons in them. For example, at low temperatures there are hardly any free electrons at all, and the semiconductor does not conduct electric current. But heating such a substance causes free electrons to appear and the semiconductor begins conducting electricity. Semiconductors may be acted upon in the same way by light and radioactive radiation. It is this property that is made use of in atomic electric batteries.

The fast electrons from the radioactive substance displace large numbers of new electrons in the semiconductor, producing a flow of electrons in one direction, or in other words, an electric current. True, this current is very small. But atomic batteries will produce a current strong enough for radio sets, telephones and the like. Atomic electric batteries can operate a very long time without being charged again.

## COMMENTARY

depending upon в зависимости от  
is made use of используется  
and the like и тому подобное

## LESSON 19

### Grammar:

The Infinitive (forms and functions)

### READING DRILLS

#### 1. Two-syllable words with the stress on the first syllable:

(13—18) modern, recent, radar, limit, global, distance, peaceful, vessel, liner, transport, basic, target, object, mountain, darkness, timer, echo, magic, human, beacon, compass, picture, common, major.

#### 2. Two-syllable words with the stress on the second syllable:

(12—16) equip, appear, achieve, improve, increase, expand, control, detect, disturb, consist, receive, desire, reflect, return, transmit, obtain, depend, display, install, employ, process, compare.

#### 3. Many-syllable words:

(24—25, 27—33) infinite, development, synchronize, indicate, energy, accurate, miracle, insignificant, communicate, composite; associate; determine, discover.

#### 4. Derivative words:

difficult — difficulty, accurate — accuracy, to disturb — disturbance, to transmit — transmitter, to receive — receiver, to synchronize — synchronizer, to indicate — indicator, to depend — dependent, to perform — performance, to employ — employment, to improve — improvement.

#### 5. Memorize the pronunciation of the following words:

weather ['weðə] — погода, minute [maɪ'nju:t] — незначительный, очень малый, measure ['meʒə] — измерять, basis [beɪsɪs] — основа, база.

## PRINCIPLES OF MODERN RADAR

Modern radar has advanced far beyond the heavy equipment of short range and limited accuracy that appeared as one of the major technical achievements after World War II.

Through continuous improvement it has been possible to increase distances. Accuracy having been infinitely improved through increased use of microwaves and the development of electron tubes capable of handling such wavelengths, the usefulness of radar has been considerably expanded.

Radar has many peaceful uses. To help navigation at sea, small radars are installed on small commercial vessels, and larger setups are used on ocean-going liners and transports.

Aboard aircraft radar is used to make air navigation and flight safe, and to map areas over which the plane is flying. Ground-based radar is employed to control flights of aircraft.

In detecting storms, radar can locate heavy clouds associated with various weather disturbances.

Whatever the application, the basic principles of all types of radar equipment are deeply rooted in radio and electronics.

### Radar in general

A radar (an abbreviation of **radio detection and ranging**) is a composite radio-electronic apparatus to be used for detecting and locating objects and targets, such as aircraft, ships, buildings, mountains, and even people at various distances and with incredible accuracy, even when darkness, fog or clouds make the targets invisible.

A radar consists essentially of a microwave transmitter, an antenna system, a microwave receiver, a timer or synchronizer and an indicator — all working with microsecond precision.

Radio energy is broadcast in any desired direction. In striking an object or target, a minute portion of the radio energy is reflected and returns to the radar within a few thousandths of a second. Knowing the speed of radio energy (186,000 miles per second) and measuring time differences between the transmitted energy and any reflected echoes, it is possible to translate these data electronically into direct distance or range — from the radar to each object or target.

To determine the exact location of any target is made possible through accurate measurements of range, altitude, and azimuth, whether the target is in space, on the ground or on the sea. The data obtained (directly or through electronic processing) are displayed continuously on an indicator. This is usually a cathode-ray tube, the type of which is dependent on the kind of data to be displayed — range, altitude, azimuth, or other.

## COMMENTARY

**ocean-going** океанский  
**ground-based radar** наземная радио-  
локационная станция  
**are deeply rooted in radio** глубоко за-  
ложены в радио  
**essentially** в основном, в сущности

**electronically** на электронной вычис-  
лительной машине  
**through electronic processing** с помо-  
щью обработки на электронной вы-  
числительной машине  
**cathode-ray tube** электронно-лучевая  
трубка

## DIALOGUE ON RADIO

**Nikolai:** I see you've got a new radio set. Will you switch it on, please?

**Boris:** Certainly, it's almost 7 o'clock, I think. Time for the news.

**Nikolai:** I see your wireless has got all sorts of waves — long, medium, short as well as ultrashort below ten meters. By the way, what are these ultrashort waves used for?

**Boris:** They are used for short distance broadcasting and communication, also for television.

**Nikolai:** Well, have you switched the wireless on? There's nothing happening.

**Boris:** I'll have a look. Oh, I've plugged it in in the wrong way. Now I've put it right.

**Nikolai:** That's all right. There's a good program of music. I should like to listen to this evening.

(The news broadcast has begun. This friends are listening, then begin their talk again.)

**Boris:** You've also got a radio set. I suppose you're listening in every day, aren't you?

**Nikolai:** Oh, I'd love to, but I can't, I'm usually too busy for that.

**Boris:** It's a pity, there are some very good programs of English by radio lessons every week. Why not join me and listen to these lessons together? They are very useful if you want to take up a language.

**Nikolai:** Oh, by all means, I'll try to spare the time to.

**Boris:** Write down my telephone number, please, and phone me when you're ready to come.

(Boris switches off the radio and the friends leave).

## COMMENTARY

**all sorts of waves** все волновые диа-  
пазоны  
**by the way** между прочим  
**there's nothing happening** ничего нет  
**have a look** посмотреть  
**I've plugged it in in the wrong way**  
я включил его неправильно в сеть  
**that's all right** хорошо  
**listen in** слушать радио

**it's a pity** жаль  
**take up a language** начать занимать-  
ся языком  
**by all means** обязательно  
**spare the time** уделить время  
**write down** записать  
**when you're ready to come** когда ты  
захочешь прийти

## EXERCISES

**I. Find in the text nouns corresponding to the following words; translate them into Russian:**

to equip, accurate, to achieve, to improve, distant, useful, to set up, dark, to transmit, to receive, to indicate.

**II. Find in the text adjectives corresponding to the following words; translate them into Russian:**

to continue, globe, capacity, technique, peace, safety.

**III. Find in the text verbs corresponding to the following words; translate them into Russian:**

appearance, improvement, expansion, installation, map, local, detection.

**IV. Translate the following groups of words of the same root:**

to expand — expansion; infinite — infinitely; to install — installation; to locate — location — locality — local; precision — precise; to desire — desire — desirable; to measure — measure — measurement — measurable.

**V. Find in the text synonyms for the following words and expressions; translate them into Russian:**

chief, by means of, use, device, to be made up of, synchronizer, accuracy, to wish, during, precise, to receive, some, to show.

**VI. a) Translate into English using the words of the text:**

Радар появился во время второй мировой войны, но в настоящее время широко применяется в мирных целях. Это устройство используется для обнаружения и определения местоположения различных предметов и целей. Радар — очень точное устройство, и дальность его действия очень велика. При помощи радара можно точно определить дальность, высоту и азимут любой цели независимо от того, находится ли она в воздухе, на земле или на море. Полученные данные указываются на различных индикаторах в зависимости от типа передаваемых данных.

**b) Translate into Russian paying attention to the meaning of "before" and "after":**

1. Radar was greatly improved after the Second World War. 2. After the introduction of transistors electronic devices have become faster and more compact. 3. After transistors had been introduced into the manufacture of electronic devices, the latter became faster and more compact. 4. After the development of new types of electron tubes the accuracy of radar has been considerably improved. 5. After new types of electron tubes had been developed, the accuracy of radar improved considerably. 6. Before radar appeared it had been impossible to detect and locate invisible objects. 7. Before the appearance of radar it was impossible to detect and locate invisible objects. 8. Before the atomic physicists constructed a powerful elec-

tron microscope, scientists were unable to study a lot of small structures. 9. Before the construction of a powerful electron microscope scientists were unable to study a lot of small structures.

VII. Find in the text all the sentences with the infinitives, state their forms and functions; translate the sentences into Russian.

VIII. State the forms and functions of the Infinitives and translate the following sentences into Russian:

A. 1. To economize on transmitted power and to provide accurate target reporting, Rf energy is concentrated in a very narrow beam by the antenna system. 2. To detect and locate objects and targets, such as ships, aircraft, buildings, mountains, etc. at various distances and with incredible accuracy is of great importance for navigation at sea, air navigation and meteorology. 3. Experiments on the improvement of radar equipment began to be made during World War II. 4. It is possible to control flights of aircraft by means of ground-based radar. 5. Radio waves may be made to perform many services more or less closely related to communication. 6. The first man to invent the radio was A. Popov, a Russian scientist. 7. To design, construct and operate a radar system is a great technical achievement. 8. Astronomers use radar to explore the universe. 9. A ship at sea can use radar to determine the nature of its surroundings, and so avoid running into other ships and obstacles.

B. 1. The Greek philosopher Thales was the first to record the fact that objects which were electrically charged would attract each other. At that time the only known way to generate electricity was by friction on amber. 2. The ability to solve problems is the surest test of one's mastery of a subject. 3. The first step in the solution of any problem is to make sure that you have read it correctly and understand what it tells you and what you are required to find. 4. The first thing to be noted when considering the chemical properties of metals is that they vary widely in degree of chemical activity. 5. At sea level our atmosphere presses with sufficient force to support a column of mercury 78 centimeters high. 6. To handle a large amount of electrical power by a single machine requires that it be a large one. 7. The method employed in the cyclotron is to apply a moderate force to a particle many times. 8. As soon as methods were developed for separating iron from its ores, it ceased to be classed as a precious material. 9. There are three conditions a material must fulfil if it is to be classed as a modern synthetic plastic. 10. Nonmetals tend to acquire electrons and, in so doing, become negative ions. 11. To supply the most important and universal demands for oxygen does not cost a cent, it is as free as the air because it comes from the air. 12. It is often possible to build (synthesize) a compound directly from its elements or to separate (analyze) a compound into its elements. 13. It is often necessary to determine what weight of some substance is required or produced in a given reaction. 14. The power supply to be described utilizes inexpensive components and will easily fit into the smallest work-

place since it measures 3 by 4 by 6 inches. 15. To launch the satellite we had to make use of the step principle.

**IX. State the functions of the infinitive and translate the following sentences into Russian:**

1. To increase the range of modern radar became possible through continuous improvement of the equipment available. 2. To increase the range of modern radar scientists had to make numerous experiments. 3. To improve the accuracy of radar meant to expand its usefulness. 4. To improve the accuracy of radar a number of investigations were made. 5. To know the principles of modern radar specialists must thoroughly study radio and electronics. 6. To know the principles of modern radar is of great value for pilots, seamen and meteorologists.

**X. Translate the following sentences into Russian paying attention to the modal verbs with the infinitives:**

1. Something must have happened to our TV set; it is out of repair. 2. Absolute accuracy cannot be expected with this kind of instrument; you should take the mean of several observations. 3. You should have tested the device more carefully considering its importance. 4. The pilot should have made use of radar in locating the position of the plane. 5. The operator ought to have known the radio fundamentals better. 6. The scope must have been out of order; that is why the data obtained were not displayed continuously. 7. The operator could have detected the target in time; somebody may have switched off the receiver. 8. The new device must have been broken by accident. 9. The instrument may have been improved, because it became more accurate.

**XI. Answer the following questions:**

1. What are the improvements introduced into modern radar? 2. In what manner was the usefulness of radar expanded? 3. What are the peaceful uses of radar? 4. What are the basic principles of radar equipment? 5. What is radar used for? 6. What does radar consist of? 7. In what direction can radio energy be broadcast? 8. How is it possible to determine the exact location of a target? 9. Where are the data obtained displayed?

**Supplementary Text. Read and retell:**

## **RADIO**

Radio is a miracle of ages. Aladdin's lamp, the Magic Carpet seem insignificant compared to the radio.

By radio the human voice may be transmitted around the earth in less time than it takes to say the word "radio".

Radio is playing an ever increasing part in human life on land, on sea and in the air. It makes possible much more than simply communicating news, music, etc., and it also plays a very important part in navigation.



The radio beacon\* and radio compass help to locate positions in air and on sea in fog and storms. Without radio, to travel by air would not be one of the safest methods of transportation, although quite recently it seemed almost incredible.

The pictures of our daily newspapers are transmitted by wireless. Even the geophysicists use radio instruments.

There are a few fundamental principles which are the basis of all the electrical means of communication. To know those fundamentals is to understand the systems of communication which at first seem as having nothing in common.

Whether the transmission system is wire or wireless, whether the signals which carry the information can be heard or seen, there is something in common to all the means of communication.

However different their aims may seem, all of them are simply means to perform certain typical operations, each of them playing an important part in radio communication.

### COMMENTARY

magic carpet ковер-самолет  
compared to по сравнению с  
than it takes to say the word чем тре-  
буется, чтобы произнести слово  
play a part играть роль  
ever increasing все возрастающий  
quite recently совсем недавно

means of communication средства свя-  
зи  
to have nothing in common не иметь  
ничего общего между собой  
there is something in common имеет-  
ся что-то общее

## LESSON 20

### Grammar:

the Objective Infinitive Construction;  
словообразование

### READING DRILLS

#### 1. Many-syllable words:

(24—25, 27—33) electricity, electrical, sufficient, proportional, natural, television, element, equivalent, continuous, demonstrate, visual, combination; amplify, analyze.

#### 2. Words ending in -ing:

require — requiring, change — changing, cause — causing, light — lighting, increase — increasing, amplify — amplifying, shine — shining, consider — considering, reach — reaching, start — starting, send — sending, convert — converting.

#### 3. Word-combinations:

the progress of television, the flow of electric current, the number of different devices, the power of the photoelectric cell, the end of the last line, the method of transmitting pictures.

\*radio beacon радиомаяк.

## TEXT

### TELEVISION

The word television comes from the Greek word "tele" which means "far", and the Latin word "visio" — "seeing". It enables us to see stationary and moving objects at great distances. We know television to be widely used both in everyday life and in industry, in scientific work, etc.

The progress of television since 1929 up to the present time has been rapid. Television requires pictures to be sent by means of electricity. Pictures are made up of light and darkness. We should have some device which will change light into electricity, so that we can send it over wires or by radio. A number of different devices will do this for us, one of them being the photoelectric cell.

The photoelectric cell is a special kind of electronic tube in which light will cause an electric current to flow. If there is no light, there will be no current, but when there is light on the photoelectric cell, the current will increase as the light is made brighter. Even with a very bright light the amount of current is exceedingly small, but that does not matter because we can amplify the current of the photoelectric cell and obtain as much current as we require. If we amplify the current sufficiently, we can cause it to light an electric lamp and make the lamp's light proportional to that shining on the photoelectric cell.

It seems natural to consider sending sections of the picture, one after the other, natural because we do this ourselves when we read. If we look at a page in a book, we get no meaning from it until we start to scan it one word at a time along the line of print. As our eyes move, we see words appear one after the other until we read the end of the line when our vision jumps quickly to the line below. When we have reached the last line of the page, we start again at the top of the next page. In this way we have scanned the pages line by line.

The same method can be used for pictures to be sent by electricity. The sensitive spot of the photoelectric cell can be moved across the field of the picture, one spot at a time, line by line until the whole picture has been covered. If the reproducing lamp is moved in the same way, the picture will be built up, one spot at a time and line by line. The fundamental method of transmitting pictures by television, therefore, consists in analyzing the picture into elements, sending their equivalent light values by electrical means, reconverting them into light elements and reassembling the picture again. The whole process must be carried out so rapidly that the eye sees a continuous picture.

In 1938 television in colour was first demonstrated, taking advantage of the fact that red, green and blue are primary colours from which every visual colour can be built up by combination. At present, colour TV is being widely introduced, replacing the black and white TV. The future certainly belongs to colour TV.

## COMMENTARY

come from происходить от  
 both ... and и ... и  
 are made up of состоят из  
 with a very bright light при очень ярком свете  
 that does not matter это не имеет значения  
 one spot at a time по одному пятну за раз  
 line by line линия за линией

consist in заключаться в  
 analyze into elements раскладывать на элементы  
 reconvert вновь превращать  
 reassemble вновь собирать  
 television in colour цветное телевидение  
 take advantage of использовать, воспользоваться  
 colour TV цветное телевидение

## EXERCISES

I. Translate into English the following groups of words of the same stem:

электричество — электрический; темнота — темный; усиливать — усиление — усилитель; достаточный — достаточно; вводить — введение; осложнение — сложный; означать — значение; чувствительность — чувствительный; воспроизводить — воспроизведение.

II. Translate into English and write synonyms for the following words:

состоять (из), устройство, преобразовать, величина, получать, достаточно, достигать, следовательно.

III. Translate into English and find in the text antonyms to the following words:

медленно, свет, недостаточно, прерывистый.

IV. Find in the text English equivalents for the following words and expressions:

на большом расстоянии; как... так и; и так далее; посредством; по проводам; это не имеет значения; таким образом; заключается в; выполнять; воспользоваться чем-либо.

V. Underline the prefixes and translate the following words into Russian:

reproduce, reconvert, reassemble, replace, reread, reconsider, reappear, remove.

VI. Translate the following sentences into English:

1. И радио и телевидение играют важную роль не только в повседневной жизни, но также и в промышленности и в науке. 2. Благодаря телевидению мы видим на большом расстоянии как неподвижные, так и движущиеся предметы. 3. Передача изображений посредством телевидения включает в себя несколько процессов. 4. Фотоэлемент преобразует свет в электричество, а затем электрический ток усиливается до требуемой величины. 5. Процесс развертки в телевидении подобен чтению печатного текста.

VII. Translate into Russian paying attention to the meaning of the words in bold type:

A. 1. Today there is hardly a field in which radioactive substances are not made use of. 2. Instruments for measuring electric

current, voltage and electric power and energy **make use of** magnets. 3. Water is one of the few substances that **is made use of** by man in all of its three states. 4. When doing many and varied kinds of work we **take advantage of** machines. 5. Manufacturers **take advantage of** the penetrating power of X-rays when inspecting their products without the necessity of taking them apart. 6. It is the weight of the air that **gives rise to** the atmospheric pressure. 7. In an alpha-ray transformation the parent atom disappears as such, and in doing so **gives rise to** two new atoms, one of which is helium. 8. The last few years some alloys have displaced iron and steel for many uses **because of** their more desirable magnetic properties. 9. **Because of** the earth's rotation we have day and night on the earth. 10. It is **on account of** their inertia that balls of all kinds continue their motion when thrown or struck.

B. 1. The field of high-temperature research is a great problem of science. But it is **by no means** a new one. 2. A wide variety of industrial processes are controlled **by means of** telemetry. 3. Telemetry is a combination of Greek and Latin words and **means** "measuring at a distance". 4. For our experiment we must take the **mean** of several temperature measurements. 5. Producing high temperatures by chemical reactions can be achieved in several ways — **by means of** combustion of metals in oxygen; **by means of** combustion of gaseous mixtures; or **by means of** plasma jets. This **means** that the problem of containing chemical substances at temperatures which conventional containers cannot withstand must be solved. 6. The computer's ability to do simple work by simple **means** explains its wide use. 7. We must strive **by all possible means** to complete the work in time. 8. Will you join me in this work? **By all means**.

VIII. Underline the complex object with the infinitive in the following sentences and translate them into Russian:

1. We know the electric current to flow in metal parts. 2. Many years ago scientists believed an electric current to be a stream of tiny electrical particles. 3. The engineer wants the new devices to be tested in the laboratory. 4. They have seen the device begin to operate. 5. We know radio to play a great part in human life. 6. They wanted the device to be examined carefully by experts. 7. Suppose the transmitted signal to be very weak. 8. Everybody considers electronic devices to play a great role in industrial control. 9. The operator considered the amplifier to be powerful enough for the given operation. 10. We often watched the operator control the functioning of the equipment. 11. We heard geophysicists do prospecting by means of radio instruments. 12. Time and again we saw the planes take off from the airdrome. 13. Suppose a large number of electrons to be concentrated on a very small area of a body. 14. Radio beacons permit the pilot to find the way in fog or storm. 15. Radio allows us to communicate with the remotest corners of the world. 16. Vacuum tubes enable us to amplify the voltage or power. 17. Radio enabled the human voice to be transmitted around

the globe. 18. We asked the engineer to show us different radio instruments. 19. The electric pressure of lightning causes the current to pass through the air. 20. Light causes electrons to be knocked out from the metal coating into the cathode ray tube.

**IX. Translate the following sentences into Russian paying attention to the modal verbs with the perfect infinitive:**

1. Anyone watching the space flights of our astronauts must have been impressed by the information available at ground stations, even without any word from the astronaut; this is possible due to telemetry. 2. You should have bought a new transistorized TV set — it is fully portable as it does not depend on the a. c. line as a source of power. 3. The designer could have introduced some changes in the cathode-ray tube to improve the TV set. 4. The circuit of the TV set must have been improved, that is why the picture is much better. 5. The radio set may have been plugged in in the wrong way, therefore there is nothing happening. 6. You must have bought a new radio set, I have not seen it before.

**X. Translate into English using the complex object with the infinitive:**

1. Мы считаем, что цветное телевидение имеет большое будущее. 2. Наши инженеры полагают, что новый прибор даст высокую точность. 3. Оператор наблюдал за тем, как работают новые приборы. 4. Вы видели, как работает мой новый телевизор? Я хочу, чтобы Вы пришли посмотреть его. 5. Мы слышали, как инженер рассказывал об этом эксперименте. 6. Я знаю, что эти приборы появились не так давно.

**XI. Answer the following questions:**

1. Where does the word television come from? 2. Has the progress of television been rapid? 3. For what purpose is the photoelectric cell used? 4. What causes the flow of electric current in the photoelectric cell? 5. What is the process of scanning? 6. What is the fundamental method of sending pictures by television? 7. Why must this process be carried out very rapidly? 8. When was colour television first demonstrated?

**Supplementary Text. Read and retell:**

### PORTABLE TV SETS

In the early days of TV, sets were physically large but screens were small, and, in fact, the 10-inch version reigned supreme for a long time. As TV reached more people, the demand for a larger screen soon followed and set picture size went up considerably. For a short period of time even this was not enough, and projection systems became the vogue.

At present there are in current use portable TV sets and living room sets. These are a. c.-powered and use vacuum-tube circuits. There are also fully portable sets, that is, sets that are not depen-

dent on the a. c. line as a source of power for operation (although they all can be operated in this fashion, if desired).

The key to the fully portable TV set is the transistor and the low-power-consumption CRT. As is well known, the transistor is perfectly capable of full operation at reasonably low supply voltages (about 12 v.) and a lot of basic research has gone into the development of a low-power CRT.

All presently available, fully portable sets are designed to operate either from a 12-volt d. c. (battery) source or from the a. c. power line. Almost all have provisions for operation from a 12-volt automobile storage battery.

With the continued research now being made into microminiaturization bulky circuits would be a thing of the past. Then it would be possible to make small-screen portable colour sets. Cathode ray tubes may undergo great electrical and mechanical changes and miniature CRT's of the future may not even look like the present ones with a screen at one end and the electron gun at the other.

## COMMENTARY

in fact действительно  
set picture size размер изображения  
телевизора  
these are in current use широко используются  
these are a. c.-powered они питаются  
переменным током  
if desired при желании  
low-power-consumption CRT электронно-лучевая трубка с низким потреблением энергии  
a lot of basic research has gone into the development много фундамен-

тальных исследовательских работ  
было направлено на развитие  
are designed to предназначены  
have provisions for снабжены устройствами  
with the continued research now being made into при непрерывных исследованиях, которые в настоящее время ведутся в направлении  
would be a thing of the past отойдут в прошлое  
may not even look like могут даже быть непохожими на

## LESSON 21

### Grammar:

the Subjective Infinitive Construction;  
словообразование

### READING DRILLS

#### 1. Two-syllable verbs with the stress on the second syllable:

(12—16) equip, compare, direct, respond, apply, demand, transform, appear, confine, conduct, explain, believe, consist, enclose, remove, maintain, contain, produce, depend, require, construct, compute, improve, desire.

#### 2. Many-syllable words:

(24—25, 27—33) industrial, comparative, development, responsible, available, maintenance, separate, particle, filament, techno-

logy, theoretical, experiment, accelerate, continuous, productivity; electric, electronic, automatic, fantastic, economic; material, various, radio, theory, variety, society, social.

**3. Derivative words ending in -able:**

to apply — applicable, to pass — passable, to explain — explainable, to believe — believable, to control — controllable, to suit — suitable, to think — thinkable, to use — usable;

inapplicable, unexplainable, unbelievable, uncontrollable, unsuitable, unthinkable, invisible.

**4. Word-combinations:**

industrial electronics, a comparative newcomer, the major developments, the critical materials, various industries, standard equipment, electric current, certain parts.

**TEXT**

**INDUSTRIAL ELECTRONICS**

Industrial electronics equipment is known to play a very important role today. A comparative newcomer to industrial plants, the major developments in industrial electronics having taken place since World War II, this electronic equipment has been directly responsible for saving millions of man and machine hours and millions of pounds of critical materials.

Hundreds of electronic equipments are now available to science and various industries to help do jobs better or more economically or to take over jobs that could not be done otherwise.

The application, use, and proper maintenance of the many electronic equipments now in industrial use demand a certain knowledge to be had of the fundamentals of various standard electronic equipments.

We already know that in motors, incandescent lamps, transformers, etc., the electricity always flows in the copper wire or other metal parts. But consider lightning, where electricity seems to jump through space. The great electric pressure of lightning forces the electric current to pass through the air. In the same way, inside any radio tube, tiny electric currents are made to pass through the space separating certain parts in the tube. Such action — where electricity appears to flow through space instead of being confined to metal conductors or circuits — is said to be electronic.

Why is it called electronic? Years ago, scientists who were trying to explain how electricity passed through space, imagined such an electric current to be a steady stream of tiny electrical particles. They called these particles electrons. Today, any electric current is believed to consist of countless numbers of electrons. Only when electricity passes through space, when the stream of electrons comes out of the metal into the open, is such action said to be electronic.

For a device to be called electronic, electricity must flow across the space inside the device and be controlled by that device.

In ordinary air, electrons can be made to jump through space only by pressure of high voltage. But if enclosed in a tube from which the air has been removed, the electrons flow across the space more easily. All tubes must be carefully sealed for the desired conditions to be maintained inside the tube. Most of the small tubes are vacuum tubes, the larger ones usually containing mercury or other vapour.

Some electric lights are electronic. The common incandescent light bulb is not considered to be electronic even though it is enclosed like a radio tube, for the electric current flows entirely within the metal filament. In contrast, the fluorescent lamp is electronic, its light being produced by the action of electric current flowing through the space between the two ends of the lamp.

Electronics as a science is not new, for radios, sound pictures, fluorescent lights, etc. are known to depend upon electronics. However, the recent developments based on electronics require a better understanding of the subject in general.

#### COMMENTARY

**a comparative newcomer** появившись сравнительно недавно  
**has been directly responsible for saving** дало непосредственную экономию  
**are now available to science** находятся теперь в распоряжении ученых  
**to take over jobs** выполнять работы  
**now in industrial use** которые применяются в промышленности  
**demand a certain knowledge to be had of the fundamentals** требуют определенных знаний основ

**seems to jump through space** как бы проскакивает в пространстве  
**in the same way** точно так же  
**appears to flow through space** как бы течет в пространстве  
**years ago** много лет тому назад  
**comes out of the metal into the open** выходит из металла в окружающее пространство  
**in contrast** наоборот

#### EXERCISES

##### I. Translate the following groups of words of the same root:

industry — industrial; to compare — comparison — comparative — comparatively; to maintain — maintenance; to conduct — conductor — conduction — conductivity; to explain — explanation; to care — care — careful(ly) — careless(ly); to contain — container — content(s); to equal — equality — equal(ly).

##### II. Mind the following groups of synonyms:

to play a role — to play a part; mill — plant — factory — works; since — because — as — for; to demand — to require; to call — to name — to term; to attain — to achieve — to reach.

##### III. Arrange the following antonyms into pairs and translate them into Russian:

confined, inside, to come out of, outside, input, unconfined, to come into, output.



#### IV. Translate into English using the words of the text:

1. Электрическое напряжение измеряется вольтметром. 2. Электронная лампа управляет потоком электронов. 3. Напряжение, приложенное к диоду, может быть ограниченным. 4. Электронное оборудование находит все возрастающее применение в промышленности. 5. Электронная лампа может усиливать входные сигналы. 6. Вместо старых машин мы используем теперь электронное оборудование, которое экономит много времени и большое количество материалов. 7. Усиленное напряжение снимается с выхода усилителя. 8. Испытания нового оборудования будет происходить на будущей неделе.

#### V. Underline in the following sentences:

- a) the complex subject with the infinitive.
- b) the for-phrase with the infinitive.

A. 1. Industrial electronics is said to be a comparative newcomer to industrial plants. 2. Electronics equipments have been proved to save millions of man and machine hours. 3. Electronics devices are known to control the stream of electrons. 4. Vacuum tubes appear to perform such functions as: rectification, amplification, detection, modulation and others. 5. The future is expected to bring a great many of new applications for semiconductors. 6. Experiments with special constructions of semiconductor diodes are reported to have been carried out. 7. Electronics equipments have been proved to do jobs better and more economically than other devices. 8. Vacuum tubes are assumed to be basic elements in numerous technical devices now in use. 9. Vacuum tubes are considered to be indispensable in industrial control. 10. Electronics equipments are likely to find an ever growing application. 11. The application of vacuum tubes seems to be almost infinite. 12. The fundamental functions of vacuum tubes are likely to be the cause of their numerous applications. 13. Electronics equipments appear to have already been applied at the beginning of the century. 14. The basis of our modern civilization is known to lie in the use of machinery. 15. The average user of electrical devices is not likely to know anything about them because they are usually small, almost hidden, and seldom require servicing. 16. The magnetic phenomenon that seems most strongly to have impressed the ancient commentators was magnetic attraction. 17. The word magnet comes from the name of the province of Magnesia in Asia Minor, where the mineral seems to have been discovered. 18. Electric currents through air or other gases proved to be carried by ions which are driven in one direction or the other in an electric field according to the sign of the charge they carry. 19. Isotopes are found to behave alike in all chemical reactions but to differ in mass. 20. Cosmic rays have been found to belong to two energy groups, one much more penetrating than the other.

B. 1. The speed of sound may be found by measuring the time required for it to travel a measured distance. 2. The time passing between the seeing and the hearing is that required for the sound

to travel a certain distance. 3. It requires but little more than two fifteenths of a second for light to travel round the earth at the equator. 4. It was necessary for the device to be tested. 5. There is a good reason for us to use the industrial electronics equipments. 6. It is not possible for forces to be in equilibrium if the sum of any two is less than the third, or if the difference between any two is greater than the third. 7. Sound waves, too high in frequency for the human ears to hear, are vital to modern industry.

**VI. State the forms and functions of the infinitives and translate the following sentences into Russian:**

1. We know electric current to be surrounded by a magnetic field.
2. We have seen the existence of life on the earth depend upon the continuous receipt of enormous quantities of energy from the sun.
3. To transmit the human voice around the earth became possible by means of the radio.
4. Air under normal conditions has been found to contain few ions.
5. A condenser is known to be a store-room for electric charges; it is known to consist of two conducting bodies separated by a dielectric.
6. Work is considered to be done by one body upon another and to be the result of some action of the one body upon the other, such an action between bodies being called a force.
7. To be able to determine the exactness of individual measurements is an important objective in laboratory work.
8. The temperature at which freezing occurs, termed the freezing point, is ordinarily stated to be  $0^{\circ}\text{C}$ .
9. Observation shows sound to originate in some kind of motion.
10. Whenever we see an object suddenly begin to move, we assume at once that something has acted or is acting upon it to produce the change.
11. The density of water may be considered to remain constant even at great depths.
12. The Egyptians seem to have made some use of iron a number of centuries before our era.
13. Copper was one of the first metals to be used by man, the reason being that it is found free in nature to a comparatively large extent.
14. Zinc seems to have been known long before the days of the alchemists as one of the constituents of the alloy brass.
15. We have learned air to be composed of many gases.
16. Physicists found the length of the wave of X-rays to range from one-thousandth to one-ten-thousandth part of the wave length of light.
17. Supplying heat to a block of ice causes it to change to liquid water at a perfectly definite temperature called the melting point.
18. Before the discovery of the neutron, all atomic nuclei (except H) were assumed to consist of protons and electrons, the latter being present in just the right number to ensure the electrical neutrality of the atom as a whole.
19. Water at a height is said to have energy because in falling through that height it can do work.
20. One way to find the wave length of a sound is to calculate it from the number of vibrations and the velocity of sound.
21. Lasers have been used to weld pieces of titanium — with no other source of power.
22. A simple example of a robot commonly used to control an operating device without human intervention is a thermostat.

**VII. State the functions of the verbals and translate the following extract into Russian:**

Scientists found the number of elements to be equal to the number of protons in their nucleus, the number of protons and neutrons together making up the atomic weight of the atom. The atomic number and the atomic weight of any element being known, you can easily determine the number of protons, neutrons and electrons composing its structure. Heavy hydrogen discovered in 1932 is known to have the atomic number 1 and the atomic weight of 2, its nucleus containing therefore 1 proton and 1 neutron. It is known as the deuteron.

Heavy hydrogen combining with oxygen, heavy water is formed, its chemical symbol being  $D_2O$ . Heavy water is found to freeze at about  $4^{\circ}C$  and to boil at about  $101^{\circ}C$ . Small animal and plant organisms seem to be affected by it. Goldfish, however, were found to behave alike in the two kinds of water. Heavy hydrogen is known to be called an isotope of hydrogen. We know isotopes to be atoms of the same atomic number but of different atomic weights. Most elements have been found to consist of two or more isotopes. Thus oxygen atoms of atomic number 8 are found to have atomic weights of 16, 17 and 18.

**VIII. Translate the following sentences into English using the complex subject with the infinitive:**

1. Известно, что цветному телевидению принадлежит будущее.
2. Говорят, что наш завод получил новые электронные приборы.
3. Считают, что полупроводники будут находить все большее и большее применение во всех областях техники.
4. Ожидают, что в ближайшем будущем появится новая модель телевизора на полупроводниках.

**IX. Answer the following questions:**

1. When did electronics equipments begin to be used at industrial plants?
2. What is the advantage of industrial electronics equipment over other kinds of equipment?
3. What is the chief characteristic feature of electronic devices?
4. What devices do we call electronic devices?
5. What kinds of vacuum tubes do you know?
6. What do radio, sound pictures and fluorescent light depend upon?

**Supplementary Text. Read and retell:**

### ELECTRONICS HELPS MAN

("In the conditions of Communist construction, automation ushers in a new era in the development of technology")

Our age has been called a variety of things: The Space Age, the Electronic Age, the Atomic Age, etc. One of them, however, is particularly suitable, namely: The Age of Automation.

One believes automation to be the highest stage in the development of technology. It has made the development of rocket produc-

tion and nuclear industry possible; it has made possible theoretical and technical experiments up to now unthinkable.

Automation has been found to be particularly effective in continuous cycle production and operation of thermal and hydropower plants.

Automation of production processes would be unthinkable without automatic control; the required machines based on electronic computers have been developed in our country.

Not long ago, the very idea of using a computer for industrial purposes would have seemed to be fantastic. However, it is a reality today!

It is common knowledge that automation results in higher labour productivity. In other words it is known to accelerate economic progress. Automation not only makes labour more productive but radically changes its nature. Automatic equipment frees man from a number of difficult and dangerous production processes and helps in making labour intellectual. Under socialism automation is an important means of improving the living standard of the people.

### COMMENTARY

has been called a variety of things  
называли по-разному  
up to now unthinkable до настоящего  
времени немислимый

continuous cycle production поточное  
производство  
it is common knowledge общеизвест-  
но  
a number of ряд, несколько

## LESSON 22

### Grammar:

review of verbals

### READING DRILLS

#### 1. Two-syllable words with the stress on the first syllable:

(13—18) solid, liquid, mixture, normal, human, whistle, nature, even, distance, constant, rapid, substance, grinding, solvent, handle, focus, tiny, neutral, proton, unit, neutron, central.

#### 2. Two-syllable words with the stress on the second syllable:

(12—16) believe, apply, include, produce, precede, compare, succeed, allow, collide, explain, arise, repeat, perform, compose, consist, exist, divide, destroy, obtain, belong, withstand.

#### 3. Many-syllable words:

(45—22, 27—33) industry, molecule, experiment, versatile, accurate, separate (adj.), separate (v), economical, material, medicine, evident, difference, experience, genius; consider, develop, distinguish, continue, imagine, remember.

**4. Memorize the pronunciation of the following words:**

touch [tʌtʃ] — касаться, thorough [ˈθʌrə] — тщательный, аккуратный, machine [məˈʃi:n] — машина, обрабатывать, piece [pi:s] — кусок.

**5. Read and translate the following word-combinations:**

modern industry, powerful tools, television sets, ultrasonic waves, human hearing, solid materials, fantastic genius, enormous distances, cold welding, mechanical cleaning, special solvents, machining methods, inaccessible places, limited number, chemical element, electrical nature.

**TEXT**

**SOUNDS WE CANNOT HEAR (ULTRASONICS)**

Ultrasonics is believed to have given modern industry one of the most versatile and most powerful tools invented by man. It throws molecules of matter against each other to shake, break, weld, boil, cut, grind and clean. It is known to detect minute flaws or measure the thickness of an ultrathin sheet of steel with the greatest accuracy. It combines solids and liquids nature has never intended as mixtures, controls television sets, etc., all this being achieved with but one tool, ultrasonic waves.

Only a few applications of ultrasonics have been touched upon, the future is sure to bring many others.

What are ultrasonic waves? They are waves like sound waves, but they are beyond the range of sound — beyond the normal range of human hearing. Any soundlike wave above 20,000 cycles is known as ultrasonic, including vibrations up to a frequency of 25,000,000,000 cycles per second in solid materials and liquids.

Experiments with ultrasonics have been carried out for a long time. The versatile and fantastic genius of man invented one of the first useful tools for ultrasonic experiments, a whistle\* producing sound waves beyond human hearing that a dog could distinguish. Of course, nature has preceded us as usual and provided bats with an ultrasonic "radar" system so accurate that they can fly in the dark between thin wires only a few inches apart without ever touching them!

How is this tool to be used in industry? Let us first look into why it is such a powerful tool. The molecules of even the hardest steels are separated by enormous distances compared to the size of the molecules. And in this space the molecules are in constant motion. Heating a substance increases this motion and the hotter it becomes, the more rapidly the molecules move. If we succeeded in somehow pushing some of these molecules around, they would in turn push on other molecules, and it is this push that allows a sound wave to travel through a substance. The distance between molecules

---

\* whistle свисток

being shorter for solids than for air, the chance of the molecules colliding with each other is much greater. This explains why sound travels faster through solids than liquids and faster through liquids than through gases. The wild shaking of molecules which arises in passing an ultrasonic wave through a body can be used in a great many ways for cold welding, cleaning, grinding, cutting, etc., to be carried out.

What are the advantages of ultrasonics over other methods? In cleaning the answer is obvious. Only very thorough and repeated mechanical cleaning plus special solvents could do as good a job. Flaw detection by ultrasonics allows an accuracy to be reached unheard of by other methods except X-rays, and is much safer and much more economical to use. In machining, ultrasonics can do things that cannot be done in any other way. It can handle materials no other machining methods can touch. For example, ultrasonic equipment can machine glass, ceramics and hard materials. It can drill holes through materials which will withstand any other attempts at penetration. In medicine, ultrasonic waves can reach inaccessible places and be focused on tiny spots in the brain or other parts of the human body to perform operations. And we have seen only the beginning!

## COMMENTARY

it throws molecules of matter against each other он сталкивает между собой молекулы вещества  
have been touched upon были затронуты  
beyond the range за пределами

without ever touching them ни разу не прикоснувшись к ним  
in turn в свою очередь  
in passing an ultrasonic wave когда ультразвуковая волна проходит  
could do as good a job могли бы так же хорошо справиться с этим

## EXERCISES

### I. Translate the following groups of words of the same root:

industry — industrial; to invent — inventor — invention — inventive; to detect — detection; to measure — measure — measurable — measurable; thick — thickness; to combine — combination; to mix — mixture; to achieve — achievement; to apply — application — applicable; to include — inclusion; to vibrate — vibration; frequency — frequent (ly); to distinguish — distinguished; to use — use — usage — useful — useless; to compare — comparison — comparative (ly); to succeed — success — successful; to collide — collision; to explain — explanation; to pass — passage; to machine — machine; to equip — equipment; to penetrate — penetration; access — accessibility — accessible.

### II. Mind the following groups of synonyms:

defect — flaw; accuracy — exactness — precision; etc. — and so on; a few — several — some; like — similar; of course — certainly; motion — movement; rapidly — swiftly — fast; to allow — to per-

mit — to let; obvious — evident — apparent; to reach — to achieve — to attain; thorough — careful.

**III. Mind the following groups of antonyms:**

powerful — powerless; advantage — disadvantage; question — answer; accessible — inaccessible; the beginning — the end; modern — ancient; to increase — to decrease.

**IV. Find in the text English equivalents for the following words and word-combinations:**

обязательно, проводить опыт, чем ... тем, в свою очередь, находиться на расстоянии нескольких дюймов друг от друга.

**V. Translate the following sentences into Russian paying attention to the words in bold type:**

A. 1. **The** higher the temperature, **the** more rapid is the motion of the molecules. 2. **The** stronger the magnet, **the** greater the distance at which its influence may be detected. 3. Since the barometer measures the pressure of the atmosphere, **the** greater the elevation, **the** lower the barometer reading. 4. **The** finer the filament, **the** greater the resistance which it offers to an electric current.

B. 1. **It** is ultrasonics **that** is one of the most powerful tools invented by man. 2. **It** is in industrial technology and scientific development **that** electronic tools made a great contribution. 3. **It** was about 100 years ago **that** the first useful tools for ultrasonic experiments were invented. 4. **It** is by ultrasonics **that** we can detect minute flaws and measure the thickness with the greatest accuracy.

**VI. Define the forms and functions of the verbals, translate the sentences into Russian:**

1. By using ultrasonic waves we can shake, break, weld, boil, cut, grind and clean. 2. The future is expected to bring a great many new applications for ultrasonics. 3. The Galton whistle has been proved to produce sound waves beyond human hearing. 4. Ultrasonics has the advantage of being a very precise tool. 5. If we want different molecules to be mixed they must be shaken by ultrasonics together and they are soon thoroughly mixed, this method being called emulsification. 6. Its having many advantages over other methods makes ultrasonics indispensable for modern industry. 7. Ultrasonics appears to drill holes through materials which do not withstand any other attempts at penetration. 8. Bats being provided with an ultrasonic "radar" system enables them to fly in the dark between thin wires only a few inches apart without ever touching them. 9. Increasing the velocity of molecules can be accomplished by raising the temperature. 10. The field of application of electronics having considerably grown, we can perform now many industrial processes with unheard-of accuracy. 11. Because of its being applied in different branches of modern industry electronics is growing in importance from day to day. 12. When doing many various kinds of work

use is made of electronic tools nowadays. 13. Manufacturers make use of the penetrating power of ultrasonic waves when inspecting their products without the necessity of taking them apart. 14. Testing will show that in cleaning and machining ultrasonics can do things that cannot be done in any other way. 15. The experiments carried out with ultrasonics resulted in its being widely used in modern industry. 16. New types of electronic tools being invented at present make a great contribution to industrial technology and scientific development. 17. The distance between the molecules to be traveled by a sound wave is shorter for solids than for air. 18. Experiments with ultrasonic waves are reported to have been going on for a long time. 19. Many new applications of ultrasonic waves are likely to appear in the future. 20. The substance being heated, the motion of the molecules increases. 21. Due to the molecules being pushed around, a sound wave can travel through a substance. 22. Sound is known to travel faster in solids than in liquids. 23. Ultrasonic waves being able to reach inaccessible places, they are used to perform different operations. 24. Great accuracy is known to be achieved in flaw detection by means of ultrasonics. 25. The new applications of ultrasonics to be discussed by the engineers will considerably improve the quality of production.

**VII. Write questions to which the words in bold type are the answers:**

1. Ultrasonics has given modern industry **one of the most versatile and powerful tools invented by man**. 2. **Yes**, ultrasonic equipment can machine glass, ceramics and hard materials. 3. The fantastic genius of man invented one of the first useful tools for ultrasonic experiments **about 100 years ago**.

**VIII. Translate the following sentences into English:**

1. Нам следовало бы применить ультразвук для обнаружения дефектов в детали. 2. Этот инженер, должно быть, знал электронику очень хорошо. 3. Поверхность этой детали, возможно, была очищена при помощи ультразвука. 4. Нам следовало бы провести ряд опытов по исследованию применения ультразвука в промышленности. 5. Эту сложную операцию, вероятно, сделали с помощью ультразвуковых волн.

**IX. Answer the following questions:**

1. What is the versatile and powerful tool that electronics has given to modern industry? 2. What are some of the processes that ultrasonics may perform? 3. When was the first tool for ultrasonic experiments invented? What was it? 4. What animals can hear sounds beyond human hearing? 5. Why does sound travel faster through solids than liquids and faster through liquids than gases? 6. What are the advantages of ultrasonics over other methods in cleaning (machining, medicine)?



## SUPERSONICS AND ULTRASONICS

You may have heard the sonic thunder, or sudden sharp bang that occurs when a plane is flying faster than sound. How does the bang arise? The speed of sound is about 750 miles an hour. So long as an airplane is flying well below the speed of sound, the particles of air move out of the way. The plane nearing the speed of sound, the air cannot move out of the way fast enough. It is, therefore, thrown suddenly aside, forming a shock wave.

The shock waves from the plane spread out until they reach our ears and give us the sound we call a "sonic bang". It is these waves that may damage the windows on the ground when a supersonic plane flies overhead. The term supersonic applies to motion at a velocity greater than that of sound.

**Ultrasonics**, on the other hand, is something quite different. It is the study of sound waves whose frequency is too high for us to hear.

An ultrasonic wave is reflected as an echo by an object. By measuring the time it takes the wave to travel to the object and return back, we can find out exactly how far away the object is. This is how sound is used to measure the depth of the sea. In the same manner, bats avoid obstacles with remarkable accuracy by emitting high frequency cries and timing their echo return.

Ultrasonic waves have many uses. We can use them, for instance, to measure the thickness of metal or to detect flaws in it.

Another use of ultrasonics is to set up vibrations in liquids to clean tiny instrument parts like watch springs. A lot of other applications, such as drilling, welding, cutting, etc., make ultrasonics a very useful tool to be used in industry, science and medicine.

## COMMENTARY

bang звук взрыва  
well below значительно ниже

move out of the way раздвигаются  
sonic bang звуковой удар (взрыв)

## LESSON 23

### Grammar:

attributes in postposition;  
review of the conditional sentences  
and the subjunctive mood

### Drills in fluent reading:

under conditions of speed, high standards of quality, the control of the manufacturing process, tens of millions of products, upon this great army of robots, the performance of our radio, to control the flight of airplanes, the whole range of products, complicated net-

works of instruments, from the process of combustion, the rotating shafts of machinery, the processing and synthesis of materials, the manipulation of machinery.

## TEXT

### AUTOMATIC CONTROL

Many articles in current use must be processed under conditions of speed, temperature, pressure and chemical exchange which make human control impossible, or at least impracticable on an extensive scale. Moreover, modern machines and instruments themselves must often satisfy extremely high standards of quality and beyond certain limits the discrimination and control of qualitative differences elude human capacity. The automatic control of both the manufacturing process and the quality of the product manufactured is therefore frequently indispensable.

### Control systems

Feedback control systems have become our servants in many more ways than most of us realize. We now have tens of millions of them at work—in industry, in offices and in homes. We are increasingly dependent upon this great army of robots. They contribute to our comfort, protect our health and safety, relieve us of hard and uninteresting work and operate difficult and dangerous enterprises which we would not dare to undertake without them.

Everyone knows about the thermostat, which keeps radiators hot and refrigerators cold. Most of the other controls are less familiar. A governor at the power station makes our clock keep correct time. Electrical and electronic governors are known to stabilize the performance of our radio and TV sets. Robots control the flights of airplanes. Process controllers supervise the manufacture of plastics, synthetic fibers, the whole range of products of the chemical industry. Complicated networks of instruments run our petroleum refineries. Our communication system is one vast feedback circuit. Throughout industry the conversion of energy, from the process of combustion to the rotating of the shafts of heavy machinery is conducted under automatic control. In sum, if the controls already operating in our economy were suddenly shut off, there would be chaos. The robots are here.

And this is only the beginning. One's imagination need not be restricted to industrial possibilities. We can look forward to feedback controls in many other fields.

A **robot** simulates the functions of a human being, and to understand how it works this is where we must start. Modern industry began with manual and semi-automatic controls. A human operator read the instruments and applied corrections to a process.

The essence of control is: measure, compare, correct and check the result.

As the tempo and complexity of technology rose, human operators began to fall behind: they could not keep up with the demands of the machine. It became necessary to give the instruments, which had merely measured and indicated, the function of control as well.

This liberation of technology from the limitations of the human system has already had great practical consequences.

Servo-mechanisms, regulators and process controllers play increasingly important roles. Simple controllers, which measure and control but one variable (for example, temperature), are giving way to complex controllers which control many variables, compute and govern the total plant performance. Combinations of automatic controllers and their respective processes function more and more as systems in the broadest sense — in energy conversion, transportation, communication, mechanized computation, the processing and synthesis of materials and the manipulation of machinery.

### COMMENTARY

on an extensive scale в широких масштабах

exceed human capacity выходят за пределы человеческих возможностей

we are increasingly dependent upon мы все больше зависим от

to keep correct time показывать правильное время

run our petroleum refineries управлять работой нефтеперерабатывающих заводов

to fall behind отставать от

keep up with the machine поспевать за машиной

are giving way to уступают дорогу, заменяются

### EXERCISES

I. Find in the text nouns corresponding to the following words; translate them into Russian:

to process, to produce, safe, comfortable, to radiate, to refrigerate, to perform, to control, to manufacture, to refine, to convert, to correct, to demand, to liberate, to limit, to regulate, to combine, to transport, to communicate, to compute, to synthesize, to manipulate.

II. Find in the text verbs corresponding to the following words; translate them into Russian:

contribution, protection, operation, stabilization, controller, conductor, measurement, comparison, correction, check, computer.

III. Find in the text adjectives corresponding to the following words; translate them into Russian:

quality, dependence, danger, importance, to vary, complexity.

IV. Find in the text synonyms for the following words; translate them into Russian:

often, necessary, understand, power plant, work, production, complex, device, extensive, transformation, lag, requirement, also, wide.

V. Find in the text antonyms to the following words; translate them into Russian:

practicable, low, seldom, easy, safe, more, simple, narrow.

VI. Find in the text English equivalents to the following words and word combinations:

в условиях, по крайней мере, неосуществимый, производственный процесс, ясно понимать, учреждение, способствовать, знакомый, электростанция, работа радиоприемника, ограничивать, имитировать, сущность, соответствующий.

VII. Translate the following into English, using the words of the text:

Современные условия работы в промышленности часто делают невозможным ручное управление производственными процессами. Большая скорость, высокие температуры и давления и т. п. требуют автоматического регулирования. Автоматическое регулирование может осуществляться как простыми механизмами (например, термостатами), так и сложными (электронными вычислительными машинами). Простые управляющие устройства управляют лишь одной переменной, а сложные — многими переменными. Фактически такие устройства могут управлять целыми цехами и заводами.

VIII. Translate the following sentences into Russian paying attention to the words in bold type:

1. Electricity has come into general use so recently that you might think—it was discovered **but** a few years ago. 2. Hydrogen and oxygen are **but** two of the elements which scientists have discovered. 3. Automatic controls are primarily not an economic measure **but** a necessity. 4. The use of computers to control complex machines and processes is coming into its own **but** promises to become an increasingly active field. 5. In former centuries man's progress in science was not rapid as at present, **but** slow. 6. **But for** the air, no life on earth could have developed. 7. The weak radiation signals can be amplified **only** by electronic means. 8. Since  $U^{235}$  is **the only** fissionable material which is naturally available, it forms the basis for all nuclear reactor fuel. 9. The larger molecules are more difficult to dissolve than the smaller ones. 10. **One** familiar man-made polymer is the plastic called polyethylene. 11. The first Earth satellite to be successfully launched was a Russian **one**. 12. **One** can see an increased use of computers, at present. 13. It has been known for many years that **as** we go deeper and deeper into the earth the temperature rises. 14. **As** water is so plentiful some people think of it **as** being of little interest or value. 15. **As** with Mars the only molecule which can be observed in the atmosphere of Venus by spectroscopic methods is  $CO_2$ . 16. Neutral or acid materials **such as** silica, glass and most organic substances tend to acquire negative charges in neutral water. 17. Some substances ionize completely **as soon as** they are dissolved in natural water. 18. A characteristic feature of progress in power engineering is to develop, **as far as** possible, the generation of electric power directly from the fuel. 19. The device under consideration can be **as precise as** we wish it. 20. **As long as** temperature remains constant, there is no danger of

overheating. 21. Continued development is under way to devise better ways of employing present feedback control systems as well as developing new and better systems. 22. As the size of optical telescopes grew, it was hoped that they would bring the farthest limits of the universe within range. 23. The efficiencies of the magneto-hydrodynamic converters have been predicted as approaching 60% as compared to 40% for conventional modern power plants. 24. Practical applications of thermoelectric energy conversion principle follow two main directions: as generators of electricity and as cooling devices.

**IX. Translate into Russian paying attention to the meaning of the word "run":**

1. That boy can run very quickly. 2. The buses run every five minutes. 3. The machine runs properly. 4. Rivers run into the sea. 5. This engineer runs a big factory. 6. One of our workers was nominated to run for elections in our district. 7. On my way home I ran across a friend of mine. 8. A man was run over by a passing car. 9. Water falling as snow in the mountains may remain for months before it melts and runs off. 10. The engine can run on almost everything — even motor oil. 11. The fuel cell is economical, lightweight, and best of all, it never runs down. 12. The new power source is used to run different machines. 13. Every technician may run into situations where human control is impossible. 14. For maximum power, a turbojet must run hot.

**X. Underline the subordinate clauses, state of what kind they are and translate the sentences into Russian:**

1. If the earth had no atmosphere, its heated surface would quickly radiate back into space all the energy which reaches it from the sun. 2. If the earth were a true sphere, life would be a great deal simpler, especially for mapmakers, geographers, navigators, geophysicists, oil prospectors and many other specialists. 3. We are now trying to find methods of controlling the fusion process, so that we may use it to give us heat and electricity. 4. Present satellites carry up to six times more solar cells than they would require if the cells were constantly exposed to the sun. 5. With a lot of passengers aboard an airliner, plenty of electronic equipment, and a heat load generated by friction of the air on aircraft's skin, the temperature inside the cabin would mount to more than 100° unless it were mechanically cooled. 6. The amount of water evaporated each year from the oceans would be sufficient, if it were carried to the continents and uniformly distributed to cover all the land with more than 100 inches of rain and snow. 7. Metals and their alloys may be safely subjected to conditions in which timber would fail. 8. Should this new alloy be tested, we could use it in the structure. 9. The engineer proposed that computer should be used to control the production process. 10. If automatic control had been used, many variable parameters could have been measured and controlled.

**XI. Translate the following sentences with attributes in postposition into Russian:**

1. With modern high-speed computers it is possible to trace a rocket by radar, feed the data of its actual course into a computer which compares it with the planned course, defines the deviations and works out the correction necessary. 2. It was shown that mechanical energy could be converted into heat and that the amount of heat developed was always exactly proportional to the amount of work done. 3. The computer circuit properly operates satisfactorily at frequencies up to approximately 35 kc. 4. Much of the work needed is done by one of our laboratories using the computer described and the automatic high-speed device shown. 5. The synthetic material under examination is both better and cheaper than the material it is to replace. 6. The design given below is described in some detail since much of it is immediately applicable to magnetic amplifiers proper. 7. The recorder wrote the voltage of the microphone under test with a 50 decibel potentiometer. 8. The principle study, if widely adopted, could greatly prolong the life of the world's oil reserves. 9. Conventional engines pump too much fuel into the cylinder for the amount of oxygen present. 10. A problem under attack is the development of new materials which will better resist the loading conditions. 11. The system under investigation right now is a very complicated one. 12. Computers sort the data received. 13. All the data available are fed into the computer in order to be processed.

**XII. Find predicates in the following sentences and translate the sentences into Russian:**

1. A computer processes the information supplied. 2. Designers work the specifications so that they may be understood by everybody. 3. Thermoelectronic emission forms the basis for the operation of all electronic tubes. 4. Two metals alloy, if they melt together to form a homogeneous liquid. 5. The building of the factory houses a new computer.

**XIII. Retell the text according to the plan:**

1. The automatic control of both the manufacturing process and the quality of the product is frequently indispensable. 2. Feedback control systems are used in many fields. 3. There are different kinds of control and they perform different functions. 4. Robots liberate technology from the limitations of the human system.

**XIV. Answer the following questions:**

1. Why is automatic control frequently indispensable? 2. Are we dependent on feedback control systems? 3. What functions do feedback control systems fulfil? 4. What automatic controllers do you know and what processes do they perform? 5. What is the essence of control? 6. Why did it become necessary to give the instruments, which merely measured and indicated, the function of control? 7. What is the difference between simple and complex controllers?

## AUTOMATION TODAY AND TOMORROW

"Within the 20-year period the comprehensive automation of production will be effected on a large scale, with more and more shops and plants being fully automated. The introduction of highly efficient automatic control systems will be accelerated. Cybernetics, computers, and control systems must be introduced on a large scale in industry, research, designing, planning, accounting, statistics and management".

Specialists in cybernetics are working on the development of self-learning machines capable of solving problems set by man.

These self-learning cybernetic systems can collect various data, analyze them and perform certain operations as a result of the analysis. What is more, they are able to produce qualitatively new information. For example, a cybernetic machine for chemists will not only give information on any specific problem but will indicate the way to develop some new substance, say, a new plastic that would be cheap and durable.

A good number of these machines are already working in our industry, such as a cybernetic system for the iron and steel industry, an electronic system for geological prospecting, a cybernetic designer which designs gas pipelines and automatizes the passing of gas along these pipes.

Automation in our country has reached the stage of developing fully automatized industries. Electronic computing techniques find wide application in and serve as a basis for the development of modern programme-controlled machine tools, the controlling of spaceship flights, weather forecasts and planning work.

### COMMENTARY

what is more более того  
a good number большое количество  
geological prospecting геологические  
изыскания

programme-controlled machine tools  
станки с программирующим устрой-  
ством  
weather forecast прогноз погоды  
planning work планирование

## LESSON 24

### Grammar:

#### Absolute Phrases

#### Drills in fluent reading:

an example of the principle of automatic control, with the problem of driving a car, the general abilities of human beings, a vast extension of the control art, from the use of simple control mecha-

nisms, with just as much cleverness, the physical analogy to the type of problem, in terms of the value of some physical quantity, the degree of angular rotation of a shaft.

## TEXT

### INFORMATION MACHINES

If the thermostat is a prime elementary example of the principle of automatic control, the computer is its most complicated expression. The thermostat and other simple control mechanisms, such as the automatic pilot and engine-governor, are specialized devices limited to a single function. An automatic pilot can control an airplane but would be helpless if faced with the problem of driving a car. Obviously, for fully automatic control we must have mechanisms that simulate the general abilities of a human being, who can drive a car or fly a plane, set a rheostat to control a voltage, operate an engine, and do many other things besides. The modern computer is the first machine to approach such general abilities.

When applied to automatic control, these machines will permit a vast extension of the control art — an extension from the use of rather simple specialized control mechanisms, which merely assist a human operator in doing a complicated task, to over-all controllers which will supervise a whole job. They will be able to do so more rapidly, more reliably and with just as much cleverness and skill as the human operator.

There are two different kinds of "information machine" in current use: the analogue computer and the digital computer.

The analogue machine is just what its name implies: a physical analogy to the type of problem its designer wishes it to solve. Information is supplied to the machine in terms of the value of some physical quantity — an electrical voltage or current, the degree of angular rotation of a shaft or the amount of compression of a spring. The machine transforms this physical quantity in accordance with the rules of its construction and the resulting physical quantity is the answer desired.

In contrast to the analogue machine, a digital machine works by counting. Data on the problem must be supplied in the form of numbers; the machine processes this information in accordance with the rules of arithmetic or other formal logic, and expresses the final result in numerical form.

In comparing digital and analogue machines as instruments for automatic control, we can see that both analogue and digital machines can be used for automatic control, and each has advantages in its own sphere. For simple operations in which no great precision is required, an analogue computer will usually be preferable. For complex problems, or problems in which high precision is required, a digital controller will be superior.

All this refers to the present state of the art of automatic control.



Man's machines are beginning to operate at levels of speed, temperature, atomic radiation and complexity that make automatic control imperative. As an instrument of over-all automatic control the digital information machine has a great but as yet untouched potential.

## COMMENTARY

over-all controller универсальный регулятор  
 supervise a whole job управлять производственным процессом в целом  
 cleverness and skill умение и ловкость

there are ... in current use в настоящее время используются  
 in terms of выраженная через  
 in contrast to в противоположность

## EXERCISES

### I. Translate into Russian the following words of the same stem:

automation — automatic; to express — expression; to control — control — controller; to limit — limit — limitation — limited — unlimited; to help — help — helpful — helpless; to drive — drive — driver; ability — able — unable; to assist — assistance — assistant; to transform — transformation — transformer; to construct — construction — constructor; to desire — desire — desirable; to compare — comparison — comparative; precision — precise; complex — complexity; to rely — reliable — reliability.

### II. Memorize the following groups of synonyms:

fully, completely, entirely; to do, to perform; modern, up-to-date; to apply, to use, to employ, to utilize; to permit, to allow, to let; to assist, to help, to aid; rapidly, quickly, fast, swiftly; to transform, to convert, to change; quantity, value, amount, magnitude; to desire, to wish, to want; to provide, to supply, to furnish; device, instrument, apparatus; sphere, field, branch; usually, commonly, generally, ordinarily; speed, velocity, rate; to require, to demand; since, as, because, for.

### III. Memorize the following antonyms:

complicated, simple; limited, unlimited; rapidly, slowly; advantage, disadvantage; complexity, simplicity; superior, inferior.

### IV. Find in the text the English equivalents for the following words and word-combinations:

автоматическое управление, водить машину, управлять самолетом, при сравнении, в соответствии с, высокая точность, нетронутый, предпочтительный.

### V. Translate into English the following sentences using the words of the text:

В настоящее время машины работают на таких уровнях скорости, температуры, атомной радиации и сложности, которые де-

лают необходимым автоматическое регулирование. В системе автоматического регулирования используются как аналоговые, так и цифровые вычислительные машины. Каждая из этих машин имеет свои преимущества и недостатки. Для простых операций, где не требуется большая точность, обычно предпочитают аналоговые машины. Для сложных задач или задач, в решении которых требуется большая точность, используются цифровые машины.

VI. Translate the following sentences into Russian paying attention to the meaning of the words in bold type:

1. When we observe the Sun visually it appears as a disk. However, the Sun **does** not terminate sharply — its density falls off gradually outwards. 2. Conversion of fertile  $U^{238}$  \* into fissionable plutonium gives a second man-made fuel source. So, too, **does** the conversion of thorium into  $U^{233}$ . 3. The engine works even on motor oil because the fuel **doesn't** have to vaporize as it **does** in conventional engines. 4. Every technician, whether he **does** some kind of servicing or any other kind of work, often faces such situations where he should be able to make measurements at various points in electronic equipment. 5. Rockets are useful in studying cosmic rays but they **do not do** all that scientists wish: artificial satellites **do** this. 6. Seldom **does** one find the role of the technician in industry overpraised. 7. Ultraviolet rays are largely blocked by layers in the Earth's upper air. This is lucky for us, **since** these rays are dangerous. 8. **Since** 1957 many satellites have been launched to study the space. 9. **Just** above and below the visible light range are ultraviolet and infrared light. 10. A new controller has **just** been brought to our plant. That is **just** what we needed for the manufacturing process. 11. The use of computers to control complex machines and processes is **just** coming into its own but promises to become an increasingly active field within the next years. 12. At the beginning it took Sputnik I **just** over 96 minutes to complete a round trip. 13. The engine under test can be controlled **just as** any other engine, and is one of the simplest heat engines. 14. Most of the problems solved have been of a **rather** elementary nature. 15. We must develop technology which will enable us to utilize a large proportion of the total heat potential of nuclear fuels **rather than** a very small part that is possible to utilize with most reactors today. 16. First in importance among the scientific achievements of the Renaissance was the idea that the sun, **rather than** the earth, is the centre of our system of sun, moon, and planets. 17. Were it not for convection, the problem of warming a room would be **rather** difficult, since the air itself is a poor conductor of heat. 18. The wind is a **rather** powerful source of power and if we utilized it fully, it could give **rather** large amounts of energy. 19. In our work we stress quality **rather than** quantity. 20. Why is ultrasonic energy used **rather than** sound energy? To anyone unfamiliar with ultrasonic principles it may seem **rather** strange.

\* Сырье для получения вторичного ядерного топлива.

**VII. Translate the following sentences with absolute phrases into Russian:**

1. Geologic evidence shows there has been little, if any, change in the rate of radiation received from the sun, so it is evident that the sun's power is not derived simply from combustion. 2. The ability of the magnetic tape recorder to capture sound, store it on a thin piece of magnetic tape and play it back again when desired and as often as desired, is the key to a practically infinite variety of application. 3. Without the gyroscope, modern guided missiles would not exist in their present form if at all. 4. Unless perfected, the device will not meet the common requirements. 5. When striking a TV antenna and flowing into the set, the signal must be reconstructed before it becomes a picture on the screen. 6. When struck by light, the metal coating of the CRT emits electrons. 7. In theory a solar battery can work indefinitely while in sunlight. 8. When passed through a prism, light forms a spectrum on the screen. 9. If exposed to ultraviolet radiation, certain materials give off visible light, such substance being called "fluorescent". 10. Unless otherwise stated, boiling points when given refer to the temperature at which the liquid boils under one atmosphere of pressure.

**VIII. Analyze and translate into Russian the following sentences:**

A. 1. The first problem we considered was, how high a temperature can be reached through chemical reactions? 2. We are only beginning to learn the uses we can make of ultrasonics. 3. One of the principal disadvantages the fire services operate under is the delay frequently occurring between the start of fire and the warning being given. 4. Automatic control a lot of manufacturing processes are dependent upon is being widely used in industry. 5. The conditions of speed, temperature and pressure man's machines are operating under at present make automatic control imperative.

B. 1. A direct energy converter powers a radio transmitter that automatically sends out temperature readings every six hours. 2. They man teams for research work in the Far North, 3. The problem of increased use of computers in automatic control faces our engineers and scientists. 4. Operators fuel reactors with uranium, plutonium and thorium. 5. In describing these devices we highlight only one rather narrow application of automatic control. 6. At our laboratory specialists range from electronics, mechanics, chemistry, mathematics, computer service and programming to vacuum tube experts.

**IX. Write questions to which the words in bold type in the following sentences are answers:**

1. When applied to automatic control, computers will permit a **vast extension of the control art**. 2. Computers can operate **rapidly, reliably and precisely**. 3. There are **two kinds of computers** in current use: the analogue computer and the digital computer. 4. Automatic control is widely used in **industry, transportation, communication and many other fields**.

**X. Answer the following questions:**

1. What example of simple control mechanisms does the text give? 2. Is the modern computer a simple or a complex mechanism? 3. What is the difference between simple control mechanisms and complex ones? 4. How many kinds of "information machine" are there? 5. What is the analogue (digital) computer? 6. Where are analogue (digital) machines used? 7. What makes automatic control imperative?

**Supplementary Text. Read and retell:**

**MORE ON ANALOGUE AND DIGITAL COMPUTERS**

Let us discuss in some detail the characteristics of analogue and digital computers. For simple control applications the analogue machine is almost always less complex than a digital machine would be. Even the most elementary digital machine requires an arithmetical (or logical) unit, a storage unit, a control unit, etc. For simple problems this great quantity of equipment is too complex. In contrast, an analogue machine need be no more complicated than the problem demands. A slide rule, for example, is a perfectly respectable "information machine" of analogue type. The analogue machine's ability to do simple work by simple means explains its current predominance in the field of automatic control.

As the control task becomes more complex, however, the analogue machine loses its advantage, and we begin to see a second fundamental difference between the two types of machine. The analogue machine is a physical analogy to the problem, and therefore the more complicated the problem, the more complicated the machine must be.

The digital machine, on the other hand, is entirely free of the limit to the complexity of the problem or process.

The third important difference is in their accuracy potential. The digital machine which deals only with numbers can be as precise as we wish to make it.

**COMMENTARY**

**in some detail** несколько подробнее  
**arithmetical unit** арифметическое устройство  
**logical unit** логическое устройство, логический элемент

**storage unit** запоминающее устройство,\* блок памяти  
**control unit** блок управления  
**slide rule** логарифмическая (счетная) линейка

**LESSON 25**

**Grammar:**

**Emphatical Inversion**

**Drills in fluent reading:**

electron chemistry, fundamental structure, existing products, high-energy electrons, charged particles, electronic equipment, elec-

tron volts, profound changes, wandering ions, new properties, giant molecules, food preservation;

the conventional accessories of chemistry, the profound changes of matter, the binding power of electrons, the positive charges of electricity, the new properties of the molecules, the major fields of science, the chemical durability of substances, the new group of polymers.

## TEXT

### ELECTRON CHEMISTRY

**High-Energy Electrons.**— Scientists define electron chemistry as the use of accelerated high-energy electrons to alter or change the fundamental structure of matter when creating new or improving existing products.

This new science uses none of the conventional accessories of chemistry. Absent are acids, bases, salts, and catalysts, nor are retorts employed. The electron is the "reagent".

These high-energy electrons are known to be the same tiny, negatively charged particles making possible all types of electronic equipment. But here they seem to have "muscle". Traveling at nearly the speed of light, they possess energies in the millions of electron volts.

In trying to understand why high-energy electrons can produce profound changes within a substance, consider, for example, how "weak" the electrons are that bind or hold together atoms and molecules — some ten electron volts, a very small energy indeed compared to that of ten million electron volt "muscle-men" of an electron accelerator.

No wonder these penetrating high-energy electrons can shake up the relatively weak binding power of electrons in molecules. Naturally, something has to take place when a powerful electron force meets a small one. In this case, the big fellow wins, with ionization or dissociation of the molecule resulting.

**Polymerization.**— What happens is that the molecule takes on some of the energy of the powerful bombarding electron and gets so disturbed that it throws off a planetary electron, the electron-deficient molecule now becoming an ion carrying a positive charge of electricity.

These wandering ions and other fragments of the irradiated substance enter into reaction with molecules that were not affected by the electron radiation. The fragments speedily recombine to form new molecules with new properties.

Polymers, if one happened to forget some of the high-school chemistry, are giant molecules composed of thousands of so-called monomer units, the starting substance. The radiation chemist uses high-energy electrons to "cut off parts" of molecules, these "parts" then speedily reassembling for a new molecule to be formed.

Making giant molecules out of little ones is called polymerization. High-energy electrons can polymerize small monomers, such as ethylene gas, into giant polymers — polyethylené in this instance — without making use of any chemical assistance. And there are many polymers (such as rubbers, plastics, glue, and so on), oil and coal resins being the usual raw materials.

We have only touched upon the surface of electron chemistry. Staggering the imagination are the many possibilities of electron chemistry in food preservation, polymerization, plastics and many others. And with hundreds of materials being subjected to the magic of the electron beam, we believe more and better products to result ultimately from this most exciting science.

## COMMENTARY

here they seem to have "muscle" здесь они как бы «обрастают мускулами»

energies in the millions of electron volts энергии порядка миллионов электрон-вольт

compared to по сравнению с ten million electron volt "muscle-men" «богатые» мощностью в десятки миллионов электрон-вольт

no wonder неудивительно shake up (зд.) ослабить

take place происходить, иметь место the big fellow wins сильнееший побеждает

with ionization ... resulting и в результате происходит ионизация takes on some of the energy поглощает часть энергии

throw off выбрасывать

electron-deficient molecule молекула, лишенная одного электрона

wandering ions блуждающие ионы

speedily recombine to form new molecules быстро соединяются вновь и образуют новые молекулы

if one happened to forget some of the high-school chemistry если оказалось, что вы отчасти забыли школьную химию

starting substance исходное вещество these "parts" speedily reassembling for a new molecule to be formed

эти части быстро соединяются вновь и образуют новые молекулы without making use of any chemical assistance совершенно не пользуясь химией

we have only touched upon the surface of electron chemistry мы лишь поверхностно коснулись электронной химии

— stagger the imagination поражать воображение

most exciting science захватывающая интересная наука

## EXERCISES

I. Translate into English the following groups of words of the same stem:

определить, определение, определенный, неопределенный; ускорять, ускоритель; создавать, создатель, созидание, созидательный; заряжать, заряд, разряд; оборудовать, оборудование; связывать, связь; сравнивать, сравнение, сравнительный, сравнительно; относиться, отношение, относительный, относительно; недостающий, недостаток чего-либо; улучшать, улучшение.

II. Translate into English the following words and write synonyms for them:

определять, ускорять, вещество, применять, крошечный, глубокий, почти, связывать, действительно, происходить, состоять из, обычный, называться.

III. Translate into English the following words and write antonyms to them:

обычный, отсутствовать, отрицательный, заряжать, маленький,

**IV. Find in the text English equivalents for the following words and expressions:**

ни одна из обычных принадлежностей химии, реторты также не применяются, вступать в реакцию, вновь соединяться, такой же, и так далее.

**V. Translate the following sentences into English using the words of the text:**

1. Электрохимия использует ускоренные электроны высокой энергии для изменения строения вещества. 2. При помощи электрохимии мы создаем новые или улучшаем существующие продукты. 3. Электрохимия не пользуется обычными принадлежностями химии, такими, как кислоты, основания, катализаторы и так далее. 4. Электроны с высокой энергией обладают такой силой, что вызывают ионизацию или диссоциацию молекул. 5. Химия полимеров создает вещества, которые никогда не существовали на земле. 6. Полимеры — это легкие, прочные вещества, которые применяются во всех областях промышленности. 7. При полимеризации одинаковые молекулы соединяются в цепи и образуют новые гигантские молекулы с новыми свойствами. 8. Полимеризация — это образование гигантских молекул — полимеров из маленьких — мономеров. 9. Обычным сырьем для производства полимеров являются нефть и угольные смолы. 10. Роль электрохимии в сохранении продуктов, полимеризации, производстве пластмасс и т. д. огромна.

**VI. Translate into Russian paying attention to the meaning of the word "any" and its derivatives:**

1. How hot the atmosphere becomes over any particular region depends on a number of factors. 2. Heat-to-electricity energy converters behave like any heat machine in that the higher the temperature difference within which the converter is operating, the higher will be its conversion efficiency. 3. Much of the electrical power generated never does any useful work today. 4. Telemetry can instantly notify if anything goes wrong in spite of the operation taking place many miles from the central station. 5. To anyone unfamiliar with electron chemistry, it may seem rather strange that high-energy electrons can produce such profound changes within a substance. 6. If we want a rocket to travel any great distance, we have to use a large amount of fuel. 7. The scientist did not make use of any chemical assistance when producing the new polymer. 8. Does anything have to take place when a powerful electron force meets a weak one? 9. Of great concern to anyone using any nuclear device is the effect of radiation on the human body.

**VII. Translate the following sentences into Russian paying attention to the meaning of the verbs with fixed prepositions and prepositional adverbs:**

1. The stability of the atom is **accounted for** by the strength of the electric attraction within the atom. 2. Negative electric charges are **accounted for** by electrons. 3. The proton is so heavy that it **makes up** nearly the whole weight of the atom to which it belongs.

4. Different combinations of atoms form millions of different molecules, out of which are built the millions of substances which **make up** the matter of the universe. 5. It is the principle of heating a piece of material to **bring about** emission that is employed in filaments and cathodes of thermionic vacuum tubes. 6. Many years of research **brought about** the first improvement over the carbon lamp. 7. The tremendous achievements of Soviet science have **resulted in** a triumph for our country, a manned space flight. 8. Heat **results from** chemical changes. 9. Light is a form of energy, and it must therefore **result from** the transformation of some other source of energy. 10. Modern physics has succeeded in transforming a number of chemical elements into other elements; in certain cases the process **results in** a release of atomic energy.

**VIII. Find in the text all the sentences with verbals, analyze them and translate into Russian.**

**IX. Analyze the following sentences and translate them into Russian:**

1. Creating new giant molecules — polymers out of little ones — monomers can be accomplished without making use of any chemical assistance. 2. Polymers being substances possessing very important properties, such as lightness, strength, etc., technical progress is impossible without them. 3. Polymers possessing such important properties as the ability to absorb vibrations and reflect, stop or let through light, sound or radio waves makes them essential for engineers. 4. Polymers are known to lend themselves to machining much better than wood, stone or metals. 5. The method to be used in the production of polymers possessing magnetic properties is based on the ability of X-rays to destroy the bonds between the atoms of a polymer. 6. Determining the composition of all bodies and learning about the changes which they undergo, as well as planning and controlling these changes and creating new compounds to give mankind a better and fuller tomorrow, is the business of modern chemistry. 7. The most promising system being studied will be described in some detail, followed by a discussion of its various possible uses. 8. We have seen the splitting, or fission, of certain heavy atoms such as  $U^{235}$  give a large amount of heat.

**X. Translate the following sentences with the predicates in the Passive Voice into Russian:**

1. New alloys which will stand higher temperatures are being developed. 2. When matter and anti-matter meet, tremendous energy is released. 3. Telemetry instantly notifies the control station if anything is wrong so that corrective measures can be taken. 4. In 1929 a system of colour television using special photoelectric cells and colour filters was described. 5. In the article under consideration every technique for generating electrical power is being investigated. 6. A new liquid zinc anti-corrosive composition for use on iron and steel and other metal surfaces has been developed. 7. Insulating materials should be non-corrosive to metals when wet or dry, and



should be unaffected by moisture. 8. Experience indicates that direct energy converters should be given special attention. 9. Different kinds of automatic controllers were dealt with in some detail in the article. 10. The new fully automated plant was much spoken about. 11. The rapidly growing application of automatic control in industry is often referred to.

**XI. Write questions to which the words in bold type in the following sentences are the answers:**

1. **No**, the new science does not use the conventional accessories of chemistry. 2. **Yes**, the high-energy electrons possess energies in the millions of electron volts. 3. Electron chemistry can be used in **food preservation, polymerization, plastics, etc.**

**XII. Translate into Russian the following sentences with emphatic inversion:**

1. Revolving around the nucleus at tremendous speeds are one or more electrons, at distances which are relatively enormous. 2. Found in the crust of the earth are many crystal materials of different form, some of them being very beautiful. 3. Acting between the molecules of matter is a force of attraction, which is much less in liquids than in solids and much less in gases than in liquids. 4. Primary cosmic rays are mainly protons having energies above a billion electron volts. Mixed with the protons are smaller amounts of high-energy nuclei of other elements. 5. A solid piece of material consists of an inconceivably large number of atoms clinging together. Also present in solids are numbers of free electrons so called because they are not permanently attracted to any of the atoms.

**XIII. Answer the following questions:**

1. How do scientists define electron chemistry? 2. What is the "reagent" in electron chemistry? 3. What energies do high-energy electrons possess? 4. Why can high-energy electrons produce profound changes within a substance? 5. What are polymers? 6. What are the usual raw materials in the production of polymers? 7. Where is electron chemistry used?

**Supplementary Text. Read and retell:**

### POLYMERS

Among the major fields of science and technology which are to receive special attention in the coming years, the Programme of the Communist Party names chemistry, special attention being paid to the chemistry of polymers and synthetic fibres.

The attraction of this field is that substances which never existed on earth, but without which technical progress is impossible, are created. Natural substances cannot be like polymers in lightness, strength, chemical durability, ability to absorb vibrations and reflect, stop or let through sound or radio waves or nuclear radiation. Polymers can be either porous or monolithic, transparent or opaque.

They have long been used as excellent electrical insulators. Now we have produced semiconductor polymers. Add to this the fact that polymers lend themselves to machining much better than wood, stone or metal, and you will understand why so much attention is being given to these man-made materials.

Some scientists are working to alter the properties of polymers obtained from oil and coal resins, the usual raw materials. The quality of a polymer depends not only on the components of its giant molecule, but on its structure as well. Another important factor affecting the properties, appearance and quality of a substance is the arrangement of the molecules. Just as the same kind of building materials can be used to build either a skyscraper or a cottage, the same molecules can be used to create substances with the most varied properties. In order to produce a material with planned properties the molecules of the required polymer must be placed in a certain order.

Still another important factor is the nature of the elementary links which make up a polymer molecule. A method of producing an entirely new group of polymers possessing interesting magnetic properties has been discovered. It is based on the ability of X-rays and nuclear radiation to destroy the bonds between the atoms of a polymer. This method can be used to produce an endless number of "hybrids" with planned properties.

## COMMENTARY

In the coming years в ближайшие годы  
to pay attention to обращать внима-  
ние на  
the attraction of this field эта область  
привлекает тем, что  
in lightness по легкости  
let through пропускать  
either ... or или ... или

the fact that то, что  
lend themselves to machining подда-  
ются механической обработке  
man-made искусственный  
as well также  
the same kind of одни и те же  
in order to для того чтобы  
planned properties заранее обуслов-  
ленные свойства

## LESSON 26

### Grammar:

#### Analysis of Sentences

#### Drills in fluent reading:

the translator was developed, a Russian word is fed in, the light beam searches the words, the beam reads this word, which compare the incoming words, a word analyzer checks each sentence, they will be able to handle all of the translation needs, the machine will be used to translate, the actual electronic machinery, a relatively simple principle, important Russian publications, one full-length book an hour, the proper keys on a typewriter, the necessary grammatical corrections, the new transistorized versions:

## RUSSIAN-ENGLISH TRANSLATING MACHINE

Today thousands of large-scale along with tens of thousands of small-scale and special-purpose computers are known to perform tasks once handled by humans as well as many more tasks too complex for humans to perform.

Not only do these machines control operations that replace men on physical jobs, but their ability to make decisions has enabled them to replace men in widely different areas. One of the many different functions a computer can fulfil is the translation of all important Russian publications into English.

The new computer developed by IBM (International Business Machine) is expected to translate all important Russian publications into English.

Take an article from a Russian scientific paper, feed it into the electronic translator, and out comes an English version. This new machine undertakes the gigantic task of translating the tons of scientific material which flows out of the Soviet Union every year. Not so long ago a quantity of some 80 million words, a small fraction of the Soviet output, was being translated in the U.S.A. Because of the time and expense involved the rest — no matter how important — went untranslated.

In the following years it became clear that the U.S.A. would never be able to translate the vast amount of Russian technical literature into English by conventional methods. It was then that the idea of developing a translating machine was born.

The translator was developed and built by IBM. It works on a relatively simple principle, though the actual electronic machinery needed to do the job is rather complex. In effect, the machine is an electronic computer with a dictionary of about 500,000 words, including actually every existing word in both English and Russian, built into its "memory". The dictionary itself is a glass disc on which the words are written in "binary" form.

When a Russian word is fed in, the computer translates it into its "binary" language — a series of light and dark spots in a certain order. Then a light beam searches through the words recorded on the disc until it finds a word in binary form that is identical to the one just fed in. Recorded immediately after the word is its English equivalent, also in binary form. The beam "reads" this word, then signals the proper keys on an electric typewriter, and the word is typed out in English. The translating circuits which compare the incoming words with those on the machine's dictionary are capable of operating at some 1,800 words a minute, a speed equivalent to about one full-length book an hour.

Because of the wide difference between Russian and English grammar and sentence structure, the English translation was far from a literary masterpiece in the first version of the machine. In fact, it might horrify an English professor. For example, the Russian

title of a "Pravda" article used to test the machine was "New Secrets of the Universe to be Revealed". It came out of the translator, "Will Open New Secret Universe". A word analyzer added to the translator checks each sentence coming out of the machine and makes any necessary grammatical corrections before sending the translation to the printer, so the machine no longer talks like an illiterate.

New transistorized versions are now being built and the new units based on the experience gained during the construction of the first model are faster, ultrareliable, and much more compact.

The translators are tremendously useful to scientists and engineers interested in the great quantity of information contained in Russian publications.

Although the machines were used first to translate Russian technical and scientific matter needed by scientists and engineers, they will find many other uses as well in economy, psychology, medicine, geology, etc.

### COMMENTARY

**feed in (to)** вводить (в машину)  
**undertakes a gigantic task** выполняет колоссальную работу  
**which flows out** который исходит из  
**because of the time and expense involved** из-за связанных с этим затрат времени и материальных расходов  
**the rest** остальное, остальная информация

**no matter how important** независимо от (ее) важности  
**in effect** фактически, в действительности  
**incoming words** входящие слова  
**in fact** в сущности, фактически  
**transistorized** транзисторный, собранный на транзисторах  
**ultrareliable** сверхнадежный  
**technical and scientific matter** техническая и научная информация

### EXERCISES

**I. Find in the text nouns corresponding to the following words; translate them into Russian:**

to compute, to translate, to expend, to type, to differ, to analyze, to correct, to print, to construct.

**II. Find in the text verbs corresponding to the following words; translate them into Russian:**

horrible, translation, a search, a record, operation, comparison, addition, development.

**III. Find in the text adjectives corresponding to the following words; translate them into Russian:**

ability, electron, necessity, grammar, illiteracy, use, importance, technique.

**IV. Find in the text synonyms for the following words and expressions; translate them into Russian:**

though, a number of, at once, on account of, for instance, some, velocity, amount, in fact, also, and so on.

V. Find in the text antonyms to the following words; translate them into Russian:

complex, light, before, literate, useless, unable, unconventional.

VI. Find in the text English equivalents for the following words and expressions:

довольно сложный; в сущности; ряд; из-за того, что это влечет за собой расходы и затраты времени; остальное; независимо от того, как это важно; как ... так и; сначала; также.

VII. Translate into English using the words and word-combinations of the text:

1. Электронная вычислительная машина выполняет работу во много раз быстрее, чем человек. 2. Электронные вычислительные машины складывают, вычитают, умножают и делят очень быстро. 3. Машина-переводчик, в сущности, представляет собой вычислительную машину со словарем в 500000 слов. 4. Машина-переводчик — довольно сложный прибор; но работает эта машина по относительно простому принципу. 5. Машины-переводчики освободят переводчиков от тяжелого труда — перевода обычными методами. 6. Электронные вычислительные машины находят широкое применение в различных областях науки и техники.

VIII. Translate into Russian paying attention to the meaning of the words in bold type:

1. Perhaps the simplest process of the production of electricity **involves** the transformation of chemical energy. 2. To understand the operation of electronic computers we must first understand the principles **involved**. 3. The details of the reactions **involved** depend upon whether the metal is above or below hydrogen in the electronical series. 4. The problem the solution of which scientists are approaching now is rather **involved**. 5. In the modern world there are many important processes **involving** impacts. 6. Momentum is a vector quantity. It possesses not only magnitude but direction, the latter being determined by the direction of the velocity **involved**. 7. The principal difficulty **involved** in an experimental study of impact lies in the measurement of the velocities. 8. An efficient stove or radiator is capable of warming a large room; the process **involved** is called convection. We should remember that the process of convection **involves** several factors. 9. The device under study must be tested under **proper** conditions. 10. Unless **properly** tested, the machine cannot be used in our work. 11. The device **proper** operates under conditions of high speed and temperature.

IX. Translate the following emphatic sentences into Russian:

1. It is the force of attraction which holds the atoms together, just as the attraction between the sun and its planets prevents the latter from wandering off in an independent way among the stars. 2. It is by diminishing the amount of unoccupied space in air that gas volumes are reduced in pressure. 3. It is the electron motion which causes the wave known as radiation. 4. It is the resistance

of the semiconductor diodes that varies in accordance with the voltage you apply to them. 5. Of course it is true that sources of commercial power do exert forces, yet those forces would be useless if their exertion did not result in motion. 6. Ice does change back to liquid water when it is warmed. 7. In chemical solutions, for example, copper sulphate in water, the salt molecules do break up into two parts.

**X. Translate into Russian the following sentences with emphatic inversion.**

1. Built into the computer's "memory" are Russian words and their Russian equivalents. 2. Recorded on a glass disk in binary form are the Russian and English words. 3. Heading the team of scientists working on this subject is one of the well-known professors. 4. Moving about the nucleus are electrons, sufficient in number so that their total negative charge is equal to the positive charge on the nucleus. 5. Closely related to the subject of electronics is the field of automatic control.

**XI. Analyze and translate into Russian the following sentences with the verbals:**

1. With modern photocells it is no longer necessary for an undesirable stranger to cross an invisible beam to be detected. His presence can now be discovered simply from the radiation given off by his body. 2. It is possible to observe the sun's electromagnetic radiation and solar activities unaffected by the earth's magnetic field in the interplanetary space. 3. The goal of the scientists is to "map" outer space and better understand the phenomena and properties of this new frontier. 4. Our present objectives with satellites are to observe sunspots and solar flares which seem to be the cause of many phenomena experienced on earth; weather generation, for example. 5. If subjected now to moisture, now to air, some materials are quickly weakened. 6. To meet the demands for various space flights two ground-station networks have been developed; one for unmanned satellites, and the other for manned space operations. 7. A world-wide communications network providing teletypewriter, voice, and data links between the control centers has been established. Switching and directing is automatic with teletypewriter equipment responding to specific directing codes. 8. To tie the entire space operation together, modern digital computers are used to assemble, store, and operate on the received information. 9. One of the most difficult problems facing scientists is the development of meteorological systems which will work longer in space. 10. The device proper is believed to have been used long ago.

**XII. Answer the following questions:**

1. What is an electronic translator? 2. Why is the development of high-speed translating machines so essential? 3. How large is the vocabulary of Russian words and their English equivalents contained in the computer developed by IBM? 4. What will take place after a Russian word has been fed into the computer? 5. Why was the

English translation far from being a literary masterpiece? 6. Which are the main improvements introduced into the translating machine? 7. What is the device that will prevent the machine from talking like an illiterate? 8. In what fields of human knowledge can the translating machine be used?

Supplementary Text. Read and retell:

### RADIO-ELECTRONICS TODAY

Much of our successes in the field of space research is due to radio and electronics. This is why on May 7, Radio Day, we honour the memory of A. Popov, the great Russian scientist who was the first in the world to invent radio as a means of wireless communication. Today, radio or more widely electronics, a very young and a very promising science, has become a powerful tool of progress.

It will give us a deeper knowledge of the properties of outer space. Radio has already helped man to learn more about the sun's atmosphere, the atmosphere of many planets, it enabled our cosmonauts to locate their position in space, and there is radio communication not only between the spaceships and their home bases, but also between the spaceships themselves.

Radio is not the only carrier of information in space. There are infra-red and ultra-violet radiation, X- and gamma-rays, elementary particles and fields, etc. The time is not so far off when these and other carriers will be used for space communication — a great advance comparable with Alexander Popov's achievement in putting radio waves at the service of mankind, when he built the first radio receiver.

There are many more uses for electronics besides communications. A good deal of progress made in space would not have been possible without electronic computers making thousands upon thousands of operations a second. They solve logical problems, supply information on many aspects of science and technology, translate from one language into another, automatically control industrial processes, etc. In medicine electronic devices help to diagnose the disease and find the best treatment.

### COMMENTARY

is due to radio обусловлен(а) радио  
a good deal of progress made in ...  
значительный прогресс, достигну-  
тый  
thousands upon thousands миллионы

## LESSON 27

### Grammar:

#### Analysis of Sentences

#### Drills in fluent reading:

the product of modern chemistry, the discovery of coloured plastics, the number of synthetic materials, the manufacture of liquid resins, the characteristics of a building material, the attractiveness of modern homes, the usefulness of the new substances, the composition of material things, the shortage of natural products, the importance of modern developments;

when moulded under great heat, when compared to cast plastics, when manufactured as liquid resins, when produced in different colours, when given certain characteristics, when subjected to tremendous pressure.

### TEXT

#### THE WONDERLAND OF PLASTICS

Plastics or "synthetic resins" as they are sometimes called, are entirely the product of modern chemistry and are like no other substances found on the earth or in the sea. The discovery of plastics has at last opened the road which will lead man to victory over nature and make him independent of nature's products.

But what is a plastic and why are the chemists so enthusiastic over them? Synthetic plastics are man-made substances which not only change their shape when moulded under great heat and pressure, but change their chemical state as well.

They are light, hard and amber-like, being produced by mixing together a number of gases and liquids. A synthetic—or man-made—product must necessarily be both better and cheaper in order to justify its manufacture at all. This is essentially true of the various plastics when compared to the material they are to replace.

As for plastics themselves, there are two kinds—those which are affected by heat and those which are not, or cast plastics and moulded plastics. Cast plastics are manufactured as liquid resins and are then cast in the desired forms. Cast resins can be coloured before being poured. The resulting plastics can be produced in all sorts of colours, more than three hundred different shades and colours being now available in the cast plastics.

Moulded plastics are usually mixed with "fillers" to strengthen the finished material and give it certain characteristics. The mixed materials are subjected to tremendous pressure and temperature until they flow and fill the mould. Since the great heat used destroys dyes, moulded plastics can be in only a few shades, usually black.



So quickly has the use of plastics been taken up by the manufacturers that one can hardly live through the day without employing some of them in some way or another. Since plastics combine all the fine characteristics of a building material together with good insulating properties, and are fireproof as well, it is no wonder that the architects and engineers have turned to them to add colour and attractiveness to modern homes and offices.

It is very difficult to predict at the present time just where the usefulness of these magical new substances will end. Plastics materials will compete with wood and some metals as materials of construction. Research is expected to cut the cost of plastics, so cost is something the chemists are not worrying about.

The greatest advantage which plastics are expected to give the world is that they will make the people no longer dependent upon nature for their materials. Chemists look upon the invention of plastics as marking the beginning of the time when they will be able to control more fully the atoms and molecules which compose all material things, and so be able to pull matter apart and put it back together again into any form which happens to be needed at the time.

## COMMENTARY

are like no other substances не похо-  
жи ни на одно вещество  
at last наконец  
man-made искусственный  
amber-like похожий на янтарь  
at all вообще  
when compared to при сравнении с,  
если сравнить с  
had been taken up было подхвачено  
as for что касается  
in some way or another так или ина-  
че

add colour and attractiveness сооб-  
щить цвет и привлекательность  
materials of construction строитель-  
ные материалы  
look upon рассматривать  
pull matter apart and put it back to-  
gether again разложить вещество  
на составные части и вновь соста-  
вить его  
which happens to be needed at the  
time которая окажется необходи-  
мой в то время

## EXERCISES

I. Translate into Russian the following groups of words of the same stem:

to discover — discovery; to desire — desire — desirable; to strengthen — strength — strong; to destroy — destruction; to attract — attraction — attractiveness — attractive; advantage — disadvantage — advantageous.

II. Find in the text synonyms for the following words; translate them into Russian:

to be named, completely, artificial, form, also, production, to use.

III. Find in the text antonyms to the following words; translate them into Russian:

dependent, heavy, expensive, untrue, disadvantage.

IV. Find in the text English equivalents for the following words and expressions:

ряд, для того чтобы, что касается, имеется в наличии, больше не...

V. Translate the following sentences into English using the words of the text:

1. Пластмассы — это искусственные вещества, которые обладают огромными преимуществами по сравнению с естественными. 2. Пластмассы — легкие, прочные и дешевые. 3. Имеется два вида пластмасс — литые пластмассы и прессованные пластмассы. 4. Литые пластмассы бывают различных цветов и оттенков; фактически сейчас имеется в наличии около трехсот цветов и оттенков литых пластмасс. 5. Прессованные пластмассы обычно бывают черными, так как температура, необходимая для их изготовления, разрушает краски. 6. Ряд пластмасс, обладающих хорошими свойствами, а также огнеупорные пластмассы применяются в строительстве. Скоро ряд строительных материалов будет полностью заменен пластмассами. 7. Что касается применения пластмасс в промышленности, можно сказать, что оно растет из года в год. 8. Химики проводят научные исследования, для того чтобы снизить стоимость пластмасс; они считают, что пластмассы — это материалы с большим будущим. 9. Благодаря пластмассам человек больше не будет зависеть от продуктов природы. 10. Основными преимуществами пластмасс являются прочность и дешевизна.

VI. Translate the following sentences into Russian paying attention to the words in bold type:

A. 1. In selecting the proper building material **availability** and cost may become primary considerations. 2. Only a few shades of moulded plastics are now **available** for use. 3. In manufacturing plastics, greatly improved methods are now **available**. 4. Of all the instruments **available** the Geiger counter is the most suitable for the purpose of counting particles. 5. All of our **available** energy has come from the sun. 6. The sun's energy will be **available** as long as there are people on the earth to use it. 7. We must learn to increase the efficiency of our use of fuel and to make **available** new sources of energy. 8. What we are interested to know is what fraction of the **available** energy we get in the form of useful work. This fraction we call efficiency. 9. Before the **availability** of rural electricity via transmission lines, a wind generator system was a very clean and convenient source of electric power.

B. 1. Ultrasonic vibrations can be used for cutting holes in hard materials **like** glass. 2. An object like a submarine can easily be detected by ultrasonics. 3. **Unlike** other direct energy converters magnetohydrodynamic converters can be built to produce huge amounts of electrical energy. 4. It is **unlikely** that the substance under study can be seen under ordinary lighting conditions. 5. The new device **is likely** to gain wide recognition. 6. The artificial moons are relatively small, and are moving at great heights, so that they

look like slowly moving stars. 7. **Unlike** ultraviolet light, infrared is not easily absorbed by clouds. 8. Fission fragments are **unlikely** to find any use. 9. **Unlike** batteries, direct energy converters do not need reacting chemicals. 10. All the visitors **like** the exhibition of plastic materials used in construction.

VII. State by what the predicates in the following sentences are expressed and translate the sentences into Russian:

A. 1. Nearly all our planet's water is salty: but land plants and animals must have fresh water. 2. One of the biggest loads a bridge has to carry is its own weight. 3. Because of the tremendously rapid rise in the world's population, energy will have to increase at the same rate. 4. Under classical theory, electrical resistance of most conductors should slowly decrease as temperature drops. 5. According to the plan automation of manufacturing processes is to be introduced on a wide scale.

B. 1. During recent years the value of aluminium as an architectural metal has been increasingly recognized. 2. The effect of additional insulation on the inside temperature was calculated. 3. When any building is to be constructed, the cheapest material which will give good results is chosen. 4. It is known that the wind load on a structure is influenced by the structure's shape. 5. The material under consideration is not seriously affected by weather conditions.

VIII. Find in the text sentences with verbals, analyze them and translate into Russian.

IX. Write questions to which the words in bold type are the answers:

1. There are **two** kinds of plastics — cast plastics and moulded plastics. 2. Moulded plastics are usually mixed with "fillers" to **strengthen the finished material**. 3. **Since the great heat used destroys the dyes**, moulded plastics can be in only a few shades. 4. **Yes**, the architects and engineers use plastics in construction. 5. **Research** will cut the cost of plastics.

X. Answer the following questions:

1. What did the discovery of plastics give to man? 2. What are plastics? 3. What properties do plastics possess? 4. How many kinds of plastics are there? 5. How are plastics manufactured? 6. Where are plastics used? 7. With what materials of construction do plastics compete? 8. What are the greatest advantages of plastics?

Supplementary Text. Read and retell:

### SYNTHETICS

The dictionary defines "synthesis" as "the putting together of two or more things". By this definition a "synthetic" would be the product that results from the "putting together" process. The putting together of the constituents that go into modern synthetics

is never just a simple physical mixing-up. It is, generally, a complicated procedure involving a number of steps and various chemical changes. There are two general reasons why man has tried to make these materials instead of being satisfied with the ones provided by nature. One reason is his desire to duplicate natural substances either to decrease cost, or because of the shortage of the natural product, or both. The other reason is the wish to produce materials with combinations of desirable properties not found in the things provided by nature. There are inorganic and organic synthetics. The difference between organic and inorganic compounds is simply that the former contain carbon, while the latter do not. One of the most important inorganic synthetic materials is glass.

Glass is known to be the oldest man-made synthetics. No one knows just when or under what conditions glass was first made. In spite of the industry's great age, scientific research into the ways of improving the product has only been carried out within the past half century or so.

Low-expansion glass is one of the most important modern developments in this field. This property makes possible its application where it is subjected to comparatively rapid temperature variations. More recently there has been developed a glass that is so resistant to sudden temperature changes that it will not break when molten metal is poured on one side of it, while the other side is in contact with ice.

## COMMENTARY

the putting together соединение  
or both или же и то и другое  
just when когда точно  
research into the ways исследование  
способов

low-expansion glass стекло с малым  
коэффициентом расширения  
more recently в последнее время

## LESSON 28

### Grammar:

#### Analysis of Sentences

#### Drills in fluent reading:

the science of producing low temperatures, the boiling point of liquid oxygen, a piece of fine crystal, with a cryogenically cooled banana, a current circulating in a ring, superconductive metals become diamagnetic, magnetic lines of force, one of the strangest cryogenic products, helium refuses to obey the natural laws, it flows easily between two sheets of flat glass, scientists may soon actually see atoms, dozens of jobs have been suggested, cryogenics is having a profound effect, the few devices now operating.

## CRYOGENICS

## Electronics at Ultra-low Temperatures

Cryogenics — the science of producing and using extremely low temperatures — comes from the Greek word "kryos" meaning "icy cold". While the Greeks may have had a word for it, they didn't really know what "cold" was. The temperatures which occur in nature — even winter's sub-zero blasts — are red hot compared to the unbelievably cold realm now produced routinely in hundreds of laboratories around the world.

Cryogenic temperatures — frequently defined as those below  $-297^{\circ}\text{F}$ , the boiling point of liquid oxygen — interest scientists because ordinary substances whose temperature is reduced to this region take on many — and frequently useful — new properties. A bar of lead which usually clinks dully when tapped rings like a piece of fine crystall at cryogenic temperatures. A rubber ball will break like a Christmas tree ornament when dropped and you can drive nails with a cryogenically cooled banana. Steel becomes five times as strong, but so brittle it will split if struck.

Near absolute zero (about  $-460^{\circ}\text{F}$  or  $-273^{\circ}\text{C}$ ) some metals lose all electrical resistance and become superconductive. A current circulating in a superconductive ring will turn around for ever, even though connected to no power source, as long as the temperature is kept low enough. Furthermore, superconductive metals become diamagnetic — magnetically opaque. Set a lead ball above the ring with the circulating current and if its temperature is low enough to maintain it in a superconductive state, magnetic lines of force cannot enter the lead, so the ball is repelled. It will float in mid-air on the cushion of magnetic force created by the revolving current.

Remarkable new cryogenic techniques are coming into use in many different fields. Scientists, for example, have devised a system for deep-freezing whole human blood for an indefinite period. Live cells and bacteria cultures can also be frozen and stored for years.

Another promising area is in storing and shipping food.

One of the strangest cryogenic products is "Helium II", simple helium gas cooled to within about one degree of absolute zero. Helium II refuses to obey the natural laws of liquids. It becomes what scientists call "superfluid". For example, it flows easily between two sheets of flat glass pressed together, a joint which is normally completely fluid-tight. Even stranger, dip a test tube half way down into a Helium II bath and this odd super-viscous liquid will flow up over the lip of the tube contrary to the laws of gravity and continue to flow until the level inside of the tube is even with that outside. Then lift the tube a little and it flows back in the other direction.

Scientists may soon actually see atoms with a powerful new cryogenic microscope hundreds or perhaps even thousands of times more powerful than to-day's best instruments.

Literally, dozens of other jobs have been suggested for cryogenic devices. Infrared detectors, for example, are far more sensitive when operated within a few degrees of absolute zero. Cryogenics is having a profound effect on the field of electronics. The devices now operating are only indications of things to come.

## COMMENTARY

**sub-zero blasts** морозные порывы ветра  
**cold realm produced routinely** область холода, получаемая по установленной методике  
**take on many new properties** приобретают новые свойства  
**clinks dully** глухо звенит

**Christmas tree ornament** елочное украшение  
**are coming into use** начинают применяться  
**half way down into** наполовину в  
**under construction** в процессе строительства

## EXERCISES

### I. Translate into Russian the following words of the same stem:

low — to lower; to mean — meaning; frequency — frequent — frequently; to define — definition — definite — indefinite; to lose — loss; to resist — resistance — resistor — resistant — resistive — resistivity; to connect — connection; to enter — entrance; to repel — repulsive — repulsion; to create — creation — creator — creative; to revolve — revolution; simple — simplicity — to simplify; to join — joint; to direct — direction — direct — indirect — directly; to suggest — suggestion; to operate — operation — operator; to detect — detection — detector; to indicate — indication — indicator; to construct — construction.

### II. Memorize the following groups of synonyms:

really, actually, indeed, in fact; to occur, to happen, to take place; often, frequently; ordinary, usual, common, general; to reduce, to decrease, to diminish; to turn, to rotate, to revolve; to connect, to join; enough, sufficiently; for example, for instance; completely, entirely, fully; device, instrument; profound, deep.

### III. Memorize the following groups of antonyms:

low, high; cold, warm; seldom, frequently; strong, weak; near, far; opaque, transparent; to repel, to attract; definite, indefinite.

### IV. Translate into Russian the following compound words:

fluidtight, watertight, airtight, gastight; waterproof, airproof, soundproof, shockproof, rustproof, windproof.

### V. Translate the following sentences into Russian paying attention to the different meanings of the word "will":

1. Many transformations of matter can be brought about in the laboratory at will. 2. It will be noted that cryogenic temperatures are those below  $-297^{\circ}\text{F}$ . 3. It will be seen that Helium II flows

easily through a completely fluidtight joint. 4. Some substances will allow the passage of an electric current much more readily than the others. 5. It is not difficult to remove oxygen from the gases of the air. It is an odourless, tasteless, colourless gas that will not burn, but it will vigorously support combustion. 6. The sun's energy will be available as long as there are people on the earth to use it. 7. Both atomic and solar energy will come into use not only in power-hungry communities but in industrial areas as well. 8. The atom, it will be remembered, consists of a central nucleus around which electrons are revolving. 9. It is common experience that of two similar objects the greater acceleration will be experienced by the one which is acted upon by a larger force.

VI. Translate the following sentences into Russian paying attention to the meanings of the words in bold type:

1. An **even** number is one that can be divided by two. 2. The plane landed on **even** ground. 3. Superfrozen food will remain frozen for weeks or **even** months without further refrigeration. 4. The liquid will flow easily between two glass plates **even though** the joint is completely fluidtight. 5. All the planets of our solar system move **about** the sun. 6. Direct energy converters are **about** to replace old-fashioned designs. 7. At a temperature **about** absolute zero some metals will lose all electrical resistance. 8. Cryogenic techniques are widely spoken **about** by our scientists and engineers. 9. Fuel cells produce electricity with efficiencies **far** greater than any other non-nuclear power system. 10. In the **far** regions of our country (Siberia) many new towns, as well as scientific centres have been and are being built.

VII. Find in the text English equivalents for the following words and word-combinations:

получать низкие температуры, попадают в природе, раскаленный, забивать гвозди, в пять раз прочнее, вечно, источник питания, до тех пор пока, ученые придумали систему, подчиняться законам природы, в противоположность, в другом направлении, мощный микроскоп, гораздо более чувствительный.

VIII. Translate the following sentences into English using the words of the text:

1. Криогеника — это наука о создании и использовании сверхнизких температур. 2. Точка кипения жидкого кислорода — 297° по Фаренгейту. 3. При криогенных температурах многие вещества приобретают ряд полезных свойств. 4. При криогенных температурах сталь становится в пять раз прочнее, но очень хрупкой. 5. При температуре около абсолютного нуля некоторые металлы теряют электрическое сопротивление и становятся сверхпроводящими. 6. Технику сверхнизких температур широко используют в промышленности.

**IX. Find the predicates and translate the following sentences into Russian:**

A. 1. At the remote stations, the emergency power supplies consist of rotary inverters operating from the plant battery. These are normally stopped and controls place them in service upon failure of station service. 2. We proportion the material available in equal quantities.

B. 1. Take a bar of lead at cryogenic temperatures and tap it — it will ring like a piece of fine crystal. 2. Connect the ring to a power source. 3. Maintain the lead ball in a superconductive state and observe its behaviour. 4. Cool the gas to one degree of absolute zero. 5. Pass Helium II through a fluidtight joint. 6. Use the new powerful microscope for your observations.

**X. State the functions of the verbals and translate the following sentences into Russian:**

1. If we want a rocket to orbit round the Earth, we must give it a speed of at least seven miles a second, which is the escape velocity for the Earth. 2. The effects of radiation are known to be cumulative and, therefore, even small doses can be dangerous over a period of time. 3. Combustion of wood, charcoal and coal has been for ages the standard method of producing heat. 4. For an electric current to flow a number of electrons must be made to move. 5. Aluminium has three electrons in its outer shell, one of them easily moved. 6. Silver is the best conductor of electricity we know, followed in order by copper, gold and aluminium. 7. Because of its being expensive silver is not widely used in electronics. We have to compromise between cost and efficiency, copper being thus the choice. 8. The lines of force are usually thought of as coming from the north-seeking pole of the magnet and travelling around in a loop to enter the magnet again at its south-seeking pole. 9. Well-trained technicians are in great demand to fill the many positions created by the introduction of equipment too complex for the average operator to control. 10. Experiments now being made to introduce the new device meet with success. 11. The time required for the amount of radiation to be reduced to half the original amount is different for different materials. 12. Larger, heavier trains and wider rivers resulted in structural steel replacing iron in the construction of bridges. 13. An important question to be dealt with in providing automatic control is the operation involved. 14. It is dangerous to look directly at the sun. 15. For a nuclear rocket engine to be thermally efficient, the reactor's temperature must be as high as possible. 16. The knowledge required by an engineer to enable him to solve a problem is very varied and extensive. 17. In designing a steel structure it is first necessary to decide on the type of floor to be used to carry the loading. 18. When a force is transmitted through a material, the latter is said to be stressed. 19. Scientists found the amount of deformation to be connected with the chemical composition and physical structure of materials. 20. To use computers in automatic control means to considerably speed up the manufacturing



process. 21. The column being the most important element of the building, a defect in one column may be the cause of failure. 22. Copper wire is estimated to have a great tensile strength. It is known to be very durable under ordinary atmospheric conditions. 23. The new system of automatic control is likely to be used in the near future. 24. Computers are used to control complex machines and processes. 25. Almost all industries use some form of telemetry to control a wide variety of industrial processes. Some of these plants are spread over large areas, with some operations often taking place many miles from the central station. 26. To tell the story of the beginnings of what we today call "electronics" would involve the writing of several large volumes. 27. After conducting thousands of experiments to find a satisfactory solution of the problem, the scientist made the first successful device. 28. No one wants his equipment to break down, so no one intentionally overloads his equipment. 29. The introduction of equipment too complex for an average operator to control requires well-trained technicians. 30. For the reactor to operate at a constant power level, an average of exactly one neutron from each fission must cause another fission.

**XI. Answer the following questions:**

1. Where does the word cryogenics come from? 2. Why do cryogenic temperatures interest scientists? 3. At what temperature do some metals become superconductive? 4. What does the word "superconductive" mean? 5. What does the word "diamagnetic" mean? 6. In what fields are cryogenic temperatures used? 7. What is "Helium II"? 8. What are the properties of helium II? 9. Have many jobs been suggested for cryogenic devices?

**Supplementary Text. Read and retell:**

**HIGH-TEMPERATURE RESEARCH**

The field of high-temperature research is a great frontier of science. But it is by no means a new frontier. Since prehistoric times the attainment of higher and still higher temperatures has characterized successfully more advanced civilizations. Thus, the stone age gave way to the bronze age, and the bronze age to the iron age. Recently man has learned how to produce temperatures equivalent to those of the sun and stars, if only for an instant, and we have the atomic age and the space age. But space technology requires the production of exceedingly high temperatures for long periods, not just instants, for powering rockets and producing the components of spacecraft. This we must accomplish if we are to continue our scientific advance and lead the way into space.

High-temperature research is a field of very broad scope, involving as it does the sciences of chemistry, physics, metallurgy, and ceramics. An important problem is that of producing high tempera-

tures by chemical reactions, which necessarily must have thermally stable reaction products. This can be achieved in several ways — through combustion of metals in oxygen; through combustion of gaseous mixtures; or through plasma jets. In every case, there arises another problem, that of confining or containing chemical substances at temperatures which conventional containers cannot withstand.

#### COMMENTARY

**gave way to the bronze age** уступил  
место бронзовому веку  
**if only for an instant** хотя бы на  
мгновение

**a field of very broad scope** очень широкая область  
**involving as it does** включающая  
фактически

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# ПРИЛОЖЕНИЕ I

## ТЕКСТЫ ДЛЯ ДОПОЛНИТЕЛЬНОГО ЧТЕНИЯ

### TEXT 1

#### FROM THE HISTORY OF THE ORIGIN OF SCIENCE

Science had its origin in some distant era when people began to show desire to know about their environment and to record what they saw. In time, studies of these observations led to the idea that nature is knowable, that it operates according to "laws".

The actual birth of science took place in prehistoric times, probably in Egypt and Babilonia, more than 2,000 years before our era.

But true progress in science did not begin until about the sixth century before our era, when the Greek civilization began to flourish. The next 500 years was the age of the great philosophers of antiquity — Thales, Pythagorus, Aristotle, Archimedes, and others.

Archimedes discovered some of the basic laws governing mechanisms and floating bodies. To Archimedes we owe the first application of mathematics to the description of nature. He was very far in advance of his time.

In the period from the Greeks to the Renaissance few contributions were made to the development of science. First in importance among the scientific achievements of the Renaissance was the idea that the sun, rather than the earth, is the centre of our system of sun, moon, and planets. At the beginning of the sixteenth century the prevailing idea was that of an earth-centered universe, as described by Ptolomy.

The Polish astronomer N. Copernicus assumed that the earth is merely one of the planets and that all of them moved about the sun. It is hard now to understand the courage required to advance an idea of this nature because of the great wave of opposition which confronted Copernicus.

### COMMENTARY

did not begin until about the sixth  
century начался приблизительно  
только в шестом столетии  
far in advance значительно опередил

rather than the earth а не земля  
to advance an idea of this nature вы-  
двинуть подобную мысль  
because of вследствие, из-за

## OUR UNIVERSITY

Our University aims to train all-round developed students, with a high degree of social consciousness and a high degree of culture and knowledge. In brief, it trains students morally, intellectually and physically.

Teaching is done according to plan and the characteristic feature of teaching is as follows. First, theory must be combined with practice. This means the students must make experiments in the laboratory and also field experiments and demonstrations in their specialities. Secondly, great attention is paid to the quality of studying. Thirdly, students must be self-reliant and they must know how to educate themselves.

There are three periods a day, so that the students have time to study on their own.

Students are also trained for research work and in the higher classes many of them begin to do independent research.

Every student must write a thesis or sit for state examinations. The principal purpose is to train students to be in a position to master the latest science.

Physical training is given to all students. Also, many students take part in recreational sport.

To be admitted to the University, students must first of all be graduates from a middle school. They must then sit for examinations.

Once admitted, the students study 5 years. In their final year they must write a thesis based on the work done in their speciality or they must take state examinations. Every term students take examinations, in winter and in spring or summer.

One foreign language is compulsory for all students. English, German and French are the most common, although Spanish is also offered.

After graduating, some of the best students are selected to remain for 3 years more to do post-graduate work, but the rest are assigned to jobs according to the needs of the State.

Students pay no tuition fees and many receive maintenance grants from the state. Most students live in hostels. A wide range of clubs exists for extracurricular activities. These are organized by the students themselves, through their students' union.

## COMMENTARY

in brief вкратце

according to согласно, в соответствии  
as follows (заключается) в следующем

to be in a position (зд.) чтобы они  
были в состоянии  
the rest остальные

first of all прежде всего, в первую очередь

sit for examinations сдавать экзамены

once admitted если они приняты  
tuition fees плата за обучение  
maintenance grants стипендия

## FRONTIERS OF CHEMISTRY

Organic chemistry is a young science. In the 19th century chemists first synthesized, or put together, an organic compound from inorganic (non-organic) material. Further they showed that carbon atoms have four available bonds which allow them to combine with other atoms.

Since those early years, the organic chemists invented many techniques for analyzing compounds whose structures are unknown and for preparing compounds that do not exist in nature. Many of these compounds are now used as medicines, dyes, foods and other products of industry.

In the last few decades chemists learned a great deal about the way in which the properties of a molecule are related to its structure. With the help of this knowledge they made great studies in understanding the structure of giant molecules.

Another striking development is the increased use of catalysts in both industrial and laboratory processes. Since no one yet knows precisely how catalysts work, each one has to be found by trial and error. Eventually we shall have such tailor-made catalysts, for we already know quite a lot about the action of the existing ones.

The most difficult problems in organic chemistry are those connected with investigating the compounds in living things. Although our knowledge is slight, it is growing rapidly.

Think for a moment of photosynthesis, the process by which water and carbon dioxide combine in a green plant to form sugar. Although every single person depends on photosynthesis for his food supply, we still do not understand the reaction. When photosynthesis can be carried out artificially on a large scale, we shall be able to set up factories to mass-produce food.

## COMMENTARY

a great deal много  
both ... and и ... и  
by trial and error по методу попыток  
tailor-made catalysts готовые катализаторы

quite a lot очень много  
to mass-produce food для массового  
производства продуктов питания

## TEXT 4

## POLYMERS — ATOMS IN STRINGS

We know that natural products like wood, petroleum and coal play an important part in our modern civilization. In about 1880 organic chemists set out to discover how the molecules of these products are constructed. They realized that once they had this knowledge they would be able to make better and more versatile materials in the laboratory. Careful study over a period of many years has

finally made known an important fact: the molecules of all natural organic materials that are strong, elastic, insoluble and melt at high temperature have one important feature in common — giant size.

But until 1920's almost nothing was known about the architecture of these giant molecules. Chemists found it very difficult to tell how they were put together by nature, and to see how they might be built up in the laboratory.

Gradually chemists realized that the giant molecules must be composed of large numbers of smaller units connected end-to-end. Like cars in a train, each molecule of cellulose must be made of strings of simple glucose molecules; each molecule of rubber must be made of strings of simple molecules (called isoprene molecules), and so on. These simple molecules are called monomers (from a Greek word meaning "single parts"). The large molecules are called polymers (meaning "many parts").

It is one thing to use materials ready-made by nature. But it is quite another to design and build special materials in the laboratory. As the chemist discovered how the behaviour of a polymer depends on its molecular structure, he realized that this knowledge would give him the possibility to design molecules that would behave just as he wanted them to. This is precisely what happened with nylon and synthetic rubber.

At our present state of knowledge, we know what molecular structure is needed to produce a particular property. We have also at our disposal about 40 materials which can be used as monomers. Most of them are obtained from coal and petroleum. Using these materials, we have produced all the synthetic fibres, plastics and rubbers, each with the properties that the chemist intended them to have.

One familiar man-made polymer is the plastic called polyethylene. An important synthetic rubber, superior to natural rubber in many ways, called butyl rubber is widely used in automobile industry.

Fibers like nylon, rubbers like butyl rubber, and plastics like polyethylene are only a few of the interesting and useful polymers that chemists have created. Using their knowledge, scientists are now working to understand and to imitate the giant polymers in living organisms.

#### COMMENTARY

play an important part играют важную роль  
have one feature in common имеют одну общую особенность  
and so on и т. д.  
ready-made готовые

just as именно так, как  
superior to natural rubber in many ways который во многом превосходит естественный каучук  
at our disposal в нашем распоряжении

## THE FIELDS AND USES OF PHYSICS

The story of man's civilization is the story of his study of nature and the application of his knowledge in his life.

Primitive man was born, lived and died with little change in his manner of living from generation to generation.

The laws of nature were not studied.

The use of tools, first of stone and later of metals, the domestication of animals, the development of writing and counting, all progressed slowly since rapid advance was not possible until man began to gather data and check theories. Till that time most of man's knowledge was based on the speculations of the Greeks.

Not until a little over three centuries ago did man adopt the scientific method of studying his environment. After this the development of civilization has become increasingly more rapid. The advance of all the natural sciences has been almost simultaneous: in fact, many of the prominent scientists were working in more than one field of knowledge.

We shall limit our attention to the one field of physics. Probably more than any other science physics has changed the conditions under which man lives. Physics deals not with man himself, but with the things he sees and feels and hears. This science deals with the laws of mechanics, heat, sound, electricity, light, which have been applied in numerous combinations to build our machine age. Modern physics also deals with electronics, atomic phenomena, photoelectricity, X-rays, radioactivity, the transmutation of matter and energy and the phenomena associated with electron tubes and the electric waves of modern radio.

The practical application of the developments of physics continues at an ever increasing rate.

"Practical physics" plays, therefore, no small role, for the laws of physics are applied in every movement we make, in every attempt at communication, in the warmth and light we receive from the sun, in every machine. Practical applications of physics are not all made by physicists, for the majority of those who apply the principles of physics are called "engineers".

In fact, most of the branches of engineering are closely related with one or more sections of physics: civil engineering applies the principles of mechanics; mechanical engineering utilizes the laws of mechanics and heat; electrical engineering is based on fundamentals of electricity, etc. The relation between engineering and physics is so close that a thorough knowledge and understanding of physical principles is important for progress of engineering. One of the tools common to physics and engineering is mathematics.

If we are to make effective use of the principles and measurements of physical science, we must have a workable knowledge of mathematics.

Physics and mathematics are thus the basic "foundations of engineering".

## COMMENTARY

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workable knowledge практическое зна-  
ние

### TEXT 6

#### TITANIUM

The development of titanium as a basic industrial metal is without precedent in metallurgical industry. Other modern industrial metals, such as aluminium and magnesium, came into use relatively slowly because from the very beginning the supply of usable metal exceeded the demand, making it necessary to stimulate the demand by suggesting new uses.

It has been quite the opposite in the case of titanium. The demand has exceeded the supply from the time that it was demonstrated to be a practical engineering material.

The rapid growth of titanium has been unparalleled by the technological development of any other metal. It was discovered in 1790, but it was not until 1943 that its potentialities were realized. Since then, its development was rapid.

Titanium is the fourth most abundant structural metal in nature. Its supply is exceeded only by aluminium, iron and magnesium, and it ranks ahead of copper, lead and zinc.

Ore deposits and beach sands throughout the world contain large quantities of titanium. The Soviet Union possesses great supplies of titanium. In fact, ilmenite is named for the Ilmen Mountains in the Urals. Large deposits of this valuable metal are found in the USA, Canada, Australia and Norway. Titanium is lightweight, strong, corrosion resistant and abundant in nature. It is finding increasing application in many different fields.

## COMMENTARY

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### TEXT 7

#### MAN AND HIS MACHINES

The efforts of civilized man are largely directed towards obtaining food and clothing, providing shelter, and gaining satisfying social and intellectual experiences. In all these activities man now makes use of a multitude of machines. Although most of these are



of quite recent origin, a few simple ones have come down from very ancient times.

The bow and arrow, for example, were well known to prehistoric man. It was by hunting that he gained his food, and this "machine" was his tool in his struggle for existence.

The wheel, one of the greatest inventions ever made by man, is also of prehistoric origin. The inclined plane and its uses have also long been known. It was doubtless by its use that Egyptian slaves lifted the huge stones that went into the construction of the great pyramids. The lever is probably of equally ancient origin. It is mentioned by the Greek Philosopher Aristotle as a means of lifting a great weight by using a very small force.

There was little change in the number of kinds of machines in use for nearly twenty centuries.

But then as one new device after another came to displace others that were less efficient, the development speeded up.

Let us take a glance at a few of these changes.

Some time ago people traveled in horse-drawn carriages. The speed on these journeys did not exceed thirty or thirty-five miles a day. This was typical of an era that provided only two other methods of land travel — on foot and horseback. Within approximately half a century of that time railroads had been built. At first trains were drawn by horses and in the middle of the nineteenth century the first steam locomotives were put in service.

From that time the development was rapid. The "iron horse" soon proved its superiority both in speed and endurance. New lines were projected and old ones extended. A speed of thirty-five miles a day had given way to regular schedules exceeding many miles an hour.

In the first decade of the present century it was thought that the limit of desirable speed had been reached. But later developments — the substitution of the Diesel and electric engines for steam engines, the improvement of roads, the use of light metals in the construction of cars, and the streamlining of trains — have shown that much higher speeds may be safely used.

However, the railroad train did not long remain the only means of rapid transit. Soon the automobile appeared. It could be used both for long and short journeys with almost any desired speed which made it very useful for traveling.

The latest and speediest type of conveyance was limited neither by rails nor by highways. It took to the air. In so doing, it greatly reduced the time of travel.

Improved means of transportation of goods have very naturally developed together with those for travel, and facilitated the development of trade.

In the country the days of the wooden plow have passed. The development of tractor made way for the use of a combine. By means of agricultural machines the farmer can not only give much more produce than ever before, but do it much more easily. This has been

greatly facilitated by the rapid extension of electric lines. Now electric motors instead of muscle power operate the machines.

A similar transformation has taken place in the means of producing clothing which is also indebted to the development and widespread use of machines.

Perhaps the greatest advancement since old times has been achieved in the art of communicating ideas. The telegraph, telephone and radio — are the stages in this field of development. But even this has become almost commonplace. The hope to see what is happening at great distances as well as to hear — has now been realized. Television has taken its place alongside with radio not only in the cities but in the countryside as well.

The machine has contributed a great deal to the dissemination of information, the exchange of opinion, and the advancement of learning by increasing the number of copies of books, newspapers and magazines.

The machine has also come to occupy a conspicuous place in the home. In the laundry a machine driven by electric or other power has become almost universal (a laundry machine, a washing machine). The electrically heated iron, the vacuum cleaner, refrigerator and many others have relieved the housewife of many physical cares and inconveniences.

Thus the machines that have developed in the last hundred years have completely transformed our life.

The constructions of the machines in common use today look very complicated. If any of these is taken apart, however, it is found that it consists of only a small number of kinds of parts. These are called the machine elements. They have been named **the lever, the pulley, the wheel and axle, the inclined plane, the wedge, and the screw.**

Since the more complex machines, such as steam engines, automobiles, printing presses, typewriters, etc., are merely combinations of two or more simple machines, a thorough understanding of these main elements is sufficient to enable one to understand the operation of all the others. Much of the mystery attached to the remarkable work of some machines in use disappears when this is understood. A machine for making complicated mathematical computations may seem almost uncanny in its action until it is found that it operates on the simple principle of the devices mentioned above. The same is true of whatever other complicated machine one may chance to see.

## COMMENTARY

gaining social and intellectual experiences приобретение социального и интеллектуального опыта  
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within approximately half a century  
of that time приблизительно через  
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## SATELLITES IN SPACE

The science-in-space programme produces much information about our universe and provides important knowledge needed for our manned space flights. The work can be divided into three general areas.

The first concerns the sun itself. Before the coming of the satellite, man could study the sun only through a translucent covering, because of the earth's atmosphere. Our present objectives with the satellites are to observe sunspots and solar flares which seem to be the cause of many phenomena experienced on earth: weather generation, for example.

The second is interplanetary space. In this area it is possible to observe the sun's electromagnetic radiation and solar activities unaffected by the earth's magnetic field.

The third region under investigation is the near-earth region called the "magnetosphere". Here the magnetic field of the earth exerts a major influence.

Modern space technology has made it possible to build orbiting scientific observatories, "laboratories", with which to conduct extended observation at and beyond the earth's atmosphere. The setting up of orbital stations is an important component of the space programme and a new trend in cosmonautics. Each station can replace an adequately large number of automatic sputniks used for meteorological observations, geological prospecting, communications, astronomy, geophysical experimenting and the study of interplanetary space. Out of this scientific research we are gaining new knowledge about the universe and its laws: about the Earth and its atmosphere; the sun and its influence on the Earth and finally, knowledge about physical life, its origin and fundamental nature. In the future these stations will also be used to assemble large interplanetary craft before they fly far out into space.

To date, our scientists and engineers have been responsible for a number of successfully launched scientific satellites which carried out a lot of scientific experiments.

We shall mention here one of them. About two decades — a very short period of time historically — have only passed since the first manned space flight; but what tremendous successes have already been achieved! In 1980 the world witnessed the longest ever, unprecedented manned 185-days space flight aboard the Salyut 6 — Soyuz orbital complex. Here space heroes Leonid Popov and Valery Ryumin showed their courage and valour in performing the programme of scientific and technological research and experiments.

According to the "Intercosmos" programme, the cosmonauts of Czechoslovakia, Poland, Bulgaria, GDR, Hungary, Vietnam, Cuba, Mongolia and Roumania worked successfully and carried out numerous important experiments. This is a most striking

illustration of fruitful cooperation in mastering space for peaceful purposes.

Lunar research conducted by automatic apparatuses furnished important data on the Moon.

On the earth, astronomers cannot get clear pictures of stars, and not in all the bands of the spectrum because of the atmosphere. Only the rays of the visible light, part of the infrared rays and waves of the radio band reach us through the so-called windows of transparency in the atmosphere.

The range of the spectrum of the electromagnetic short wave radiations, less than 3,000 engstrom — the ultraviolet, the X-ray and the gamma radiation of celestial bodies which carries most valuable information — is absolutely inaccessible on Earth.

The recent achievements in Lunar research demonstrate the high level attained by scientists and engineers and are the result of the major complex work performed by numerous groups of specialists over many years. Scientists successfully coped with their difficult programme.

The Soviet Union is methodically carrying out its multipurpose programme of studying and conquering outer space. The Soviet scientists and designers who deal with the problems of cosmonautics and space rocketry are making a worthy contribution to the achievements of science and engineering.

#### COMMENTARY

science-in-space programme выполне-  
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космосе.

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#### TEXT 9

#### LENIN'S LINKS WITH LONDON

Persecuted by the tsarist police, Lenin had to spend many years in exile abroad, often in very hard conditions.

But he never gave up the struggle to build that strong Party which led the workers and peasants of Russia to victory, the overthrow of tsarism, and the establishment of the first Socialist State.

Finland and Germany, Switzerland, France and Poland — in all these countries Lenin and his wife Krupskaya found refuge.

And London, too, had the honour of giving hospitality to Lenin on five separate occasions during his wanderings abroad before the cause of the Revolution triumphed in 1917.

He first came in April 1902 to continue the illegal publication of *Iskra* (The Spark), after the activities of the German police had made it impossible to continue in Munich.

He stayed for a year, but was again in London in July 1903, when the Second Congress of the Russian Social Democratic Labour Party was transferred from Brussels because of the activities of the police there.

In April 1905, Lenin again came to London from Geneva to attend the Third Party Congress, and he was in London again for the Fifth Party Congress in April 1907.

His last visit was in April-May 1908 to work at the British Museum gathering material for his work on "Materialism and Empirio-Criticism."

In her magnificent "Memories of Lenin", his wife Krupskaya tells how when they arrived at King's Cross Station they were met by Nikolai Alexandrovich Alexeyev, "a comrade living in London in exile and who had a fine knowledge of English."

Lenin's time in London was divided between editing Iskra, dealing with the correspondence that came through illegal channels from Russia and studying in the British Museum Reading Room.

Krupskaya helped with the correspondence, kept house, bought food, prepared meals. But occasionally Lenin and Alexeyev used to eat at one of the many fish restaurants which were then such a feature of London, as they are today.

Alexeyev, before Lenin's arrival in London, had made arrangements with Harry Quelch for the publication of Iskra in the editorial offices of Justice.

Harry Quelch, the editor of the journal of the Social Democratic Federation, placed his printing press entirely at the disposal of \* Lenin and his comrades, and at one stage personally helped settle some difficulties which had arisen.

The tiny room where V. I. Lenin and Harry Quelch worked together in those days still stands and is kept as it was in their day in Marx House — a standing memorial to the cooperation between the Socialist movements of Britain and Russia.

The Fifth Congress of the Russian Social Democratic Labour Party was held in London in 1907, and it was there that the famous Russian author Maxim Gorky met Lenin for the first time.

London newspapers reported at the time that the appearance of the delegates in the streets caused a sensation.

A reporter of the "Morning Post" recorded at the time that he was impressed by their appearance of "deep study and thought."

#### TEXT 10

#### FUEL CELLS

When the spaceship orbits the earth the electric power to operate its complex electronic and life-supporting equipment may come from a new source: a fuel cell.

Fuel cells will soon be pouring their power into devices designed

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\* at the disposal of в распоряжение

for industrial use, too. And, although no one is ready yet to make predictions as to when fuel cells may appear in automobiles and trucks, their advantages lead many engineers and scientists in the field to believe that most of us may ultimately drive fuel-cell-powered cars.

Fuel cells, in fact, could bring about the biggest electrical revolution since the dynamo launched the electrical age in the closing years of the last century. The reason is that they generate far more electricity per pound of fuel than any other non-nuclear method of power production. The most modern turbine electric generating plants, for example, operate at 40% efficiency, that is, turn 40% of the energy stored in the fuel into usable electrical power. Automobiles run at about 20% efficiency, motor boats at 10%. Present-day fuel cells, on the other hand, extract 50% to 85% of the potential power out of every pound of fuel.

Even though the excitement about them is relatively new, fuel cells themselves are not. The first primitive model was built in 1839. A half century later, a more advanced model was developed. But the electric dynamo was just coming into its own at that time and it captured the attention of scientists and engineers. Fuel to run the machine was plentiful, efficiency wasn't important, and the dynamo appeared simpler and was easier to build.

Poor efficiency has been the disadvantage of the dynamo through the years, though, and there is not much engineers can do about it. The trouble comes from the fact that in the process of releasing the energy of the fuel, we throw most of it away. We extract the fuel's energy by burning it. The heat is converted to mechanical energy by a turbine or some other heat engine, the engine drives the dynamo which generates electricity. Energy is wasted at every step.

The fuel cell eliminates the efficiency problems of the dynamo by skipping the heat cycle entirely: it transforms the potential energy stored in the chemical bonds of the fuel directly into electrical energy without the wasteful intermediate heat step. Theoretically, the fuel cell could have 100% efficiency. Certain practical limitations, internal  $I^2R$  losses, for example, make it unlikely that we will ever reach this point, but even today's relatively crude devices have little trouble achieving efficiency at least twice as good as the nearest competitors, and, what is more, they are getting better all the time.

Whatever the final form, though, there is little doubt that fuel cells will occupy an important place in future power generation. The electric car and truck whispered about for some time now, looks more likely with the coming of the fuel cell.

Fuel cells are, of course, only one of the new power sources which are being developed for future use. Others — magnetohydrodynamic, thermoelectric and thermionic generators — all have their strong points, but none of them rivals the efficiency of the fuel cell.

## COMMENTARY

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to run the machine приводить машин-  
ну в действие

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at least по крайней мере  
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what is more более того  
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## TEXT 11

### BIG PIECES SPEED HOMEBUILDING

Homes today are being built in weeks instead of months with new factory-type big-piece methods. These new methods also produce homes with better insulation, better weatherproofing, better inside and outside surfaces which are easier to care for.

Until recently, homes were built much like they were in grandpa's day — by cutting and fitting hundreds of pieces together at each house. Now architects and engineers have come to realize that prefabrication offers them considerable savings in time and money during construction. Building elements are manufactured at factories and erection is reduced to on-site assembly of ready-made parts.

Most new buildings are multistorey blocks of flats assembled from large panels forming whole-room walls. Many plants for the manufacture of large structural elements are being built.

Naturally, prefabrication is most profitable when used with a great number of repeated units. Therefore, its greatest use is in large multiunit housing projects, hotels, hostels, or where similar homes are built in relatively large numbers.

Brick has got a new life. Experimental and mass construction have confirmed that it is more effective to manufacture so-called vibrobrick panels at a plant than to lay brick buildings; the brick serves only as the load-carrying material. Thermal insulation is done with fibre glass and thermal light insulation materials.

The most labour-consuming job is plumbing, sanitation and water supply. Experience has shown that in numerous instances the potential saving in prefab plumbing assemblies and subassemblies is much greater than most other building operations. Now bathrooms are being prefabricated, complete with walls, floor, ceiling, door, bathtub, wash-basin and piping. This makes it possible to speed up housing construction substantially.

The experience of prefabricated bathrooms suggested the idea of prefabricated rooms and flats which could be simply assembled into houses.

The new techniques of Soviet housing construction include the erection of building by jacking up complete storeys as well as new effective thermal and sound insulation materials and plastics.

Another new feature is the design of special flats, not only for

the average family but also for small families; these will have community services including cafes, canteens, homeservice kitchens, gymnasiums, auditoriums, parlours, clubrooms, children's rooms, libraries, public service establishments, medical rooms, etc.

There are designs which provide for service centres to be linked with the dwelling houses by roofed passages.

## COMMENTARY

**new factory-made big-piece methods**  
новые методы заводского крупно-  
панельного изготовления  
**have come to realize** начали пони-  
мать

**on-site assembly** сборка на строитель-  
ной площадке  
**ready-made parts** сборные детали (из-  
делия)  
**brick has got a new life** кирпич вы-  
ступил в новой роли

## TEXT 12

### THE SUN AND PROBLEMS OF LIFE

The utilization of solar energy is an even more important problem than of atomic energy. It is now generally recognised that one of the most important problems of modern natural science is that of photosynthesis — the ability of plants to absorb solar energy, assimilate the carbon dioxide of the air, create organic matter and release oxygen.

Photosynthesis is not only a source of food and the process that keeps life going on earth; it is also a source of tremendous quantities of energy that man consumes, energy accumulated in combustible minerals and in plants. The green leaf holds the great secret of the transformation of solar energy into chemical energy. However, plants use up only a hundredth part of the solar radiation absorbed, though this portion of radiant energy is most efficiently utilised.

Today, in this era of space flight, the problem of solar energy and life on the earth and other planets is especially important.

Although photosynthesis is the basic process in agriculture, science is only now beginning to penetrate into the mechanism of this remarkable phenomenon. It is only recently that ways have been found for synthesizing chlorophyll.

A long time ago the prominent Soviet physicist Academician A. F. Yoffe called for a practical study of the problem of harnessing solar energy. His investigations demonstrated the possibility of efficient transformation of solar energy into electric current by means of semiconductors. And now, semiconductor photoelectric devices, solar batteries, are widely used in artificial satellites and spaceships.

As man learns about solar energy and its transformations, he will put this knowledge to use in the form of solar generators on earth. The solar devices which are now being built are already



a wise economic investment. It has been shown that such installations are profitable in a number of regions of the U.S.S.R.

Speaking about the problems of utilizing solar energy, we should stress the humane aim — raising the level of agriculture, supplying the growing population of the world with food, and the conquest of space for the good of man. Along with these, solutions can be found to many applied problems in solar-energy uses for industry and the home: the building of devices for power, heat, air conditioning, and the distillation of water.

The rays of the sun warm us here on earth, they give us life and they inspire hope that the harnessing of solar energy will mean not only a fresh approach to large and small discoveries, but also a means to raise the welfare of the peoples.

### COMMENTARY

keeps life going on earth поддержи-  
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### TEXT 13

### OUR SOLAR FAMILY

Our solar family consists of the sun, nine known planets and their satellites, asteroids, comets and meteors.

The most important body in this great family is the sun. There are few kinds of energy on the earth that are not the gift of the sun.

The sun's mass is 750 times that of all the planets put together. Like all the other bodies in the universe, it is composed of the same sort of materials we find on the earth. Of all the elements or building blocks of nature which we have discovered, some 68 have been found on the sun, and none have been found in the sun which are not now known on earth.

Our sun has a surface temperature of about 6,000°C. A star as hot as the sun must radiate an enormous amount of heat. Every square metre of the sun's surface radiates energy equal to 84,000 horse power. Yet, the total amount the earth receives is only a very small fraction of it. Here is a possible source of energy for the future. The age of the earth is about two billions of years. The sun must have been in existence long before the earth was formed. During all that time the sun has been radiating heat continuously, and still continues to do so. To produce this great amount of heat would require the hourly burning over its entire surface of a layer of high-grade anthracite coal sixteen feet thick. If the heat of the sun were produced by burning coal, it would require an inexhaustible supply to furnish such intense heat over this great period of time,

## The Planets

Planets, the most important bodies of the sun's family, are of greatest interest to man, not simply because they are nearest to him, but because he lives, works, and enjoys life on one of them. If somewhere life similar to our own exists, we must look for it on planets, not on stars, comets, or meteors.

The sun has a family of nine planets moving around it in orbits that are ellipses, and not circles. Their names in order from the sun are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto.

Mercury is not only the nearest planet to the sun, but it is, with one possible exception, the smallest of the planets. It is the swiftest in its movement about the sun, and its year consists of eighty-eight days. Because of the difficulty of locating it in the bright twilight, it has been called the "elusive planet." Venus is the brightest star in the sky, next to the sun and the moon. When it appears as an evening or morning star, it shines very brightly.

Jupiter is the giant among the family of planets. It has a diameter 11 times that of the earth. Not only is Jupiter the largest planet, but it is whirling rather quickly, completing a rotation every 9 hours and 58 minutes. In its movement around the sun, however, it is rather slow, requiring almost 12 years to make a complete revolution.

Jupiter has a family of fourteen satellites, and some of them are larger than Mercury. Beyond Jupiter is Saturn, the second largest of the planets. It has a family of 15 satellites, one of which, Titan, is larger than our moon and is almost as big as Mercury.

From recent observations made by automatic cosmic apparatuses which added three more new small satellites to the first twelve, it was established that these three new moons strikingly resemble our moon in appearance. The diameter of the fifteenth satellite, the nearest to the planet's surface, is about 50 kilometers and its surface is likely to be very uneven.

The most impressive thing about Saturn is its ring system. The rings lie like thin sheets of silver around the planet's equator. There are six basic rings stretching for about 300 thousand kilometers from the planet. Observations show that they are not solid but consist of hundreds of independent "ringlets". The automatic cosmic apparatuses also succeeded in measuring Saturn's magnetic fields which are thought to be highly important in the creation of both protoplanets and planets.

Little is known of the planets Uranus, Neptune and Pluto, they are so far away that the most powerful telescope cannot reveal anything but, small, illuminated bodies. Uranus and Neptune are small when contrasted with the earth. Uranus has four satellites and Neptune one; Pluto may not have any. In 1977 5 rings round Uranus were found, and in 1978 3 more were discovered.

Because of the earth's rotation, we have day and night on the

earth. Revolution is the earth's yearly motion about the sun. The path that the earth pursues is called its orbit. Although it is really an ellipse, it is so nearly round as to appear a true circle.

Mars aroused more interest than any of the other planets. When nearest the earth, as it was in September 1956, it is an object of great beauty.

There are many ways in which this planet is similar to the earth. It rotates on an axis in about the same time as does the earth. It has seasons similar to the seasons on the earth, except that they are nearly twice as long.

Small bodies located between the orbits of Mars and Jupiter are called asteroids.

Of these bodies, called "planetoids" or miniature planets, the largest is Ceres — 780 kilometres in diameter. Their origin is, as yet, not fully known. It is thought that they represent small masses of matter that were not able to combine into larger ones during the genesis of the solar family.

### COM-MENTARY

the sun must have been in existence  
солнце, должно быть, существовало  
are of greatest interest to man пред-

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человека  
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### TEXT 14

### METALS AND ALLOYS

One basis of classification of the elements groups them into metals and non-metals. It is with the metals that we shall concern ourselves, considering the group as a whole.

The first metals which were used by primitive man were those that are found free in nature to the greatest extent. These are gold, silver, and copper. Tin entered the metal picture when someone discovered, probably accidentally, that if it was mixed with copper the resulting substance was harder. So there came into being the alloy that we call bronze, a material which was so important in the ancient world that its name is given to one of the cultural stages in human development. The Bronze Age began in Egypt around 3,000 before our era and in Europe some 500 or 1,000 years later.

Since almost no iron exists free in nature, it undoubtedly came into general use somewhat later than those just mentioned. However, the Egyptians and Assyrians made some use of iron a number of centuries before our era. As soon as methods were developed for separating iron from its ores in reasonably large quantities and at fairly low cost, it ceased to be classed as a precious material and began its career as the world's most valuable metal from the standpoint of actual use.

Copper was one of the first metals used by man; the reason is that it is found free in nature to a comparatively large extent.

It is only since man has learned how to obtain and use metals and their alloys that he has been able to adapt his environment to

his needs and desires. The present age is, in fact, the Age of Metals and it is important that we should have some acquaintance with these useful substances.

In the ancient times, gold, silver, copper, tin, iron, lead and mercury were known as "The Seven Metals".

One other metal, zinc, has also been known in its role as one of the constituents of the alloy brass. Almost no metals other than these seven or eight were known until the eighteenth century and many that we use today, not until the nineteenth.

Metals are mostly solids at ordinary temperature and have comparatively high melting points with the exception of mercury. They are for the most part good conductors of heat and electricity, and silver is the best in these respects. They can be drawn into fine wires and hammered into thin sheets, characteristics that are called ductility and malleability, respectively. An ounce of gold can be drawn into a wire almost 50 miles long or hammered into a sheet that has an area of between 175 and 200 square feet.

In considering the chemical properties of metals, the first point which must be mentioned is that they vary widely in degree of chemical activity: some are enormously active and others very inert. In general, metals are chemically combined with one or more other elements and the compounds are known as ores.

Alloys are usually prepared, simply by melting two or more metals together and then this liquid mixture is allowed to cool and solidify. If no chemical reaction occurs between or among the constituents, the resulting alloy is a simple mixture. In some cases there is a definite reaction and the resulting alloy is a chemical compound. In a third type the degree of combination of the metals is such that the product can be described best by calling it a solid solution.

The enormous importance of alloys lies in the fact that by combining metals in this fashion almost any desired set of properties can be attained.

#### COMMENTARY

it is with the metals that we shall  
concern ourselves мы как раз и зай-  
мемся металлами  
tin entered the metal picture олово  
вошло в группу металлов  
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lies in the fact that заключается в  
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in this fashion таким образом

#### TEXT 15

#### CHEMICAL PROGRESS IN THE U.S.S.R.

In our time chemistry, as a science and industry, has become one of the prime movers of progress and much attention is being given to its development in the Soviet Union.

The rapid progress of chemistry and the chemical industry helps to provide all citizens with adequate food and means to combat diseases.

Chemistry is one of the sciences that flourished considerably in Russia before the Revolution. There are many Russian names among the classics of world chemistry. Yet the high scientific level of chemistry in old Russia was completely out of proportion with the extremely low level of industry.

In 1917 Russia accounted for 2 to 3 per cent of world industrial output. The share of the chemical industry was even lower.

The manufacture of many important chemical products was either non-existent or negligible. Tremendous mineral reserves lay untouched and hardly even explored.

As a result of the First World War and the Civil War that followed it, Russia's industry was practically destroyed. Chemical plants, which were located mainly in the country's West and South, suffered especially. For all practical purposes the chemical industry had to be built anew.

The rehabilitation of the industry was completed by 1927—28 when chemical production exceeded the 1913 level.

Many new, big chemical establishments were built during the industrialization period, from 1928 to 1940, new mineral deposits were discovered, surveyed and developed.

Other branches of the chemical industry were also set up, including chemical engineering.

Investments in the chemical industry will go into construction of establishments manufacturing plastics, synthetic fibres, synthetic rubber, aldehydes, ethers and other products of organic synthesis.

The development of the chemical industry will ensure more efficient use of the country's mineral wealth and further technological progress in all branches of the economy.

Many large new chemical works will be built and reconstructed in our country.

The main tasks confronting our chemical industry today are those of ensuring the most efficient use of available raw materials, power and by-products and the elimination of harmful effects.

The motto of Socialist industry is complete safety of work and protection of the neighbourhood around chemical plants from harmful industrial by-products.

Like all branches of Soviet science and technology, chemistry serves the interests of the people, and contributes to their well-being, health and culture.

#### COMMENTARY

was out of proportion with не соответствовал

Russia accounted for на Россию приходилось

## KIEV CIVIL ENGINEERING INSTITUTE

The Kiev Red Banner of Labour Order Civil Engineering Institute is one of the largest educational institutions for training engineering and scientific personnel and carrying out scientific research in the field of construction. It was founded by the Decree of the Supreme National Economic Council of the U.S.S.R. in 1930 on the basis of factory and communal construction branch of the Kiev Polytechnical Institute created in 1898 and the architectural faculty of the Kiev Art Institute. During the years of its work the Institute has trained thousands of engineers and architects, including specialists for 60 countries of the world.

The graduates of the Institute work at large construction sites, at designing and research institutions, at Party and Soviet bodies. Among them are outstanding engineers and architects, scientists, leading Party and Soviet workers, Heroes of the Soviet Union, Heroes of Socialist Labour, State Prize winners, Merited scientists, construction workers and architects.

At the beginning of the 1930—1931 academic year there were 842 students at the Institute. At present 9 departments and prep courses train about 10,000 students, among them young people from many countries of Europe, Asia, Africa, Latin America. All instruction and educational work with students is conducted by 45 chairs numbering over 650 teachers, more than half of whom have scientific degrees and academic ranks.

To a considerable extent, the training of engineers and architects at the Institute is carried on the basis of textbooks and manuals written by the scientists of the Institute.

There are post-graduate courses in 30 specialities at the Institute numbering over 200 post-graduates — future scientists and instructors.

The Institute has lecture buildings, a testing ground for road-construction machinery, 6 student dormitories for 3,000 persons, a modern sports complex with a stadium and a swimming-pool, a sporting health camp and a preventorium. The Institute also owns a comfortable, well-equipped assembly-hall.

The laboratories are equipped with modern apparatus and devices enabling to carry on instruction process at a high level, to conduct scientific research on a large scale. All this work is done by the staff of professors and instructors as well as by students. There is a computing centre at the Institute.

Day-time, part-time and extra-mural forms of instruction are practised in the training of specialists. The Institute is made up of the following main departments: construction, architectural, automation and complex mechanization, city development, construction-technological, sanitary engineering. The general technological departments (in Kiev and Cherkassy) train students at the first

stage of instruction (within the period of three years) according to part-time and extra-mural forms of education.

The students get theoretical and practical training at the Institute, form their work habits in students' building brigades while constructing diverse objects of national economy. Certain care is taken of the students' creative abilities and their advance. This is gained by way of including research elements into the instruction process, lectures, laboratory and practical studies, course and diploma designs. Most of the students take part in carrying out research conducted by the chairs. Many of the students' scientific works are awarded medals of the Ukrainian Academy of Sciences, prizes, diplomas at All-Union and Republican competitions.

Extensive measures are taken to improve the training of specialists, to perfect the instruction process, to use modern technical means. The teaching staff of the Institute has worked out, and the factories have manufactured, several series of teaching machines. A number of manuals have been published, and methodical directions for introducing programmed instruction have been brought into being. Functioning in this field are methodical studies, programmed training and teaching-machines laboratory. Many works in this field were presented with Diplomas of Honour, First and Second Degree Diplomas and medals.

Research work conducted at the Institute embraces scientific and technical problems in the field of construction, problems of natural and social sciences. In its scientific work the Institute is closely connected with numerous scientific-research, designing, construction and industrial organizations, including research institutes of the Academies of Sciences of the U.S.S.R. and the Ukrainian S.S.R.

The proper organization of leisure hours of students, postgraduates, the teaching staff, workers and employees of the Institute makes it possible to conduct educational, scientific-pedagogical and scientific-research work. The Institute's club with its sections of music, art and literature plays a great role in this respect.

For great successes in All-Union emulation in honour of the 50th Anniversary of the U.S.S.R. the Kiev Civil Engineering Institute was awarded a Jubilee Charter of Honour of the Central Committee of the Communist Party of the Ukraine, Presidium of the Supreme Soviet of the Ukrainian S.S.R., Council of Ministers of the Ukrainian S.S.R. and the Ukrainian Republican Council of Trade Unions. For outstanding achievements in training specialists for national economy and carrying out scientific research in the 9th Five-Year Plan the Institute was decorated with the Order of the Red Banner of Labour on the 23rd of March, 1976 by the Decree of the Presidium of the Supreme Soviet of the U.S.S.R.

#### COMMENTARY

the Decree of the Supreme National  
Economic Council of the U.S.S.R.

постановление Высшего Совета на-  
родного хозяйства (ВСХ) СССР

**factory and communal construction branch** отделение фабрично-заводского и коммунального строительства

**State Prize winner** лауреат Государственной премии

**Merited scientist** заслуженный деятель науки

**Merited construction worker** заслуженный строитель

**a tested ground for road-construction machinery** полигон строительных машин

**conduct scientific research on a large scale** вести научные исследования в широких масштабах

**award a Jubilee Charter of Honour** наградить юбилейной Почетной грамотой

## TEXT 17

### ULTRAVIOLET AND INFRARED

Visible light covers only a very small part of the electromagnetic spectrum. Just above and below the visible light range are ultraviolet and infrared light. The "ultra" in ultraviolet tells us that this light lies at frequencies higher than that of violet light; and the "infra" in infrared tells us that this light lies at frequencies lower than red.

With the wave lengths, however, it is the other way round. Ultraviolet has a shorter, and infrared a longer wave length than visible light. These radiations were discovered long before anyone thought of electromagnetism. When light was passed through a prism and formed a spectrum on a screen, scientists found that heating effects occur beyond the edges of the visible light spectrum.

Ultraviolet radiation produces many effects, some useful and some unpleasant. A certain amount of ultraviolet radiation is good for our health. It helps to form vitamin D in the skin. Ultraviolet light also kills microbes, and for that reason it is used in hospitals and to sterilize food.

Direct ultraviolet radiation is very bad for the eyes. This is one reason why it is dangerous to look directly at the sun. On the other hand, the human eye is quite capable of dealing with normal doses of scattered ultraviolet light.

Certain materials give off visible light when ultraviolet radiation falls on them. Such substances are called "fluorescent". In fluorescent lighting ultraviolet radiation falls on a special substance which lines the inside walls of the lighting tube and so produces light.

Infrared rays are heat rays, every object being a natural radiator of invisible infrared energy.

Infrared is the portion of the electromagnetic spectrum starting at the deep red (hence its name — "beyond red") and extending to the microwave radar region. It bridges the gap between visible light and the microwaves used for radar.

Infrared energy is being used in automatic regulation of chemical and biological processes, temperature measurement and control during manufacture of textiles, plastics and metals. New applications are appearing in navigation and aviation, weather research and



numerous scientific projects. Other applications for infrared are found in photography aerial mapping, communications and control techniques.

Infrared energy is in use all around us. Infrared techniques are of great value in many industrial applications and are considered indispensable in many others. The possibilities of its application appear to be limited only by the imagination and skill of the user.

Research and development are constantly improving the state of infrared technology as infrared takes its place among the tools of science. Whatever the ultimate goal of infrared may be there is no doubt that it will play an important role in industrial electronics.

### COMMENTARY

it is the other way round дело обстоит  
совершенно иначе  
hence its name отсюда происходит на-  
звание  
aerial mapping аэросъемка

is in use all around us используется  
везде  
are of great value имеют большое  
значение  
appear to be limited по-видимому,  
ограничены

### TEXT 18

### LIGHTNING

**What is Lightning?** Just how lightning is generated we can't say for sure. But we know that it's the world's most colossal spark, created by the discharge of colossal amounts of static electricity. It can carry a punch of hundreds of millions of volts, a current of 1,000 to 100,000 amperes or more.

We also know that there are two basic types of lightning. The so-called "cold" variety has extremely high voltages, combined with relatively low amperages. It hits and disappears within 1/10,000th of a second. It doesn't often start fires, but the enormous pressure of its passage can literally explode whatever it hits. "Hot" lightning, on the other hand, has extremely high amperage but relatively low voltage. With a temperature as high as several thousand degrees, this is the type that almost invariably starts fires.

Like all electric sparks, lightning results when the potential between negative and positive charges becomes great enough to cause arcing. In some cases, the arcing goes through a barrier of air between the negative charge in a storm cloud and the positive charge of the earth. While we don't know the exact mechanics by which this potential is built up, we do know the rough sequence of events.

A thunderstorm is generated when a layer of cool air overruns a mass of low-lying, moist, warm air. The warm air tends to rise through the cool air, causing its moisture to condense into water droplets. This movement of air current against air current — and possibly of droplet against droplet — generates large quantities of static electricity.

Lightning going through such non-conductors as wood or brick meets with tremendous electrical resistance. But the massive electrical energy contained in the lightning smashes through this resistance. In the process it generates enough heat to set fire to — or perhaps even melt — the structure it hits.

**Protection System.** If the lightning hits a good electrical conductor, however, it takes the path of least resistance, and its energy is carried harmlessly into the ground.

The objects which shorten the gap between the descending negative stroke leaders and the earth's positive potential form the ideal basis for a protection system. In fact, the obvious thing to do is to make part of that system the highest point on the house.

This highest point is familiarly known as the lightning rod. The modern version of Benjamin Franklin's invention is a far cry from the large creations of earlier days. It even goes by a different name — the air terminal. Today's air terminal is pencil-thin and pointed, designed to be as small as possible.

## COMMENTARY

**for sure** определенно, уверенно  
**lightning results** молния возникает  
**smashes through** прорывается  
**negative stroke leaders** массы отрицательного электричества (т. е. молнии), предшествующие удару грома

**familiarly** в обиходе  
**is a far cry** очень далек  
**it goes by a different name** известно под другим названием

## TEXT 19

### LASERS AND THEIR USES

A beam of brilliant red light sent toward the moon leaped the 250,000-mile space, illuminated a two-mile-wide circle on the moon's surface, and was reflected back to earth. The entire half-million-mile trip took just over two and a half seconds.

This wonderful achievement — the first time man has lighted another celestial body from the earth — was made possible by a super-powerful light maker called the laser.

Lighting the moon isn't the only job for which this new electronic device is ideally suited. It also serves many other purposes. Surgeons have used it as a delicate scalpel for removing tiny tumors deep within the human eye. Put to work producing a carrier wave for communication system, it may, under certain conditions, transmit more information on a single beam than thousands television stations all broadcasting simultaneously. It also welds tough metals, cuts through steel — literally in a flash — and may eventually change the trajectory of Sputniks.

The laser can perform these and scores of other remarkable things because it is the world's first source of coherent light; that

is, all of its light waves are in phase. All light until now — from the sun, from light bulbs, from flame — has been incoherent. The laser harnesses the energy of orbiting electrons, causes them to release their power in phase rather than at random as in a light bulb and generates a coherent beam of light.

The laser's fluorescent material is either a combination of gases or a synthetic ruby containing chromium atoms. The chromium absorbs green light of a certain frequency which raises its electrons to a high level. When they fall back to the normal low-energy level, they fluoresce and give off a red light.

## COMMENTARY

scores десятки  
at random произвольно  
give off light испускать свет

## TEXT 20

### TELEVISION

The sending of images through the air, or television, is of about the same age as radar. Both use waves so high in frequency that normally they are not reflected back to the ground by the upper atmosphere. For this reason television signals have a short range — usually from the transmission antenna on the horizon to a receiving antenna on the opposite horizon. On the other hand, radio signals can be reflected off the ionosphere and so sent half-way round the globe.

There are three stages in televising a picture: 1) forming and analyzing the picture in the camera; 2) sending the signal from the studio and receiving it in the TV set; 3) reconstructing the signal into a picture on the screen.

The picture is formed by a television camera in the studio. TV cameras have a cathode-ray tube (CRT) whose inside face carries a thin metal coating. This coating is sensitive to light and has high electrical resistance. It has a negative charge, so that when it is struck by light, electrons are knocked out from it into the tube. The stronger the light, the more electrons are knocked free. If one area of the tube's face is very strongly lighted, the area becomes more positive than the rest of the tube because of its losing so many electrons.

The TV camera now carries an "electric copy" of the scene in front of it. This must now be analyzed by the camera. In analyzing the picture the electron beam of the cathode ray tube is passed through two sets of "deflecting plates" arranged at right angles inside the camera tube. The first set of plates makes the beam sweep back and forth across the tube's face. The second set moves the beam up and down as it sweeps across the tube's face. Each sweep —

called a scanning motion — occurs about 30 times a second, so that the eye sees a continuous picture.

When the scanning beam strikes strongly lighted areas on the metal coating of the tube's face, the beam is partially absorbed. But areas that are dimly lighted strongly reflect the scanning beam. The reflected beams are then drawn away by a positively charged plate (conductor) inside the tube. This completes the "analysis" of the picture taken by the camera. The electric message is now strengthened, or amplified, and then sent out on a very high frequency carrier wave. When the signal strikes a TV antenna and flows into the set, it must be reconstructed before it becomes a picture on the screen. This happens inside the "picture tube", a kind of cathode-ray tube with a fluorescent screen.

In the narrow neck of the tube is a heated filament, a kind of electron gun that shoots electrons at the inside face of the tube. The stronger the signal received by the set, the more electron bullets are fired at the screen. As this steady flow of electrons leaves the filament it is focused into a beam which sweeps across the fluorescent screen — in perfect time with the beam that sweeps across the face of the tube of the TV camera back in the studio. The stronger the beam, the more it excites the fluorescent coating of the picture tube, and so the more light shows on the screen. The rapid sweeps over the screen produce a picture made up of vast numbers of tiny grains lighted and dimmed by a stream of electrons.

#### COMMENTARY

half-way round the globe вокруг по-  
ловины земного шара

the rest of the tube остальная часть  
трубки  
in perfect time совершенно синхронно

#### TEXT 21

#### NUCLEAR RADIATION GAGES FOR INDUSTRY

Nuclear radiation has teamed up with electronics to take over a very important operation in many industrial processes. We are referring to the rapidly growing application of nuclear radiation gages in industry. Radiation gages can be found checking the level of beer in cans, the stuffing of cigarettes, the thickness of wet paper, the coating of paint on metal, the stretching of rubber, and the flow of gases.

Such gages need a source of radiation and a detector to measure the amount of radiated energy. Radioactive isotopes of certain elements are used as sources and these are obtained as incidental and often undesired byproducts of a nuclear reactor. These isotopes are elements whose atomic structure has been altered during the nuclear chain reaction so that they themselves become sources of nuclear radiation. Typical materials used as sources for industrial work include strontium-90, krypton-85, cesium-137 and cobalt-60.

Radioactive isotopes emit three types of radiation of various relative strengths. The alpha radiation, consisting of high-speed helium nuclei, is not generally used for gaging since the particles are too large to penetrate dense materials in sufficient numbers. Beta radiation, which is really a stream of high-speed electrons, is used in a few radiation gages for certain specialized applications, but the most widely used type of radiation involves gamma "rays". Gamma radiation is essentially electromagnetic energy somewhat similar to but at a higher frequency than X-rays. Like X-rays, gamma radiation will expose photographic film and illuminate phosphor when the radiation has sufficient energy.

For industrial radiation gaging the radioactive material must be securely mounted and adequately shielded. For this reason this material is not normally visible. Although emitting energy and apparently "alive", a piece of radioactive strontium, cobalt, or cesium looks disappointingly like any lump of dull gray ore. Its emitted energy can only be measured by special devices such as the Geiger-Müller tube, the scintillation detector, the electroscope, or the cloud chamber. The latter two devices are not suitable as radiation gages and are only useful for laboratory experiments. However, the Geiger-Müller tube and scintillation detectors are rapidly becoming accepted industrial instruments.

Of great concern to anyone using any nuclear device is the effect of radiation on the human body. While the amount of radiation involved in most applications is very small, the effects of radiation are known to be cumulative and, therefore, even small doses can be dangerous over a period of time. For this reason all such devices are carefully designed and are completely and effectively shielded.

Radiation gaging is still a relatively new technique but its applications are growing steadily.

Radiation gages are used in steel rolling mills to maintain the desired thickness of steel (a radiation thickness gage), in the processing and chemical industries to measure density, degrees Baumé, etc.

We have highlighted only one rather narrow application of nuclear energy to industry. There are many other services which radioactive materials perform.

Radiation gaging, as described here, forms a very important link and serves as an excellent sensing device in automation systems. Its wedding to electronic devices represents a permanent union since only by electronic means can the weak radiation signals be amplified and converted into control voltages. It is another example of how electronics, combined with another technology, has produced a new and valuable tool.

#### COMMENTARY

has teamed up объединилось  
to take over (зд.) выполнять

nuclear radiation gage ядерный контрольно-измерительный прибор

the Geiger-Müller tube счетчик Гейгера-Мюллера  
the scintillation detector сцинтилляционный детектор  
the cloud chamber камера Вильсона

of great concern to anyone using any nuclear device все, кто использует ядерные приборы, очень озабочены  
we have highlighted мы осветили  
its wedding to electronic devices его объединение с электроникой

## TEXT 22

### ADVANCES IN ULTRASONICS

Ultrasonic applications continue to expand steadily. Under water, on land, and in space "silent sound" waves are used in an amazing variety of application — from underwater sound gear to experiments for controlling combustion, from welding metals to delicate brain surgery, from automatic parking systems to burglar detection devices, from remote control TV channels selectors to garage door openers and many, many more. To anyone unfamiliar with ultrasonic principles, it may seem rather strange that vibrational (mechanical) energy above the range of human hearing can be so versatile. It may be helpful to review some of the basic principles as a background before discussing current applications.

Ultrasonics makes use of "sound" waves above the range of human hearing, that is above about 20,000cps. The fact that ultrasonic vibrations can be applied to solids, liquids, or gases at low or high power provides the basis for dozens of different applications in many fields.

Ultrasonics received its first big impetus in 1917. During World War I, it was found that ultrasonic waves could be used in underwater echo-ranging. Further developments were continued in this area after the war. In World War II, Sonar (Sound Navigation and Ranging) used improved methods of generating, transmitting, and receiving ultrasonic waves and was one of the decisive factors in winning the Battle of the Atlantic against German submarines.

The principle of underwater echo ranging is simple and was subsequently applied to solids and used for flaw detection (non-destructive testing) in metals, thickness gaging of metal pipes, and in many different types of medical applications where X-rays are not practical or possible. Ultrasonic energy is also used in related echoranging applications such as guidance for the blind. Interestingly enough, bats use ultrasound for much the same purpose — as a guide during flight to prevent collision with obstructions as well as to home on a target.

Cavitation is the second major area of ultrasonic applications. Cavitation occurs when high-power ultrasonic energy from a generator is applied through a transducer to liquids, whether the liquid is water, molten metal, or paste. Cavitation is "cold boiling". The high-power ultrasonic energy causes intense agitation of the molecules in the liquid. Vapour bubbles form and implode continuously in step with the alternating rarefaction and compression cycles of

the vibrational energy applied. As a result, tremendous local forces are released in the liquid medium. Ultrasonic cavitation in liquids is the basis for applications such as ultrasonic cleaning, drilling, soldering, and numerous others. In related applications, such as ultrasonic welding of metals and sealing of plastics, the ultrasonic energy applied to the surface of the materials breaks up the surface film (oxides, contaminants, etc.). This causes a diffusion-type of molecular interaction at the point of contact. A weld results without producing or requiring enough heat to melt the materials.

Cavitation involves high power, echo ranging comparatively low power applied to the transmission medium. Specialized applications not falling readily into either of these categories commonly use low power.

## COMMENTARY

to home on a target наводить на цель  
in step with синхронно с

not falling into either of которые не  
относятся ни к одной

## TEXT 23

### ELECTRONICS AND THE NATIONAL ECONOMY

Electronics penetrates into every branch of the national economy. Electronics helps us to produce superhard alloys, pilot planes in darkness and fog, count the erythrocytes in man's blood, work out construction plans, etc., etc.

The first automatic electronic train driver in the world has been constructed in Moscow. For the first time a computing machine, and not a human being, has taken charge of an underground train. An electronic instrument mounted in a small case is installed in the first carriage, and proves to be a more accurate driver than the most experienced human operator.

Obviously no single person could perform all the necessary driving operations and time the speed accordingly to arrive on schedule at the next station. The machine solves differential equations and the solutions are sent to the motors in the form of signals. The result is not only the maximum accuracy but the minimum expenditure of power.

The rays of TV installations substitute for the eyes of the driver, and one dispatcher simultaneously controls several trains.

Electronics has since long been the principal ally of nucleonics. Automatic remote control instruments and telemechanical devices have taken the place of man in fields where man's immediate participation is impracticable, as in atomic power installations.

Electronic instruments help investigators to reveal the mysteries of the structure of matter, and to study the molecular composition of gases, liquids and solids. This is effected by the most complicated analytical instruments known as mass-spectrometers. These are

widely used by physicists for various types of analysis, and are particularly important for isotopic analysis supplying a quick and accurate result. They detect the slightest admixtures within a cubic centimetre of gas, inform the scientists of the presence of rare elements in ore, and detect the molecules of a metal in diffused steam.

The Soviet instrument-making industry manufactures a variety of computing machines to assist doctors, economists, geologists, accountants, specialists in aerodynamics, in biochemistry, shipbuilding and turbine construction.

One of the latest models of electronic machines is capable of a wide range of operations: it can calculate designs of jet planes and trajectories of artificial earth satellites, it can tell fishermen where the catch is likely to be the biggest, it is capable of working out the proper technology for the manufacture of polymers, it is useful for weather forecasting and can decipher ancient manuscripts.

Soviet scientists continue to work at cybernetic machines.

### COMMENTARY

on schedule по расписанию  
have taken the place of заменили  
impracticable невозможно

### TEXT 24

### DATA FLOW IN DIGITAL COMPUTERS

According to a popular belief, the outstanding characteristic of modern digital computer is its amazing speed. Although it is true that the computer operates with electronic swiftness, this is not its most outstanding characteristic. It is the **automatic** sequencing of its internal operations that makes the computer something more than just a king-size\* adding machine. What would be the use of a machine capable of thousands of mathematical operations per second if it were not automatic? Could an operator punch the keyboard fast enough to keep the computer supplied with data and to control the internal operations? Obviously not. The automatic digital computer must, therefore, contain a memory unit capable of holding large amounts of data and instructions, and these must be automatically extracted from memory as they are needed.

Because computers employ two-state ("on-off") type of circuits, data and instructions must be handled in binary form. The binary system of notation employs only two symbols, 0 and 1, and various combinations of these symbols are used to represent numerals and letters of the alphabet. Several such representations are shown below:

001001 = 9  
110101 = E

010111 = X  
001011 = %

---

\* 3д. очень больших размеров.



Each numeral, letter, etc. is represented by a unique group of six bits (binary digits). There are a total of 64 different six-bit combinations — more than enough to represent all the letters of the alphabet, the numerals from 0 to 9, punctuation marks, and other special symbols. In world practice there is a code now employing seven-bit groups. Since there are 128 seven-bit combinations, this code handles all the alphabetic and numeric characters and special symbols and leaves many other combinations to be used for special control purposes.

## TEXT 25

### NEITHER BURNS NOR SINKS

A quarter of a century ago it was taken for granted that only carbon atoms were capable of building up into giant polymer molecules. Our scientists turned their attention to silicon, carbon's next of kin in the Mendeleyev table, and a new branch of organic chemistry soon appeared.

Such natural silicon compounds as quartz, rock crystal and topaz are extremely heat resistant, a property which organic polymers lack so much. By "injecting" silicon atoms into polymers the scientists obtained so-called silicones, substances combining the best properties of the parent materials. Today the silicone family numbers more than 5,000 members. Both solid and liquid organo-silicon polymers have been produced. Silicone oils do not freeze at low or liquefy at high temperatures like their mineral counterparts. Heat resistant organo-silicon varnishes mixed with powdered aluminium withstand heating up to 550°C. Silicones are not affected by water, and machines and apparatuses coated with them are reliably protected from corrosion.

Scores of polymers have emerged from the laboratories and are finding wide application in industry. Scientists are experimenting extensively to learn the laws governing the properties and qualities of man-made chemical compounds. When these laws are finally formulated, science will be in a position to exploit the latent possibilities of giant molecules, thereby contributing to further progress in all branches of industry.

### COMMENTARY

it was taken for granted считали са-  
мо собою разумеющимся

carbon's next of kin стоящий непо-

средственно под углеродом (в пе-  
риодической системе Менделеева)  
latent possibilities скрытые возмож-  
ности

## THE FUTURE OF CYBERNETICS

The new science dealing with the problems of maximum control and governing of processes, known as cybernetics, occupies a leading place among the sciences of the future. The objective of this new science of controlling complicated natural processes and phenomena of society and industry is to increase the efficiency of human labour.

The field of research which has been attracting man's resources and effort for many centuries is our environment of living nature. However, progress in biology and medicine has been comparatively slow for developments in living organisms are extremely complicated.

Advances in instruments construction, the theory of information, mathematical logics, electronics and cybernetics open up great prospects of accelerating the pace of research in biology and medicine.

The part played by cybernetics in increasing the efficiency of those engaged in planning, finance, supply and other spheres of economic activity will also grow. This field of human endeavour is becoming increasingly important in our rapidly expanding and well planned socialist economy, in particular. We are facing the task of continuous planning and ensuring a well balanced development of all the branches of the national economy.

At present there are thousands of electronic computers in operation throughout the world.

The existence of hundreds of computing centres equipped with learning and rapid acting machines, and connected by automatic communication lines with industry, supply centres, transport and organs of finance will fundamentally change national economic management. Controlled by cybernetics, industrial enterprises will operate at their most efficient peak. This, in its turn, will effect tremendous economy of time and resources.

The comparatively simple methods of automation used for some technologies will become more and more complicated. As production techniques become more efficient, they can be more effectively controlled, with the aim of raising the quality and the quantity of manufactured goods and improving working conditions.

Despite the numerous results of research into cybernetics, opening up breath-taking prospects for science, industry and economics generally, it is still hard to predict the achievements this wonderful science may make in the near future, since the pace of technical progress is exceptionally great and continually increasing.

The advance in the technical progress is the outcome, primarily of the talent, inventiveness and the effort of man — this great remaker and master of nature.

## COMMENTARY

this field of human endeavor эта область человеческой деятельности

in its turn в свою очередь  
breath-taking захватывающие дух

## SYNTHETIC PLASTICS

Man has known how to make all sorts of things for many centuries. Until about 1870, however, for materials out of which to make these things, he was limited to nature's products, such as wood, stone, metals, animal oils, etc.

In using the available raw materials, man has had to accept the particular combination of properties that they happened to possess, regardless of whether or not they were desirable characteristics. With the development of modern plastics, however, he has learned how to make many raw materials out of which other things can be constructed and how to put into these materials the properties he wishes them to have.

There are three conditions a material must fulfil if it is to be classed as a modern synthetic plastic. First it must be a synthetic substance that is built up chemically and is not found in nature.

Second, the molecules of the substance must be able to polymerize. And third, at some stage of the manufacture, it must be capable of flow under heat, pressure, or both.

As the above definition suggests, plastics did not just happen. Their present development is the result of what probably has been the most extensively planned research programme. This research has been pointed toward the production of the following five main types of products:

1. Synthetic resins for use as plastics in the manufacture of moulded articles.

2. Synthetic transparent resins.

3. Synthetic bases for paints and lacquers.

4. Synthetic resins for adhesives.

5. Synthetic fibers.

There are two general types of chemical reactions by which plastics are formed. The first of these is the usual one of polymerization by which small molecules unite with each other to form large molecules. This is the process by which synthetic rubbers are made. The most important plastics formed by polymerization are those of the vinyl type, all of which are based on acetylene, although acetylene is not necessarily an important link in their manufacture.

The vinyl resins are thermoplastic, which means that they will flow under pressure at about the temperature of boiling water.

At ordinary temperatures they are hard plastics although they can be modified by the addition of plasticizers to form soft rubber-like materials which can be substituted for rubber in a great many uses. Other applications of the vinyl resins are in wrist watch straps, belts, tubing, and electric wiring insulation.

Naval ships and aircraft are wired with electric equipment insulated with polyvinyl chloride and polyvinyl acetate. They can be dissolved in solvents and spread on cloth to make it waterproof for

use in shower curtains and raincoats. They can be made into sheets and sealed to make waterproof containers or pressed into paper to make oilproof containers to replace tin cans.

Closely related to the vinyl plastics are the acryloid plastics derived from acrylic acid. They will replace glass in many uses as they form the most transparent plastics.

## COMMENTARY

raw materials сырье  
regardless of whether or not they  
were независимо от того, были ли  
они

if it is to be classed as если он дол-  
жен быть отнесен к  
plastics did not just happen пластмас-  
сы появились не случайно

## TEXT 28

### AIR CONDITIONING AND REFRIGERATION

The mechanical refrigeration industry dates back to about the time of the American Civil War, just about 100 years ago, but the machines then designed were not important commercially for many years. It was at the end of the 19th century that the first ice-making machine started commercial production, using ammonia as a refrigerant. Ammonia was for many years the most widely-used liquid refrigerant, and, indeed, is still used today in quite a few specialized applications. However, after many years' work, chemists developed the low-boiling-point fluids now in wide use in nearly all refrigeration and air-conditioning systems — non-toxic, non-flammable and non-corrosive.

By the early years of the present century, mechanical refrigeration for ice-making purposes, and for the cooling of large meat holding rooms, and other big warehousing applications, became pretty much of an accepted fact. Even so, there was still a large amount of natural ice being cut from lakes and streams in winter, stored in insulated ice houses, and delivered for summer use — both commercially and for domestic "ice boxes", which were by this time becoming fixtures in many houses.

However, "artificial" ice, made by ice plants in towns and cities began to supplant natural ice, even in these domestic boxes, as well as in commercial and industrial cooling applications, and was a major source of cooling until about the second decade of this century. The 1920s saw a major breakthrough, with the development of the domestic refrigerator. At the same time, larger and more specialized equipment was being developed for chilling applications in industry and commerce.

The idea of adapting the refrigeration cycle to creating artificial "climate" for industrial processes seems to have occurred to a number of industrialists and refrigeration engineers soon after the turn of the century.

In the 1920s air-conditioning for comfort was first used when the motion picture industry was building theatres in the United States. All of the "Movie Palaces" of those years hung out huge signs proclaiming that it was "20° cooler inside", and while, admittedly, some of the installations were far from perfect by today's standards, they served to introduce the public to air-conditioning.

While a few residences were air-conditioned prior to World War II, home air-conditioning did not really start growing until some 10 years after the war. The early residential air-conditioners were expensive, and were truly a luxury item, installed only in the most expensive homes.

Today, the number of centrally air-conditioned homes is growing each year at an accelerating pace. In addition to homes that are centrally air-conditioned, there exist window air-conditioners in one or more rooms. Complete data are not available on the penetration of air-conditioning in industrial plants, but it is known that only a small percentage of them are air-conditioned. Schools and hospitals are now also moving into air-conditioning, and most of those being designed today are being designed for air-conditioning. It has already been proved conclusively that air-conditioning is a "must" in hospitals, and all new hospital structures being built today are air-conditioned. At the same time, virtually all stores, restaurants and other retail establishments are being air-conditioned.

Aside from the creation of comfort conditions, numerous studies have determined that air-conditioning adds to human efficiency. Air-conditioning cuts the costs of products, steps up production. Many of the "new" industries of our present era, and many new developments within all types of industry, could not have existed in a non-air-conditioned age.

Three-quarters of the food that reaches our tables depends upon refrigeration, in varying degrees, from producer to consumer. Fleets of refrigerated trucks and trains bring it to refrigerated warehouses or processing plants, and other fleets carry it out and distribute it to the supermarkets. All of this has been made possible by the development of refrigeration, which has also played and is playing a large part in the development of medicine and surgery. Many of the so-called "wonder drugs" could not have been developed in non-controlled atmosphere — nor could they be stored. Refrigerated storage cabinets keep blood and living parts of the human body in "banks" to be used in surgery.

In addition to these are the newly-developed and the still-to-be-developed applications. Astronauts have to be protected from the heat generated by their passage through the atmosphere — at take-off and landing. This is achieved by special refrigeration equipment developed for the purpose. Even in jet aircraft flying at 40,000 ft, where the outside temperature is often lower than -40°F, an air-conditioner powerful enough to cool 14 homes is needed to keep passengers comfortable. With more than 150 passengers aboard

an airliner, a lot of electronic equipment, and a heat load generated by friction of the air on the aircraft's skin, temperatures inside the cabin would mount to more than 100° unless it were mechanically cooled. A small refrigeration compressor does the job.

#### COMMENTARY

were not important commercially не  
имели промышленного значения  
now in wide use широко применяю-  
щиеся в настоящее время  
pretty much в значительной степени  
even so даже в этом случае  
after the turn of the century в начале  
столетия

admittedly предположительно  
conclusively убедительно  
aside from кроме  
adds to увеличивает  
supermarket магазин самообслужива-  
ния (большой)  
does the job (зд.) поддерживает не-  
обходимую температуру

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## ПРИЛОЖЕНИЕ II

### КРАТКИЙ ФОНЕТИКО-ОРФОЭПИЧЕСКИЙ КУРС

В данном разделе вкратце описывается артикуляция отдельных звуков и более подробно — система правил чтения, определяющих связи между звуком и буквой в английском языке.

В английском языке основная трудность техники чтения заключается в отсутствии строгого соответствия между произношением слова и его написанием, т. е. между звуком и буквой.

Современный английский алфавит содержит 26 букв — 6 гласных и 20 согласных, которым соответствуют 22 гласных и 24 согласных звука. Таким образом, одна и та же гласная буква передает от трех до четырех гласных звуков. Часто имеет место и обратное явление, когда один звук передается сочетанием двух или более букв. Использование одной гласной буквы для передачи разных гласных звуков является характерной особенностью английской графической системы. Привычный для нас принцип чтения, основанный на переходе от буквы к звуку, неприменим для английского языка. Здесь приходится дробить слово не на отдельные буквы, а на более крупные графические единицы — на слоги, и одна и та же гласная буква в зависимости от типа слога читается по-разному. Знание системы связей буквы и звука способствует развитию у учащихся навыков правильного чтения на английском языке.

В английском языке существуют и слова, представляющие исключения из правил чтения, но таких слов сравнительно немного, особенно в научной и технической литературе. В учебнике они вводятся постепенно, по мере накопления учащимися лексического материала.

# А. ЧТЕНИЕ СОГЛАСНЫХ

Согласная или со- четание согласных	Произношение	Тран- скрипци- онное обозна- чение	Примеры
p, f, k, s, x, b, g, m, v, z	Эти согласные передают зву- ки, близкие к соответствую- щим звукам русского языка. Глухие звуки произносятся в английском языке более от- четливо и энергично, чем в русском языке	[p], [f], [k], [s], [ks], [b], [g], [m], [v], [z]	
альвео- лярные t, d, n, l	Кончик языка слегка касает- ся альвеол (бугорков над верх- ними зубами)	[t], [d], [n], [l]	tip, ten, fat, pit, did, dot, mud, dad, net, not, pin, pen, lamp, let, lot, lid
h	Звук, близкий к русскому х, но значительно слабее и явля- ется в сущности простым вы- дохом	[h]	him, hill, hat, hot
c	Перед гласными e, i, y	[s]	cent, central, cine- ma, city, cycle
	В остальных случаях	[k]	cat, class, fact, cut
j	Звук, соответствующий соче- танию русских звуков д и ж, произнесенных слитно	[dʒ]	jam, jet, job
g	Перед гласными e, i, y	[dʒ]	general, gin, gyp- sum
	В остальных случаях	[g]	grab, glide, gun
r	Звук, отличающийся от рус- ского р отсутствием раскати- стой вибрации; кончик языка поднимается выше альвеол и слегка загибается назад. Про- износится только перед глас- ными	[r]	race, run, rent
s	В конце слова после гласной и звонкой согласной и в сере- дине слова между гласными произносится как русское з	[z]	plays, cabs, rose
	В остальных случаях	[s]	say, caps, consider
sh ch	Звуки, близкие к русскому ш и ч	[ʃ] [tʃ]	shop, shut, chop, chip
ck	Звук, соответствующий рус- скому к	[k]	clock, block



Согласная или со- четание согласных	Произношение	Тран- скрипци- онное обозна- чение	Примеры
ng	Задняя часть языка смыкается с мягким нёбом, и воздух пропускается через носовую полость с вибрированием голосовых связок. Кончик языка у нижних зубов. Язык и нёбо остаются в указанном положении до прекращения носового звука. Получается носовой звук [ŋ], g не произносится	[ŋ]	song, ring, lung
nk	—	[ŋk]	think, bank, tank
th	Кончик языка лежит между верхними и нижними зубами. Основная часть языка остается плоской. Струя воздуха пропускается между верхними зубами и кончиком языка  • Этот звук может произноситься как а) глухой звук (без участия голоса) б) звонкий звук (с участием голоса) в служебных словах и между гласными	[θ]  [ð]	thin  this, that

## Б. ЧТЕНИЕ ПОЛУГЛАСНЫХ

Полу- гласная	Произношение	Тран- скрипци- онное обозна- чение	Примеры
w wh	Губы слегка выпячиваются вперед и округляются. Струя воздуха пропускается между губами	[w]	want, what, way
qu	В начале слова передает звук kw	[kw]	quite, quick
y	Перед гласной и после гласной передает звук, похожий на русское й	[j]	yes, yet, boy

## В. ЧТЕНИЕ ГЛАСНЫХ

### Раздел 1. ОДНОСЛОЖНЫЕ СЛОВА

#### I. Чтение гласных букв в односложных словах

1. Чтобы узнать, как читается гласная буква в односложном слове, надо определить, какой это слог — открытый или закрытый. Слог называется закрытым или открытым в зависимости от того, заканчивается ли он на согласную или на гласную. В английском языке следует отметить также наличие условно-открытых слогов типа пате, т. е. таких, в которых после гласной следует согласная с немой буквой *e*. Кроме того, чтение гласных букв в закрытых и открытых слогах изменяется в зависимости от наличия буквы *г* после гласной.

Таким образом, каждая гласная буква в английском языке может передавать четыре различных звука, как указано в следующей таблице.

Гласная буква	Без буквы <i>г</i> после гласной		С буквой <i>г</i> после гласной	
	закрытый слог	открытый слог	закрытый слог	открытый слог
	I	II	III	IV
<b>a</b>	man [æ]	name [ei]	car [ɑ:]	care [eə]
<b>o</b>	not [ɒ]	note [ou]	nor [ɔ:]	more [ɔ:]
<b>e</b>	met [e]	mete [i:]	her [ə:]	here [iə]
<b>u</b>	but [ʌ]	mute [ju:]	burn [ɜ:]	cure [juə]
<b>i/y</b>	pin [i]	pine [ai]	first [ɜ:]	fire [aɪə]
	gyp [i]	type [ai]	—	tyre [aɪə]

#### Упражнения

lamp	flag	that	hand	stamp
take	plate	skate	brave	wave
charge	spark	yard	march	harm
care	fare	share	spare	square
stop	spot	drop	box	fond
stope	stone	close	woke	smoke
form	north	short	storm	sport
core	store	spore	more	shore
less	pen	desk	spend	spent
these	scene	Swede	cede	eve
term	serve	nerve	germ	verge
	here	sphere	more	

must	bulb	dusk	rust	hunt
use	huge	cube	fuse	tune
curve	burst	burn	hurt	Turk
pure	cure	dure	lure	cure
mist	hint	cyst	gyp	strip
drive	type	wide	size	side
third	Byrd	bird	first	shirk
wire	tyrè	tire	hire	spire

## II. Зависимость чтения гласных от рядом стоящих согласных

Ряд согласных букв в английском языке оказывает влияние на чтение рядом стоящих гласных, а именно:

2. Гласная **a** после буквы **w** или сочетания **qu** в закрытом слоге обычно передает звуки [ɔ], [ɔ:]:

watch	want	wash	was	[ɔ]
warn	war	warm	quart	[ɔ:]

3. Сочетание **or** в закрытом слоге после буквы **w** передает звук [ɔ:]:

worm	work	word
worst	worth	world

4. В односложных словах читаются, как в открытом слоге:

а) гласные **i** и **o** перед сочетанием согласных **ld**:

mild	child	wild
old	sold	gold

Сравните:

mill — mild	chill — child	will — wild
odd — old	bond — bold	fond — fold

б) гласная **i** перед сочетаниями **nd** и **gh** (буквы **gh** не читаются):

kind	find	mind	bind
right	light	might	sight

Сравните:

kin — kind	fin — find	bin — bind
pink — right	lit — light	sit — sight

5. Гласная **a** в закрытом слоге читается как [ɑ:] перед сочетаниями **ff**, **ft**, **th**, **nt**, **nch**, **nse**, **s** + глухая согласная:

staff	shaft	bath
plant	branch	chance
pass	past	ask

Сравните:

stack — staff	shack — shaft	bat — bath
plank — plant	brand — branch	chap — chance
pan — pass	pack — past	grand — grasp

6. Гласная **a** в закрытом слогe перед сочетанием **l + согласная** читается как [ɔ:] (**l** перед **k** не читается):

all	call	fall	small	wall
salt	bald	false	chalk	walk

7. Гласная **u** в закрытом слогe между **p, b, f** (слева) и **ll, sh** (справа) читается как [u]:

pull	bull	full
push	bush	

8. Гласная **u** в открытом слогe после **r, l** передает звук [u:], а не [ju:]:

rule	lute
------	------

## Раздел 2. ДВУСЛОЖНЫЕ СЛОВА

### I. Ударение в двусложных словах

9. В двусложных словах ударение, как правило, приходится на начальный слог:

Marxism	typist	slogan	pilot	custom
victim	ostrich	fancy	cubic	fatal

10. Двусложные глаголы, начинающиеся с префиксов, обычно получают ударение на конечном слогe (корне). К этому случаю можно отнести и чтение ряда предлогов, союзов, наречий, а также отдельных существительных и прилагательных:

assume	affect	begin	become
compare	control	decide	define
insist	inspect	obtain	occur
report	require	support	suspect
away	before	because	aloud

11. Ряд слов префиксовой структуры получает ударение на префиксе, если эти слова выступают как существительные или прилагательные, и на конечном слогe-корне, если они выступают как глаголы; например:

(n) 'combine	'compound	'concrete	'conduct	'import
(v) com'bine	com'pound	con'crete	con'duct	im'port

Некоторые из них имеют ударение на конечном слогe независимо от того, являются ли они именем существительным, прилагательным или глаголом:

cor'rect (adj, v)	con'cern (n, v)	con'sent (n, v)
con'trol (n, v)	de'bate (n, v)	re'port (n, v)

## II. Правила графического слогоделения

12. Чтобы научиться правильно читать ударные и неударные гласные в двусложных словах, необходимо прежде всего уметь делить двусложные слова на слоги. Для этого следует усвоить следующие правила графического слогоделения:

а) если между ударной и неударной гласной в двусложном слове стоят две согласные, то граница слогоделения проходит между согласными:

'as-pect	'ob-ject	'pen-cil	'fur-ther
'tic-ket	'cus-tom	'sel-dom	'win-ter
• as-'sume	ob-'tain	per-'form	in-'sist

б) одна согласная буква между двумя гласными отходит к слогу, стоящему справа:

'fa-tal	'fo-cus	'e-ra	'fu-ry
be-'gin	de-'fine	re-'port	re-'quire

в) когда две смежные гласные буквы передают не один звук, а два, то слоговая граница проходит между ними:

'sci-ence	'li-on	'fu-el
'li-ar	'gi-ant	'tri-umph
'du-al	'cha-os	'tri-al

г) если в состав конечного неударного слога входят согласные *l* и *r*, то при графическом слогоделении они увлекают за собой ближайшую предыдущую согласную, оставляя ударный слог закрытым или открытым в зависимости от числа согласных перед *l*, *r*:

'ta-ble	'o-nly	'se-cret	'du-plex
'sti-file	'fra-grant	'me-tre	'lu-crous
'ni-trous	'cra-dle	'hy-dro	'mi-cro
'set-tle	'han-dle	'bot-tle	'fum-ble

## III. Чтение ударной гласной

13. а) в двусложных словах с ударением на конечном слоге ударная гласная читается по правилам, установленным для односложных слов:

pre'vent	con'struct	re'place	pre'cede
re'mark	re'turn	com'pare	se'cure

б) гласная *a* перед *ll* в закрытом слоге произносится [ɔ:], но если *ll* стоит на слоговой границе, то *a* читается, как в обыкновенном закрытом слоге [æ]:

'bal-lad	'bal-last,	'cal-lous	'tal-low	'gal-lap [æ]
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Сравните:

ball — ballad    call — callous    tall — tallow

в) если на слоговой границе стоят две буквы **r**, то ударная гласная читается, как в обыкновенном закрытом слоге:

‘car-ry [æ]    ‘sor-ry [ɔ]    ‘er-ror [e]    ‘cur-rent [ʌ]    ‘mir-ror [ɪ]

г) если неударный слог в двусложном слове с ударением на первом слоге содержит звук [ɪ] или [ju:], то ударная гласная читается, как в закрытом слоге независимо от того, является ли ударный слог закрытым или открытым:

‘physics	‘logic	‘limit	‘civil	‘critic
‘habit	‘rapid	‘acid	‘solid	‘liquid
‘chemist	‘planet	‘damage	‘manage	‘rivet
‘volume	‘tribune	‘value	‘statue	‘menu

Однако ударная гласная в этих случаях читается, как в открытом слоге, если:

1) ударный слог содержит букву **u**:

‘unit    ‘usage    ‘music    ‘stupid    ‘tunic

2) неударный слог содержит **y, ive**,

‘baby    ‘navy    ‘ivy    ‘native    ‘motive

3) ударный слог представляет собой корень, к которому добавлен суффикс:

‘typist    ‘whitish  
‘stylish    ‘Polish

4) за ударной гласной имеется согласная с буквой **r** после нее:

‘April    ‘matrix    ‘sacred    ‘secret    ‘hatred

#### IV. Чтение гласных в неударных слогах

14. В английском языке гласные произносятся ясно только в ударных слогах. В неударных слогах гласные обычно подвергаются редукции, т. е. ослабляются, либо вовсе не произносятся.

15. Гласные **e, i, y** и буква **a** с последующим сочетанием согласная + немое **e** дают мягкую редукцию [ɪ] в неударном слоге:

‘rabbit	‘summit	‘army	‘forty	‘pocket	‘college
‘active	‘native	‘passive	‘village	‘surface	‘manage

К этому случаю редукции гласных относится также чтение буквы **e** в грамматических окончаниях **-es** [ɪz] после свистящих и шипящих или **-ed** [ɪd] после **d** или **t**:

'classes	'watches	'wishes	'judges
'stated	'fitted	'added	'needed

Точно так же произносится окончание **-ed** в словах, не представляющих собой глагольных форм Past Indefinite или Past Participle:

'ragged    'aged    'sacred    'naked

16. Гласные **a**, **o**, **u** в неударном слоге дают твердую редукцию [ə]:

ad'dress	at'tach	con'sent
sub'mit	suc'cess	con'tain

17. Любая гласная в сочетании с **г** в конце неударного слога передает нейтральный звук [ə]:

'bitter    'Peter    'doctor    'sulphur

18. Неударная гласная не произносится совсем или звучит как нейтральный [ə] при наличии букв **l** или **n** после нее:

sudden [sʌdn]	open ['oupen]
lesson [lesn]	common ['kɒmən]
nickel [nikl]	vessel [vesl]
sentence ['sentəns]	constant ['kɒnstənt]

19. Гласные в конечных неударных слогах с **o**, **ow** и открытых слогах с **u** не редуцируются:

hero ['hiərou]	potato [pə'teɪtəu]	window ['windəu]
argue ['ɑ:gju:]	menu ['menju:]	unite [ju:'naɪt]

20. В префиксах **re-** (со значением «наново, вторично»), **un-**, несущих второстепенные ударения, и в сложных словах, состоящих из двух компонентов, восходящих к самостоятельным словам, неударная гласная не редуцируется:

unknown ['ʌn'nəʊn]	reunite ['ri:ju:'naɪt]
meanwhile ['mi:nwaɪl]	postcard ['pəʊstkɑ:d]

### Раздел 3. ЧТЕНИЕ ДИГРАФОВ

21. Диграф представляет собой сочетание двух гласных. Чтение диграфов под ударением не зависит от того, является ли ударный слог закрытым или открытым. Правила чтения диграфов в ударных слогах приводятся ниже:

1-я гласная буква	2-я гласная буква				
	a	o	e	u/w	i/y
a				pause law [ɔ:]	main may [ei] pair [eə]
o	road [ou] roar [ɔ:]	book [u] pool [u:] poor [uə]	toe [ou]* goes vetoed	loud [au] sour [auə] show [ou] town [au]	voice joy [oi]
e	teach [i:] hear [iə]		meet [i:] cheer [iə]	feud [ju:] few crew [u:]	vein [ei] grey
u			due [ju:] cues [ju:] true [u:] blue [u:]		suit [ju:] fruit juice [u:] sluice
i			pie [ai]* ties tied		

Примечание. Сочетания, отмеченные звездочкой (\*), представляют собой диграфы только перед **d** или **s** в конце слов. В остальных случаях мы имеем дело с двумя различными звуками, например:

peon ['pi:ən] dual ['dju:əl] fuel ['fju:əl] dial ['daɪəl]  
lion ['laɪən] poet ['pouɪt] triumph ['traɪəmf]

## 22. Влияние последующих согласных на чтение диграфов:

Диграф **ea** перед **d** произносится как [e]:

head bread stead tread

Диграф **oo** перед **k** читается как краткое [u]:

book hook brook took

Диграф **ea** читается как [ə:] перед сочетанием **r**+согласная:

learn early earnest

Сочетание **ou**+немое **gh** перед **t** читается как [ɔ:]:

ought fought

## 23. Некоторые диграфы в неударных слогах редуцируются. Мягкой редукции [ɪ] подвергаются следующие диграфы:

ay: 'Friday 'Thursday 'holiday  
ey: 'valley 'chimney 'trolley

Твердой редукции [ə] подвергается диграф **ou**:

'famous 'nervous 'monstrous

Не подвергается редукции диграф **ue**:

'argue 'tissue 'issue [ju:]



## I. Ударение в многосложных словах

24. Ударение в многосложных словах, как правило, падает на третий слог с конца. Если слово имеет пять слогов и больше, то, отсчитывая от ударного слога третий слог влево, найдем место второстепенного ударения:

'Hospital	'symphony	'currency	'character
ex'periment	de'mocracy	in'vestigate	'analyze
,perpen'dicular	,peri'odical	po'litical	'verify

25. Отклонения от общего правила:

а) глаголы с двусложными и двойными префиксами получают ударение на последнем слоге:

inter'fere	under'line	counter'act	inter'sect
corres'pond	disap'pear	subdi'vide	over'turn

б) трехсложные глаголы, если они не оканчиваются суффиксами **-ate**, **-ize (ise)**, **-y** и не принадлежат к группе глаголов с двусложными и двойными префиксами, получают ударение на втором слоге:

de'velop	con'sider	de'terminate	il'lumine
de'posit	de'liver	re'member	i'magine
e'xamine	en'visage	pro'hibit	es'tablish
a'bandon	ac'complish	con'tinue	dis'tinguish

в) прилагательные с суффиксом **-ic** имеют ударение на слоге, предшествующем этому суффиксу:

his'toric	eco'nomie	syste'matic	or'ganic
sul'phuric	ino'rganic	e'lectric	spe'cific

26. Группа «живых» суффиксов **-ful**, **-less**, **-ness**, **-ly**, **-er**, **-or** и грамматических окончаний **-(e)s**, **-(e)d** не сдвигает ударения с той гласной, на которую оно падает в основном слове:

'powerful	'merciless	pro'ducer
'beautiful	'readiness	in'ventor
'bitterness	con'tinuously	con'ductor

## II. Чтение ударной гласной

27. Если ударение в многосложном слове падает на конечный слог, то ударная гласная читается по правилам, установленным для односложных слов:

corres'pond	subdi'vide	decom'pose	disap'point
repre'sent	under'stand	inter'fere	under'go

28. Если ударение в многосложном слове падает на второй слог с конца, то ударная гласная читается по правилам, установленным для двусложных слов:

as'sistance	ar'rival	ad'justment
im'portance	re'current	a'musement

29. Если ударение в многосложном слове приходится на третий слог с конца, то ударная гласная читается, как в закрытом слоге, независимо от того, является ли ударный слог закрытым или открытым:

'factory	'tendency	'officer	'interval
'armament	'personal	'family	'memory
'typical	a'nalogous	'origin	com'parative
de'mocracy	e'conomy	proba'bility	hospi'tality

30. Ударная гласная читается, как в открытом слоге:

а) если вслед за ударной гласной идет другая гласная, принадлежащая последующему слогу:

'di-agram	'the-ory	'vi-olent	va'ri-ety
'di-amond	'di-ary	'sci-entist	so'ci-ety

б) при наличии гласной **u** в ударном слоге:

'unity	'union	oppo'r'tunity
'luminous	'purity	ma'turity

в) если вслед за ударным слогом идут две гласные, принадлежащие различным слогам:

'period	'genius	'radio	'serious	'genial
'mediate	'radial	'deviate	'series	ex'perience

Однако гласная **i** в этом случае читается, как в закрытом слоге, согласно п. 29:

de'cision	ef'ficient	i'nitial	mi'litia
of'ficial	'idiom	fa'miliar	con'dition

г) ударная гласная (за исключением **u**) читается, как в закрытом слоге, в тех трехсложных глаголах, в которых ударение падает на второй слог, например:

de'velop	con'sider	de'terminate	a'bolish
de'liver	de'posit	re'member	i'magine
e'xamine	es'tablish	con'tinue	dis'tinguish

В прилагательных с суффиксом **-ic**, имеющих ударение на слоге, предшествующем этому суффиксу, ударная гласная читается, как в закрытом слоге, независимо от того, является ли он закрытым или открытым, за исключением буквы **u**, которая в открытом слоге всегда читается, как в открытом слоге:

his'toric	eco'nomie	or'ganic	spe'cific
e'lectric	pho'netic	dra'matic	sul'phuric

### III. Чтение гласных в неударных слогах

31. Если ударение приходится на второй или третий слог с конца, то гласные в неударных слогах (трехсложных слов) редуцируются по изложенным ранее правилам твердой и мягкой редукации:

'adjective	'symmetry	'omnibus	'fluency
'maximum	'alphabet	'algebra	'typical

32. В конечных неударных слогах глаголов, содержащих суффиксы **-ate, ize (ise), -y**, редукации гласных **a, i, u** не происходит:

'cultivate    'organize    'occupy

В существительных и прилагательных, оканчивающихся на **-ate**, гласная **a** подвергается мягкой редукации:

(n) delegate ['delɪɡɪt], но (v) 'delegate ['delɪɡeɪt]

(adj) 'separate ['seprɪt], но (v) 'separate ['sepəreɪt]

33. Не редуцируется неударная гласная **u** в открытом слоге:

'regular    'instrument

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# ПРИЛОЖЕНИЕ III

## КРАТКИЙ ГРАММАТИЧЕСКИЙ СПРАВОЧНИК

### ОСНОВЫ ГРАММАТИЧЕСКОГО СТРОЯ АНГЛИЙСКОГО ЯЗЫКА

#### ПРОСТОЕ ПРЕДЛОЖЕНИЕ

При изучении иностранного языка самое важное — знать его строй, т. е. систему отношений между словами, и эти отношения надо научиться определять в первую очередь, иногда даже независимо от того, понятны ли сами слова или нет.

В русском языке грамматические отношения выражаются преимущественно при помощи изменения окончаний слов, поэтому в большинстве случаев мы можем переставлять члены предложения в каком угодно порядке без изменения основного содержания. Так, в предложении: «Студенты готовятся к экзаменам в библиотеке», возможны 24 перестановки, т. е. переставляя слова, мы получим 24 различных предложения, отличающихся друг от друга порядком слов, но основной смысл предложения сохраняется, поскольку в любом случае подлежащее остается подлежащим, сказуемое — сказуемым и т. д.

Чтобы правильно понять и перевести английский текст, нужно научиться анализировать предложение. Для этого следует усвоить:

а) порядок слов в предложении, т. е. его синтаксическую структуру;

б) значения и функции всех служебных элементов: артиклей, предлогов, союзов, местоимений и числительных, а также вспомогательных и модальных глаголов *to have, to be, to do; can, could, may, might; must; will, would; shall, should; ought*;

в) грамматические окончания: **-s(-es)**, **-ed**, **-ing**, **-er**, **-est**, **-ly**, где **-s(-es)** — окончание, служащее для образования множественного числа имен существительных и 3-го лица единственного числа Present Indefinite; **-ed** — окончание Past Indefinite и Past Participle стандартных глаголов; **-ing** — окончание, соответствующее Present Participle, Gerund и Verbal Noun; **-er**, **-est** — окончания, служащие для образования степеней сравнения прилагательных и наречий.

В английском языке система окончаний развита слабо; связи между отдельными словами предложения выражаются иными средствами, главным образом определенным порядком слов в предложении.

Обычный порядок слов в простом распространенном предложении может быть представлен следующим образом:

- 0 — обстоятельство,  
I — подлежащее,  
II — сказуемое,  
III — беспредложное дополнение: а) косвенное дополнение (переводится на русский язык дательным падежом), б) прямое дополнение (переводится на русский язык винительным падежом),  
IV — предложное дополнение, обстоятельство.

Например:

The teacher told the boys an interesting story yesterday  
I II IIIa IIIб IV

или

Yesterday the teacher told the boys an interesting story  
0 I II IIIa IIIб

Указанный порядок двух беспредложных дополнений IIIa и IIIб имеет место только в том случае, когда косвенному дополнению не предшествует распространенное определение. При наличии же последнего косвенное дополнение входит в состав предложной группы с предлогом to:

I am giving my friend a book,

I am giving a book to my best friend Comrade Petrov.

Следует отметить, что под словами *подлежащее, сказуемое, дополнение, обстоятельство* может подразумеваться не одно слово, а целая группа слов — группа подлежащего, группа сказуемого, группа дополнения, группа обстоятельства (т. е. член предложения вместе со всеми его определениями).

Анализ ошибок и трудностей, встречающихся при чтении литературы на английском языке, показывает, что в большинстве случаев ошибочное понимание или неверный перевод текста является результатом неумения определить отдельные члены предложения, в первую очередь главные.

В этом случае весьма полезно помнить следующее:

1) Служебные элементы (грамматические окончания, артикли, предлоги, союзы, местоимения, числительные, вспомогательные и модальные глаголы) определяют границы между отдельными членами предложения.

2) Сказуемое в предложении можно узнать по вспомогательным и модальным глаголам: to have, to be, to do; can, could; may, might; must; shall, should; will, would; ought, а также по окончаниям **-es, -ed**. Необходимо, однако, помнить, что окончания **-es, -ed** не являются достаточными признаками для выявления глагола-сказуемого. В этом случае, равно как и при отсутствии этих признаков, прежде отыскивается подлежащее, а стоящее после него слово и будет сказуемым.

Твердое знание трех главных форм основных нестандартных глаголов во многих случаях облегчает нахождение сказуемого.

3) В большинстве случаев отсутствие предлога и отсутствие глагола перед словом (существительным или его заменителем) в предложении служит признаком того, что оно является подлежащим. Исключением, как мы увидим в дальнейшем, являются случаи бессоюзного подчинения дополнительных придаточных предложений и отдельные случаи инверсии (изменения обычного порядка слов). Тогда сначала нужно найти сказуемое, а по нему подлежащее.

4) Наличие существительного без предлога после неизвестного слова служит показателем того, что это слово является глаголом, например:

Bottle the milk before shipping it.

Слово *bottle* настолько известно в значении «бутылка», что студенты часто, не задумываясь, делают неверный перевод этого простого на вид предложения. Однако наличие беспредложного существительного *the milk* сразу укажет, что слово *bottle* является в данном случае глаголом, в словаре найдем его значение «разлить по бутылкам».

5) Для английского языка характерным является то, что существительные могут выступать в функции определения.

Например:

a gas molecule — молекула газа;

the cosmic space research results — результаты исследования космического пространства;

a higher-quality alloy steel — легированная сталь повышенного качества;

the  $\frac{1}{8}$  inch inside diameter quartz tube — кварцевая лампа с внутренним диаметром  $\frac{1}{8}$  дюйма;

the room temperature neutron bombardment effects — явления, вызванные бомбардировкой нейтронами при комнатной температуре.

Ниже приводим несколько примеров подробного анализа и перевода простых распространенных предложений для иллюстрации изложенного выше.

1. Since the war the peace policy of the Soviet Union has found concrete expression in numerous acts aimed at the promotion of stable and lasting peace and international co-operation.

В первую очередь с помощью служебных элементов определяем границы между отдельными членами предложения:

Since the war / the peace policy / of the Soviet Union / has found / concrete expression / in numerous acts / aimed / at the promotion / of stable and lasting peace and international co-operation.

Единственной группой существительного, перед которой нет ни предлога, ни глагола, является *the peace policy*; следовательно, она представляет собой группу подлежащего.

Формальными признаками сказуемого обладают два члена предложения *has found* и *aimed*. Однако окончание *-ed* присуще как *Past Indefinite* (сказуемому), так и *Past Participle* (определению), тогда как вспомогательный глагол служит бесспорным показателем сказуемого.

После нахождения главных членов предложения перевод не представляет затруднений.

«Со времени войны мирная политика СССР нашла конкретное выражение в многочисленных действиях, направленных к укреплению прочного и длительного мира и международного сотрудничества».

2. For the comparison of different materials in their opposition to conduction of heat through them some unit of measurement for this thermal resistance is needed.

При помощи служебных элементов производим членение предложения:

For the comparison / of different materials / in their opposition / to conduction / of heat / through them / some unit / of measurement / for this thermal resistance / is needed.

Сказуемое узнается сразу по вспомогательному глаголу *is* и *Past Participle* глагола *need*. Единственной группой существительного, перед которой нет предлога и глагола, является *some unit*. Следовательно, это и есть подлежащее.

«Для сравнения различных материалов по их сопротивлению прохождению тепла требуется какая-нибудь единица измерения этого теплового сопротивления».

### СЛОЖНОЕ ПРЕДЛОЖЕНИЕ

Подробное описание структуры и видов сложных предложений можно найти в любом курсе грамматики английского языка. Здесь мы остановимся лишь на некоторых особенностях сложноподчиненного предложения и укажем ряд практических приемов их анализа.

Сложноподчиненное предложение состоит, как известно, из главного предложения (*the Principal Clause*) и придаточных предложений (*the Subordinate Clauses*). Типы придаточных предложений те же, что и в русском языке, а именно:

1. Придаточное предложение-подлежащее (*the Subject Clause*).
2. Придаточное предложение-сказуемое или предикативный член (*the Predicative Clause*).
3. Придаточное дополнительное предложение (*the Object Clause*).
4. Придаточное определительное предложение (*the Attributive Clause*).
5. Придаточное обстоятельственное предложение (*the Adverbial Clause*).

Придаточные обстоятельственные предложения, в свою очередь, делятся на:

обстоятельственные предложения времени (Adverbial Clauses of Time);

обстоятельственные предложения места (Adverbial Clauses of Place);

обстоятельственные предложения условия (Adverbial Clauses of Condition);

обстоятельственные предложения причины (Adverbial Clauses of Reason or Cause);

обстоятельственные предложения цели (Adverbial Clauses of Purpose);

обстоятельственные уступительные предложения (Adverbial Clauses of Concession);

обстоятельственные предложения следствия (Adverbial Clauses of Consequence or Result);

обстоятельственные предложения образа действия (Adverbial Clauses of Manner);

обстоятельственные предложения сравнения (Adverbial Clauses of Comparison).

Придаточные обстоятельственные предложения могут занимать два положения по отношению к главному — они могут стоять перед ним или после него. В первом случае, особенно когда эти предложения являются распространенными, они отделяются запятыми. Однако в научной и технической литературе эти запятые часто опускаются.

## ВИДЫ ПОДЧИНЕНИЯ ПРИДАТОЧНЫХ ПРЕДЛОЖЕНИЙ

В английском языке существуют два вида подчинения: 1) союзное подчинение, когда придаточное предложение вводится с помощью подчинительных союзов или союзных слов; в этом случае членение предложения на главное и придаточные не представляет затруднений; 2) бессоюзное подчинение, когда подчинительное союзное слово отсутствует (в дополнительных и определительных придаточных предложениях).

Чтобы определить тип придаточного предложения при бессоюзном подчинении, полезно запомнить следующее: бессоюзное придаточное предложение является дополнительным, если оно примыкает к глаголу, и определительным, если оно примыкает к существительному.

В случае затруднений в понимании текста, т. е. если содержание предложения остается непонятным несмотря на то, что все слова кажутся известными, необходимо произвести грамматический анализ текста в такой последовательности:

1) найти все подлежащие и сказуемые, пользуясь указанными выше формальными показателями;

2) произвести членение предложения на главное и придаточные;

3) определить границы между отдельными членами каждого предложения (главного и придаточных) с помощью служебных



элементов (грамматических окончаний, артиклей, местоимений, числительных, предлогов, вспомогательных и модальных глаголов);

4) выделить главные члены каждого из предложений;

5) выполнить перевод.

Анализ трудного предложения, как правило, целесообразно проводить параллельно с переводом. Однако нередко встречаются случаи, когда для уяснения смысла предложения анализ должен предшествовать переводу.

## ПРИМЕРЫ АНАЛИЗА

### А. Союзное подчинение придаточных предложений

1. That a substance is in the liquid state denotes that the melting point of the substance is below the ordinary temperature.

Анализ данного предложения легче выполнить, найдя сказуемое. Руководствуясь формальными показателями, находим сразу три сказуемых: *is*, *denotes*, *is*. Явными признаками подлежащего (отсутствие глагола и отсутствие предлога) обладают, однако, всего два существительных: первому сказуемому *is* будет соответствовать подлежащее *a substance*, а третьему сказуемому — группа подлежащего *the melting point of the substance*. Ни одно из слов, стоящих перед сказуемым *denotes*, не может быть подлежащим, следовательно, делаем вывод, что вся группа слов перед *denotes* является подлежащим и, таким образом, представляет собой придаточное предложение-подлежащее. Придаточное предложение с союзом *that*, непосредственно примыкающее к сказуемому *denotes*, является дополнительным. Членение производится следующим образом:

That a substance / *is* / in the liquid state // *denotes* // that the melting point of the substance / *is* / below the ordinary temperature.

Перевод: «То, что вещество находится в жидком состоянии, означает, что его точка плавления ниже обычной температуры».

2. The force which is called cohesion is what holds the molecules of a body together.

Анализ этого предложения также начнем с отыскания формальных показателей: *is called*, *is*, *holds*. Далее легко установить, что сказуемому *is called* соответствует подлежащее *which*, сказуемому *is* должно отвечать подлежащее *the force*. Следовательно, подлежащим к сказуемому *holds* будет служить ближайшее к нему слово *what*. В расчлененном виде предложение может быть переписано следующим образом:

The force // *which* / *is called* / *cohesion* // *is* // *what* / *holds* / the molecules of a body together.

Таким образом, рассматриваемое предложение содержит придаточное определительное предложение: *which is called cohesion*

и придаточное предложение — предикативный член: what holds the molecules of a body together.

Перевод: «Силы, которые называются силами сцепления, являются тем, что удерживает вместе молекулы тела».

3. When one force is given it is possible to find two other forces which when they are applied simultaneously will produce the same effect.

Благодаря наличию подчинительных союзов и служебных элементов, членение предложения на главное и придаточные не представляет труда, а именно:

When one force is given // it is possible to find / two other forces // which // when they are applied simultaneously // will produce / the same effect.

Главным предложением будет то, перед которым нет союзного слова: it is possible to find two other forces. Далее имеем два придаточных обстоятельственных предложения: when one force is given и when they are applied simultaneously и одно придаточное определительное предложение: which will produce the same effect.

Перевод всего предложения: «Когда дана одна сила, можно найти две другие силы, которые, если приложить их одновременно, произведут то же действие».

## Б. Бессоюзное подчинение придаточных предложений

Прежде чем перейти к рассмотрению примеров анализа, остановимся на одном случае бессоюзного подчинения придаточных определительных предложений, с которым приходится часто встречаться при чтении литературы, а именно: когда придаточное определительное предложение вводится союзным словом, перед которым стоит предлог. Например:

The kind of energy with which we are most familiar is mechanical energy.

В таком виде предложение легко анализировать и затем перевести.

При бессоюзном подчинении предлог не может предшествовать подлежащему и стоит в конце придаточного предложения. В этом случае написанное выше предложение будет выглядеть следующим образом:

The kind of energy we are most familiar with is mechanical energy.

Перевод: «Вид энергии, с которым мы знакомы лучше всего, — это механическая энергия».

При анализе предложений с бессоюзным подчинением необходимо помнить, что если в конце придаточного предложения стоит предлог без соответствующего ему именного слова, то он относится к союзным словам which, whom, whose, которые должны мысленно восстанавливаться при переводе.

In many of the cases the scientist will have to consider the magnitude of the velocity is of importance.

По формальным признакам легко найдем два сказуемых: will have to consider и is of importance. Первому сказуемому соответствует подлежащее the scientist, а подлежащим второго сказуемого является существительное the magnitude, несмотря на наличие перед ним глагола to consider, ибо нет другого слова, которое могло бы быть подлежащим. В расчлененном виде предложение может быть переписано следующим образом:

In many of the cases // the scientist / will have to consider // the magnitude of the velocity / is of importance.

Рассматривая In many cases the magnitude of the velocity is of importance как главное предложение, а the scientist will have to consider как придаточное предложение-определение к существительным cases, переводим:

«Во многих случаях, которые должен будет рассмотреть ученый, имеет значение величина скорости».

Everybody knows the mechanical and electrical inventions physics has given us are applications of physical principles.

Руководствуясь формальными признаками, выделяем три сказуемых этого предложения: knows, has given и are applications. Сказуемому knows соответствует подлежащее everybody, сказуемому has given — подлежащее physics, ибо перед этими словами нет ни предлога, ни глагола. Тогда единственной группой слов, которая может служить подлежащим к сказуемому are applications, является the mechanical and electrical inventions, несмотря на наличие перед ней глагола knows.

Разбиваем предложение на составные части:

Everybody / knows // the mechanical and electrical inventions // physics / has given us // are applications of physical principles.

Предложение the mechanical and electrical inventions are applications of physical principles является придаточным дополнительным, ибо оно примыкает к глаголу knows, а предложение physics has given us, примыкая к существительному inventions, является придаточным определительным.

Перевод: «Каждый знает (всем известно), что механические и электрические изобретения, которые дала нам физика, представляют собой приложения законов физики».

The physical state a body is in depends on the temperature and the pressure it is subjected to.

Подлежащими этого предложения являются the physical state, a body, it, как слова, перед которыми нет ни предлога, ни глагола. Подлежащему a body будет соответствовать ближайшее к нему сказуемое is, подлежащему it — сказуемое is subjected, тогда естественно, что сказуемому depends будет соответствовать подлежащее the physical state.

Расчленяем заданное предложение на составные части.

The physical state // a body is in // depends on the temperature and the pressure // it is subjected to.

Предложение: the physical state depends on the temperature and

the pressure будет главным, а предложения: a body is in, it is subjected to являются придаточными определительными предложениями бессоюзного подчинения, так как они непосредственно прилегают к существительным. Предлоги in и to в конце этих предложений при переводе ставятся перед соответствующими союзными словами.

Перевод всего предложения имеет следующий вид: «Физическое состояние, в котором находится тело, зависит от температуры и давления, которому оно подвергается».

When the point a force is applied at moves work is done.

По формальным признакам можно допустить наличие трех сказуемых: is applied, moves, is done, которым должны отвечать три подлежащих. Два из них узнаются сразу: the point и a force, благодаря отсутствию перед ними предлога и глагола. Третьим подлежащим должно быть слово work, несмотря на наличие перед ним глагола moves, ибо нет другого слова, которое могло бы быть подлежащим к сказуемому is done.

В расчлененном виде предложение имеет вид:

When the point // a force is applied at // moves // work is done.

Бессоюзное придаточное предложение a force is applied at, прилегающая к существительному the point, является определительным. Теперь перевод не представляет затруднений: «Когда точка, в которой приложена сила, движется, совершается работа».

### СЛОВСОЧЕТАНИЕ\* (WORD-COMBINATION)

Изучение иностранного языка (в данном случае английского) неизбежно связано с необходимостью четкого понимания его синтаксического строя, основу которого составляют предложение и словосочетание. Эти синтаксические категории строятся по определенным образцам — структурным схемам, вся совокупность которых входит в парадигму, т. е. систему форм.

Если для предложения характерным признаком является коммуникативная функция, т. е. функция сообщения, выражения законченной мысли, то словосочетанию свойственна иная функция — выражения незаконченной мысли, незавершенного по смыслу высказывания.

Словосочетанию, заключающему в себе блок информации, при этом выражать грамматическую и лексическую зависимость одного слова от другого. Между ними существует отношение подчиненности, например: Soviet power, a large building, to learn a language, to consist of molecules, one in a thousand и т. д.

Обязательным признаком словосочетания является наличие по крайней мере двух полнозначных слов, между которыми имеется подчинительная связь. Она может быть непосредственной, т. е.

\* Настоящий раздел для данного издания учебника написан проф. Г. П. Ятелем.

осуществляться без помощи предлога (*синтетические словосочетания*), например: to take examinations, experimental equipment, scientific research и т. д. или опосредствованной, т. е. осуществляться при посредстве предлога (*аналитические словосочетания*), например: some of the elements, free of charge, to differ in size, particles of air и т. д.

Минимальный объем словосочетания — два полнозначных слова, которые объединены подчинительной связью (без предлога или с его помощью). Такое минимальное по объему словосочетание является двучленным, представляя собой, по сути, элементарную синтаксическую структуру, например: a scientific worker, the professors of the institute и т. д. Однако эта лексико-грамматическая единица может состоять и из большего количества полнозначных слов, т. е. быть трехчленной (very large molecules, the normal state of the substance и т. п.), четырехчленной (to divide a piece of metal into parts, entirely different in its properties, two kinds of solid masses и т. п.), пятичленной (fundamental building blocks of all elements, a theoretical limit to the magnifying power of microscopes и т. п.) и т. д.

Между компонентами словосочетания могут существовать различные по характеру отношения: определительные (a solid body, a clear picture и т. д.), объектные (to found a theory, to solve a problem и т. д.), обстоятельственные (explored in accordance with Soviet space programmes, to examine the stars on moonless nights и т. д.).

Словосочетания принято классифицировать по главному (ведущему) члену, которым может быть любая полнозначная часть речи: глагол, существительное, прилагательное, местоимение, числительное, наречие. Условно обозначим эти полнозначные части речи следующим образом: V (verb), S (substantive), A (adjective), P (pronoun), N (numeral), Adv (adverb).

Зависимым (подчиненным) членом может быть также только полнозначная часть речи: существительное, прилагательное, местоимение, числительное, наречие, а также неличная форма глагола.

Следовательно, структурная схема словосочетания может иметь такой вид: V+S (например: to construct a machine, to select the material и т. д.); либо (при предложной связи, когда предлог обозначается p — preposition) V+p+S (например: to experiment in the laboratory, to enter into a reaction и т. д.).

В составе предложного словосочетания (V+p+S) предлог может быть более тесно связан (лексически и грамматически) либо с последующим, т. е. зависимым, либо с предшествующим, т. е. главным членом, образуя в первом случае препозитивную группу (p+S), а во втором случае — постпозитивную группу (V+p).

Тогда функционируют структурные схемы следующих типов: 1) V+(p+S); например: to stand in a garden, to live in Kaluga и т. д. 2) (V+p)+S; например: to turn to science, to deal with a problem, to work at a programme и т. д.

В составе препозитивной группы нередко встречаются устойчивые предложно-именные обороты наречного типа, такие, как *in general, in fact, of course, in the end* и т. п.

Словосочетания, выражающие составные понятия (в отличие от слов, выражающих простые понятия), являются средством номинации (названия) действий, предметов, качеств, находящихся в определенных соотношениях с предметами, явлениями, свойствами и т. д. Они могут быть вычленены из текста (предложения), либо служить «строительным материалом» для предложения, т. е. существовать независимо от него. Так, в специальных отраслевых словарях обычно приводятся наряду со словами-терминами и словосочетания-термины, например: *strength of materials* (сопротивление материалов), *compression fracture* (разрушение при сжатии), *fineness modulus method of proportioning* (подбор состава бетона с учетом модуля крупности) и т. п.

По своей синтаксической структуре словосочетания могут быть простыми, сложными, усложненными и комбинированными.

**Простые (или элементарные) словосочетания** представляют собой основную, базовую модель, которая служит фундаментом для разветвления всех остальных типов словосочетаний. Структурная схема простого словосочетания может быть беспредложной или предложной, например: *simple forms, deformations in structures* и т. д. Предлог либо связывает полнозначные слова между собой (например: *to exist in the world, to consist of atoms*), либо является связующим звеном, вводящим предложную группу или простое словосочетание в состав более крупной синтаксической единицы (например: *for a long time, of different kinds, in a flow of electrons* и т. д.).

**Сложные словосочетания**, в основе которых лежит структурная схема простого словосочетания (предложного или беспредложного), отличаются следующими характерными чертами: они расширяют свой компонентный состав за счет увеличения объема главного или зависимого члена словосочетания. В таких случаях входящие в состав сложных словосочетаний простые словосочетания выполняют роль главного или зависимого члена базовой модели (скажем, *V+S* или *V+p+S*). Например: а) в роли главного члена выступает простое словосочетание, а в роли зависимого — слово: *a special field of knowledge, to create conditions for workers*, и т. п.; б) роль главного члена выполняет слово, а зависимого — словосочетание: *to employ these abilities, to carry on scientific research, schools of higher learning, these two kinds* и т. п.

Таким образом, входящее в состав сложного словосочетания простое словосочетание выполняет функцию либо главного, либо зависимого члена.

**Усложненные словосочетания** состоят из простых словосочетаний, выступающих в роли как главного, так и зависимого членов. Каркасной основой их является структурная схема простого словосочетания, расширенная за счет увеличения как ведущего, так и подчиненного элемента словосочетания. Например: *to understand*

well these problems, to move differently in three states, to transform the substance in this way и т. п.

**Комбинированные словосочетания**, в основе которых также лежит структурная схема простого словосочетания, отличаются от рассмотренных выше тем, что в качестве главного или зависимого члена в них выступают координированные элементы (т. е. слова, объединенные сочинительной связью). Например: to divide and subdivide a stone; to graduate from institutes and universities; a certain field of engineering or science и т. п.

Подчинительная связь, существующая между главным и зависимыми членами словосочетания, здесь осложняется сочинительной. Комбинированные словосочетания представляют собою сжатые структуры, возникающие во избежание повторения элементов. Ср. в этом плане с вышеприведенными следующие соединения слов: to divide a stone and subdivide a stone; to graduate from institutes and to graduate from universities; a certain field of engineering or a certain field of science.

Вышеперечисленными основными типами словосочетаний не исчерпывается все их структурное многообразие. Нередко встречаются их варианты, сохраняющие, однако, основной принцип организации данной синтаксической единицы. Так, например, при развертывании словосочетания расширяться посредством координативной связи может не только главный или зависимый член базовой структурной схемы, но и относящееся к нему слово. Показательны в этом плане приведенные ниже случаи координативного расширения словосочетания: the physical and chemical changes of that substance, to produce water by combining hydrogen and oxygen, to invent a new and easy method и т. д.

Поскольку в основе всех сложных, усложненных, комбинированных словосочетаний, а также их вариантов лежат элементарные словосочетания, важно знать их главные разновидности.

Рассмотрим их более подробно. Как уже говорилось, подчинительная связь между компонентами словосочетания осуществляется либо без предлога (синтетические конструкции), либо при посредстве предлога (аналитические конструкции).

Ниже приводятся основные элементарные словосочетания, наиболее характерные для языка современной английской технической литературы.

#### **I. Элементарные беспредложные словосочетания**

1. Структурная схема V+S: to conduct electricity, to distinguish the elements, to understand the theory, etc.

2. Структурная схема V+Adv: to establish experimentally, to move rapidly, to arise at once, to come in freely, etc.

3. Структурная схема  $V_1+V_2$ : to begin to work, to plan to investigate, to go to get, etc.

4. Структурная схема S+V: a book to read, a problem to solve, the experiment to be carried out, etc.

5) Структурная схема A+V: easy to get, impossible to find out, important to understand, etc.

6) Структурная схема A+S: the material world, the gaseous state, important uses, etc.

7) Структурная схема P+S: all the elements, these changes, such combinations, etc.

8) Структурная схема  $S_1+S_2$ : miniature planets, the information machines, spaceship flights, the word molecule, etc.

9) Структурная схема N+S: two molecules, three states, the first condition, 327° Centigrade, etc.

10) Структурная схема Adv+A: very great, so small, truly remarkable, etc.

11) Структурная схема Adv+Adv: so quickly, far apart, just there, etc.

12) Структурная схема Adv+S: simply water, exactly the electrons, almost a mile, etc.

Во всех тех случаях, когда в качестве зависимого компонента словосочетания выступает существительное, его можно заместить соответствующим местоимением либо формой, эквивалентной по функции существительному.

## II. Элементарные предложные словосочетания

1) Структурная схема V+p+S: to exist in the world, to think of the problem, to consist of atoms, etc.

2) Структурная схема  $S_1+p+S_2$ : the kind of substance, the interaction of forces, the characteristics of the atom, etc.

3) Структурная схема A+p+S: true for substances, different in properties, divisible into particles, etc.

4) Структурная схема P+p+S: some of the students, none among the substances, each of the liquids, etc.

5) Структурная схема N+p+S: two of the states, one of the molecules, the first of the elements, etc.

6) Структурная схема Adv+p+S: somewhere in Siberia, early in 1980, forward to victory, etc.

7) Структурная схема V+p+A: turn to normal, to get back to ordinary, to take for granted, etc.

8) Структурная схема V+p+Adv: to work till then, to know by now, to learn since then, etc.

9) Структурная схема A+p+A: far from clean, red upon green, moderate to fresh, etc.

10) Структурная схема S+p+A: a change to quiet, the transition to soft, a wall of green, etc.

11) Структурная схема S+p+N: a figure of 100, the meeting at three, the division into two, etc.

12) Структурная схема N+p+N: one in ten, two by two, etc.

В качестве зависимого компонента предложного словосочетания обычно выступает существительное или аналогичный по функ-



ции его эквивалент (местоимение, отглагольная форма с именными признаками и т. д.).

Рассмотренными типами не исчерпывается все многообразие структурных схем словосочетания (как беспредложного, так и предложного). Здесь приведены лишь основные элементарные единицы словосочетательного уровня, лежащие в основе построения более сложных синтаксических единиц.

Твердое знание основных структурных схем словосочетания поможет ориентироваться в оригинальном английском техническом тексте и в терминологических двуязычных словарях, облегчит процесс усвоения иноязычной лексики в рамках определенных грамматических моделей, обеспечит восприятие и запоминание информации в блоках — элементарных синтактико-семантических комплексах языка.

**ТАБЛИЦА ОБРАЗОВАНИЯ  
МНОЖЕСТВЕННОГО ЧИСЛА СУЩЕСТВИТЕЛЬНЫХ**

№	Правила	Примеры
1	Большинство существительных образуют множественное число прибавлением окончания -s к форме единственного числа	scientist — scientists science — sciences day — days radio — radios
2	Существительные, оканчивающиеся на свистящий или шипящий звук, принимают окончание -es	class — classes box — boxes match — matches
3	В существительных, оканчивающихся на у с предшествующей согласной, у переходит в i и прибавляется окончание -es	city — cities library — libraries
4	Существительные, оканчивающиеся на -о с предшествующей согласной, принимают окончание -es	negro — negroes tomato — tomatoes
5	В существительных, оканчивающихся на -f или -fe, f обычно переходит в v и прибавляется окончание -es	leaf — leaves life — lives no roof — roofs
6	Некоторые существительные греческого и латинского происхождения сохраняют формы образования множественного числа тех языков, из которых они произошли	analysis — analyses basis — bases parenthesis — parentheses radius — radii nucleus — nuclei locus — loci datum — data phenomenon — phenomena

7	Некоторые существительные латинского происхождения имеют две формы множественного числа	formula — formulae — formulas medium — media — mediums memorandum — memoranda — memorandums
8	Ряд существительных образует множественное число изменением корневой гласной или добавлением суффикса	man — men woman — women foot — feet tooth — teeth child — children

### ТАБЛИЦА ОБРАЗОВАНИЯ СТЕПЕНЕЙ СРАВНЕНИЯ ПРИЛАГАТЕЛЬНЫХ

Положительная	Сравнительная	Превосходная
old small	1. В односложных прилагательных к положительной степени прибавляется суффикс <b>-er</b> older (than) smaller (than)	К положительной степени прибавляется суффикс <b>-est</b> (the) oldest (the) smallest
happy easy	2. В двухсложных прилагательных, оканчивающихся на <b>у</b> с предшествующей согласной, <b>у</b> переходит в <b>і</b> и прибавляется суффикс <b>-er</b> happier (than) easier (than)	<b>У</b> переходит в <b>і</b> и прибавляется суффикс <b>-est</b> (the) happiest (the) easiest
serious interesting difficult	3. В двухсложных и многосложных прилагательных к форме положительной степени прибавляется <b>more</b> more serious (than) more interesting (than) more difficult (than)	В двухсложных и многосложных прилагательных к форме положительной степени прибавляется <b>the most</b> (the) most serious (the) most interesting (the) most difficult
good bad little many, much far	4. Приведенные ниже прилагательные имеют следующие формы сравнительной и превосходной степени: better (than) worse (than) less (than) more (than) { farther (than) { further (than)	(the) best (the) worst (the) least (the) most (the) farthest (the) furthest

**ТАБЛИЦА МЕСТОИМЕНИИ**

	Личные				Притяжательные			
	Именитель- ный падеж		Объектный падеж		1-я форма		2-я форма	
	Ед. число	Множ. число	Ед. число	Множ. число	Ед. число	Множ. число	Ед. число	Множ. число
1	I	we	me	us	my	our	mine	ours
2	you		you		your		yours	
3	he she it	they	him her it	them	his her its	their	his hers its	theirs

### УПОТРЕБЛЕНИЕ ОСНОВНЫХ ВРЕМЕН\*

1. Present Indefinite употребляется для обозначения действия, совершающегося в настоящем, без указания на его длительность или завершенность.

She speaks English quite well.

I go to the institute every day.

2. Past Indefinite употребляется для обозначения действия, совершившегося или совершавшегося в прошлом. Past Indefinite может переводиться прошедшим временем глагола как совершенного, так и несовершенного вида.

He saw me yesterday.

We finished our work at 5 o'clock.

3. Future Indefinite употребляется для обозначения действия, которое совершится или будет совершаться в будущем. Future Indefinite может переводиться будущим временем глагола как совершенного, так и несовершенного вида.

He will return from Moscow to-morrow.

We shall help them in their work.

Примечание. Для выражения будущего действия вместо Future Indefinite употребляется Present Indefinite в обстоятельственных придаточных предложениях условия и времени после союзов if, when, as soon as, before, until, till, unless, provided (that) и т. п.

If you come in time, we shall go to the museum together.

As soon as the lesson is over, the students will go home.

\* Под основными временами подразумеваются Present Indefinite, Past Indefinite, Future Indefinite, Present Continuous, Past Continuous, Future Continuous, Present Perfect, Past Perfect, Future Perfect, Present Perfect Continuous, т. е. те времена, которые широко используются в разговорной речи и технической литературе.

**ТАБЛИЦА ВРЕМЕН**  
 Изъявительное наклонение  
*Действительный залог*

Time	Affirmative Form	Interrogative Form	Negative Form
Present	I ask he (she) asks we (you, they) ask	do I ask? does he (she) ask? do we (you, they) ask?	I do not ask he (she) does not ask we (you, they) do not ask
Past	I asked he (she) asked we (you, they) asked	did I ask? did he (she) ask? did we (you, they) ask?	I did not ask he (she) did not ask we (you, they) did not ask
Future	I shall ask he (she) will ask we shall ask you (they) will ask	shall I ask? will he (she) ask? shall we ask? will you (they) ask?	I shall not ask he (she) will not ask we shall not ask you (they) will not ask
Future- in- the-Past	I should ask he (she) would ask we should ask you (they) would ask	should I ask? would he (she) ask? should we ask? would you (they) ask?	I should not ask he (she) would not ask we should not ask you (they) would not ask
Indefinite			

Time	Affirmative Form	Interrogative Form	Negative Form
Continuous	Present I am asking he (she) is asking we (you, they) are asking	am I asking? is he (she) asking? are we (you, they) asking?	I am not asking he (she) is not asking we (you, they) are not asking
	Past I was asking he (she) was asking we (you, they) were asking	was I asking? was he (she) asking? were we (you, they) asking?	I was not asking he (she) was not asking we (you, they) were not asking
	Future I shall be asking he (she) will be asking we shall be asking you (they) will be asking	shall I be asking? will he (she) be asking? shall we be asking? will you (they) be asking?	I shall not be asking he (she) will not be asking we shall not be asking you (they) will not be asking
	Future-in-the-Past I should be asking he (she) would be asking we should be asking you (they) would be asking	should I be asking? would he (she) be asking? should we be asking? would you (they) be asking?	I should not be asking he (she) would not be asking we should not be asking you (they) would not be asking
Perfect	Present I have asked he (she) has asked we (you, they) have asked	have I asked? has he (she) asked? have we (you, they) asked?	I have not asked he (she) has not asked we (you, they) have not asked
	Past I had asked he (she) had asked we (you, they) had asked	had I asked? had he (she) asked? had we (you, they) asked?	I had not asked he (she) had not asked we (you, they) had not asked

Time	Affirmative Form	Interrogative Form	Negative Form
Future	I shall have asked he(he) will have asked we shall have asked you(they) will have asked	shall I have asked? will he (she) have asked? shall we have asked? will you(they) have asked?	I shall not have asked he(he) will not have asked we shall not have asked you(they) will not have asked
	I should have asked he(he) would have asked we should have asked you(they) would have asked	should I have asked? would he(he) have asked? should we have asked? would you (they) have asked?	I should not have asked he(he) would not have asked we should not have asked you(they) would not have asked
Present	I have been asking he(he) has been asking we (you, they) have been asking	have I been asking? had he (she) been asking? have we(you, they) been asking?	I have not been asking he(he) has not been asking we (you, they) have not been asking
Past	I had been asking he (she) had been asking we (you, they) had been asking	had I been asking? had he (she) been asking? had we (you, they) been asking?	I had not been asking he (she) had not been asking we(you, they) had not been asking
Future	I shall have been asking he(he) will have been asking we shall have been asking you (they) will have been asking	shall I have been asking? will he(he) have been asking? shall we have been asking? will you(they) have been asking?	I shall not have been asking he (she) will not have been asking ing we shall not have been asking you(they) will not have been asking
Future-in-the-Past	I should have been asking he(he) would have been asking we should have been asking you(they) would have been asking ing	should I have been asking? would he(he) have been asking? should we have been asking? would you(they) have been asking? ing?	I should not have been asking he(he) would not have been asking ing we should not have been asking you(they) would not have been asking

Perfect

Perfect Continuous

Изъявительное наклонение  
Страдательный залог

Time	Affirmative Form	Interrogative Form	Negative Form
Indefinite	Present I am asked he(she) is asked we(you, they) are asked	am I asked? is he(she) asked? are we(you, they) asked?	I am not asked he( she) is not asked we (you, they) are not asked
	Past I was asked he(she) was asked we(you, they) were asked	was I asked? was he(she) asked? were we (you, they) asked?	I was not asked he( she) was not asked we (you, they) were not asked
	Future I shall be asked he( she) will be asked we shall be asked you( they) will be asked	shall I be asked? will he( she) be asked? shall we be asked? will you( they) be asked?	I shall not be asked he( she) will not be asked we shall not be asked you( they) will not be asked
	Future- in- the-Past I should be asked he( she) would be asked we should be asked you( they) would be asked	should I be asked? would he( she) be asked? should we be asked? would you( they) be asked?	I should not be asked he( she) would not be asked we should not be asked you( they) would not be asked
Continuous	Present I am being asked he( she) is being asked we (you, they) are being asked	am I being asked? is he( she) being asked? are we(you, they) being asked?	I am not being asked he( she) is not being asked we(you, they) are not being asked
	Past I was being asked he( she) was being asked we(you, they) were being asked	was I being asked? was he( she) being asked? were we (you, they) being asked?	I was not being asked he( she) was not being asked we (you, they) were not being asked

Time	Affirmative Form	Interrogative Form	Negative Form
Present	I have been asked he (she) has been asked we (you, they) have been asked	have I been asked? has he (she) been asked? have we (you, they) been asked?	I have not been asked he (she) has not been asked we (you, they) have not been asked?
Past	I had been asked he (she) had been asked we (you, they) had been asked	had I been asked? had he (she) been asked? had we (you, they) been asked?	I had not been asked he (she) had not been asked we (you, they) had not been asked?
Future	I shall have been asked he (she) will have been asked we shall have been asked you (they) will have been asked	shall I have been asked? will he (she) have been asked? shall we have been asked? will you (they) have been asked?	I shall not have been asked he (she) will not have been asked we shall not have been asked you (they) will not have been asked?
Future-in-the-Past	I should have been asked he (she) would have been asked we should have been asked you (they) would have been asked	should I have been asked? would he (she) have been asked? should we have been asked? would you (they) have been asked?	I should not have been asked he (she) would not have been asked we should not have been asked you (they) would not have been asked?

Perfect



4. Present Continuous употребляется для выражения действия, происходящего в момент речи.

She is reading a newspaper.

5. Past Continuous употребляется для выражения действия, происшедшего в прошлом в какой-то момент или в течение определенного отрезка времени.

I was reading a book at 5 o'clock yesterday.

She was writing a letter when I came.

We were working from 5 till 7.

6. Future Continuous употребляется для выражения действия, которое будет происходить в будущем в какой-то момент или в течение определенного отрезка времени.

At 10 a. m. tomorrow we shall be working at our English.

I shall be doing my home work when you come.

They will be waiting for us from 9 till 10.

7. Present Perfect употребляется для выражения завершенного действия, результат которого ощущается в настоящее время:

а) в сочетании с наречиями неопределенного времени, такими, как ever, never, often, seldom, already и т. п.

I have already read this book.

б) в сочетании с обстоятельственными словами и выражениями, обозначающими еще не истекший период времени, такими, как to-day, this week и т. п.

Have you seen him to-day?

в) если время совершения действия вообще не указано, а результат наличен.

We have built socialism.

В таких случаях Present Perfect переводится на русский язык прошедшим совершенным.

Примечание. Однако есть случаи, когда Present Perfect не имеет результативного значения и по-русски переводится настоящим временем:

I have lived in Kiev since 1950.

I have known him all my life.

8. Past Perfect употребляется для выражения прошедшего действия, завершившегося к определенному моменту в прошлом или ранее другого прошедшего действия.

We had finished our work by 6 o'clock.

They had gone away before we came.

9. Future Perfect употребляется для выражения будущего действия, которое завершится к определенному моменту в будущем или ранее другого будущего действия.

We shall have finished our work by 6 o'clock.

They will have gone away before we come.

10. Present Perfect Continuous употребляется для выражения действия, начавшегося в прошлом, но продолжающегося и в настоящее время.

I have been working at this article since 9 o'clock.

## СОГЛАСОВАНИЕ ВРЕМЕН

### (SEQUENCE OF TENSES)

1. Если сказуемое главного предложения выражено глаголом в одной из форм настоящего или будущего времени, то сказуемое дополнительного придаточного предложения может быть выражено любым временем.

She says that her brother works much.

She says that her brother worked much.

She says that her brother will work much.

2. Если сказуемое главного предложения выражено глаголом в одной из форм прошедшего времени, то сказуемое дополнительного придаточного предложения выражается одним из прошедших времен.

а) Для выражения действия, одновременного с действием главного предложения, в придаточном предложении употребляются Past Indefinite и Past Continuous, которые переводятся на русский язык настоящим временем.

She knew that I lived in Kiev.

Она знала, что я живу в Киеве.

He thought that I was waiting for him.

Он думал, что я ожидаю его.

б) Для выражения действия, предшествующего действию главного предложения, в придаточном предложении употребляется Past Perfect, которое переводится на русский язык прошедшим временем.

He said that he had finished his work.

Он сказал, что закончил работу.

в) Для выражения действия, будущего по отношению к действию главного предложения, в придаточном предложении употребляется время Future-in-the-Past.

I said that I should help him in his work.

Я сказал, что помогу ему в работе.

## СПОСОБЫ ПЕРЕВОДА СТРАДАТЕЛЬНЫХ ОБОРОТОВ НА РУССКИЙ ЯЗЫК

1. Страдательные обороты могут переводиться на русский язык посредством: а) краткой формы причастия страдательного залога; б) возвратного глагола на -ся; в) глагола действительного залога в третьем лице множественного числа с неопределенно-личным значением.

The house is built.

а) Дом построен.

б) Дом строится.

в) Дом строят.

2. Страдательные обороты, подлежащее которых соответствует беспредложному косвенному дополнению действительных оборотов, обычно переводятся на русский язык неопределенно-личными оборотами.

I was given an English book.

Мне дали английскую книгу.

They were shown a new film.

Им показали новый фильм.

3. Страдательные обороты, подлежащее которых соответствует предложному косвенному дополнению, обычно переводятся на русский язык неопределенно-личными оборотами.

The doctor was sent for.

За доктором послали.

His report was much talked about.

О его докладе много говорили.

4. Страдательные обороты, состоящие из формального подлежащего-местоимения it и глагола в страдательном залоге (типа it is said, it is reported, it is expected и т. п.) обычно переводятся на русский язык глаголами третьего лица множественного числа с неопределенно-личным значением.

It is said that the meeting will take place to-morrow.

Говорят, что собрание состоится завтра.

It is expected that the experiment will be a success.

Ожидают, что опыт будет удачным.

## НЕЛИЧНЫЕ ФОРМЫ ГЛАГОЛА (NON-FINITE FORMS OF THE VERB)

В английском языке глагол имеет три неличные, т. е. неспрягаемые, формы, а именно:

1) Infinitive (неопределенная форма),

2) Participle (причастие, деепричастие),

3) Gerund (герундий).

Неличные формы глагола не имеют форм лица и числа, и поэтому они не могут самостоятельно выступать в функции сказуемого. Кроме того, они не имеют наклонений.

Английский инфинитив происходит от отглагольного существительного. Этим и объясняется, в сущности, его двойственная природа: ему свойственны не только признаки глагола (он обладает системой временных и залоговых форм, может иметь после себя дополнение и определяться наречиями), но и некоторые признаки существительного (может выполнять в предложении функции подлежащего и дополнения).

Показателем инфинитива в английском языке служит частица **to** (*to speak* — говорить, *to see* — видеть), которая опускается в некоторых случаях. Укажем главные из них:

а) при сочетании с модальными и вспомогательными глаголами: *can, could; may, might; must; shall, should; will, would; to do*. Например:

*I could not come yesterday* — Я не мог прийти вчера.

*He does not study French* — Он не изучает французский язык.

б) в объектном инфинитивном обороте (*Complex Object*) после таких глаголов, как *to see* — видеть, *to hear* — слышать, *to watch* — наблюдать, *to feel* — чувствовать (в смысле физического восприятия), *to let* — пускать, позволять, разрешать, *to make* — заставлять:

*We saw the boy enter the house* — Мы видели, что мальчик вошел в дом.

*I felt him put his hand on my shoulder* — Я почувствовал, как он положил руку мне на плечо.

*Let him do it* — Пусть он сделает это.

*They made him resume his work* — Они заставили его возобновить работу.

## I. ФОРМЫ ИНФИНИТИВА

Формы инфинитива	Действительный залог (Active Voice)	Страдательный залог (Passive Voice)
1. Неопределенный инфинитив (Indefinite Infinitive)	<i>to take</i>	<i>to be taken</i>
2. Перфектный инфинитив (Perfect Infinitive)	<i>to have taken</i>	<i>to have been taken</i>
3. Длительный инфинитив (Continuous Infinitive)	<i>to be taking</i>	—
4. Перфектный длительный инфинитив (Perfect Continuous Infinitive)	<i>to have been taking</i>	—

В отношении употребительности форм инфинитива можно сказать, что в устной речи и в научно-технических текстах наиболее широко распространенной формой является неопределенный инфинитив действительного залога. Реже встречается неопределенный инфинитив страдательного залога. Очень редко применяются перфектные формы инфинитива, особенно в научной и технической литературе и в устной речи. Случаи использования длительного инфинитива чрезвычайно редки (на них мы здесь останавливаться не будем).

Рассмотрим несколько простых примеров с целью иллюстрации способов перевода различных форм инфинитива:

He is glad to see me — Он рад меня видеть.

It was a pleasant surprise for him to be invited to the conference — Для него явилось приятной неожиданностью, что его пригласили на конференцию.

He is glad to have spoken to me — Он рад, что поговорил со мной.

I am glad to have been asked to take part in research — Я рад, что меня попросили принять участие в исследовании.

Неопределенный инфинитив действительного залога может переводиться неопределенной формой глагола либо существительным. Неопределенный инфинитив страдательного залога обычно переводится придаточным предложением и реже — неопределенной формой глагола. Что касается перфектных форм, то они за редкими исключениями переводятся придаточными предложениями.

## II. ФУНКЦИИ ИНФИНИТИВА В ПРЕДЛОЖЕНИИ

В настоящей работе мы не рассматриваем всех функций инфинитива. Мы останавливаемся лишь на тех его функциях, которые представляют интерес с точки зрения особенностей перевода научно-технической литературы.

### 1) Инфинитив в функции подлежащего

To answer the question of how much higher or lower the temperature is requires a unit of measurement and a special kind of instrument.

В данном примере имеются два слова с формальными признаками подлежащего в предложении: инфинитив to answer и существительное the temperature. Сказуемыми соответственно являются requires и is. Перевод инфинитива to answer в функции подлежащего может быть выполнен при помощи неопределенной формы глагола либо существительного:

«Ответ на вопрос о том, насколько повышается или понижается температура, требует какой-нибудь единицы измерения и специального прибора».

Перевод может быть теперь стилистически изменен следующим образом:

«Для ответа на вопрос о том, насколько повышается или понижается температура, требуется какая-нибудь единица измерения и специальный прибор».

Часто, когда подлежащим в предложении служит инфинитивная группа, она занимает положение после сказуемого, перед которым тогда ставится так называемое вводное *it*. Само личное местоимение *it* при этом не переводится, оно служит лишь формальным безличным подлежащим, тогда как смысловым подлежащим является инфинитив. Такого рода конструкция встречается в предложениях типа *it is necessary to...* — необходимо, *it is important to...* — важно, *it is easy to...* — легко, *it is difficult to...* — трудно и т. д. Например:

*Common experience teaches that it is difficult to stop or change the direction of a body moving with considerable velocity.*

Придаточное дополнительное предложение, начинающееся союзом *that*, представляет собой конструкцию с вводным *it*, которое не переводится, а инфинитивная группа *to stop or change the direction...* является смысловым подлежащим. Перевод предложения:

«Повседневный опыт учит нас, что трудно остановить или изменить направление тела, движущегося со значительной скоростью».

## 2) Инфинитив в функции обстоятельства цели или следствия

Инфинитив и зависящие от него слова в функции обстоятельств могут стоять в начале предложения перед подлежащим или в конце предложения.

Инфинитив в функции обстоятельства цели обычно переводится неопределенной формой глагола с союзом «чтобы» или «для того чтобы». В этом случае перед инфинитивом часто ставится составной союз *in order to* — для того чтобы.

Инфинитив в функции обстоятельства следствия обычно сочетается со словами *enough*, *sufficiently* (достаточно) и другими, и тогда он также переводится неопределенной формой глагола с союзом «чтобы». В некоторых случаях, особенно в научной и технической литературе, такой инфинитив может переводиться придаточным предложением, деепричастием или каким-нибудь другим способом.

*To answer the question in what way we explain the differences in properties of the solid, liquid, and gaseous states, we must study the structure of matter in each of these states.*

В этом примере инфинитивная группа *to answer the question* представляет собой обстоятельство цели и переводится неопреде-

ленной формой глагола с союзом «для того чтобы» или просто «чтобы».

«Для того чтобы ответить на вопрос о том, как объясняется различие в свойствах твердого, жидкого и газообразного состояния, необходимо рассмотреть строение вещества в каждом из этих состояний».

The heating elements of a system may be constructed and located to emit as much as possible of their heat through radiation.

Инфинитивная группа с инфинитивом to emit занимает место в конце предложения и является, таким образом, обстоятельством. Из содержания предложения видно, что это обстоятельство следствия:

«Элементы отопительной системы можно сконструировать и разместить так, чтобы они излучали возможно больше тепла с помощью радиации».

When a mixture of iron and sulphur is heated they combine to form a new substance known as iron sulphide.

Инфинитив to form в функции обстоятельства следствия часто встречается в научной и технической литературе и, как правило, переводится деепричастием или существительным:

«Если нагревать смесь железа и серы, они соединяются, образуя новое вещество, известное под названием сульфид железа».

Деепричастный оборот «образуя новое вещество» можно заменить оборотом «с образованием нового вещества».

### 3) Инфинитив в функции определения

Инфинитив в функции определения стоит непосредственно после определяемого слова.

В английской научной и технической литературе инфинитив в функции определения встречается главным образом в пассивной форме и реже — в активной. В первом случае он имеет модальный оттенок долженствования, выражая действие, которое должно или может совершиться в будущем, и переводится придаточным определительным предложением. Часто, однако, такой модальный оттенок не соответствует стилю языка русской научной литературы, и инфинитив переводится придаточным предложением, в котором глагол имеет оттенок настоящего или будущего времени.

Next to be considered is the place of the atom in the general scheme of the structure of matter.

Пассивный инфинитив to be considered примыкает к слову next, заменяющему существительное, и является к нему определением с модальным оттенком,

Перевод предложения:

«Далее необходимо рассмотреть, какое место занимает атом в общей схеме строения вещества».

Air motion at all points within the space to be considered must be sufficiently rapid to prevent air being close.

В этом предложении два инфинитива: to be considered и to prevent. Первый из них, в пассивной форме, занимает положение непосредственно после существительного the space и служит определением к нему, но в данном случае модальный оттенок не соответствовал бы стилю русской технической литературы. Второй инфинитив в сочетании с наречием sufficiently служит обстоятельством следствия. Перевод выглядит следующим образом:

«Чтобы воздух не был сперт, движение воздуха во всех точках рассматриваемого пространства должно быть достаточно быстрым».

The heat to melt the metal cannot be supplied instantaneously by the flame.

В этом примере явно чувствуется модальный оттенок инфинитива to melt, служащего определением к подлежащему the heat, к которому он примыкает. Перевод может быть выполнен следующим образом:

«Теплота, необходимая для расплавления металла, не может быть передана пламенем мгновенно».

### III. ПРЕДИКАТИВНЫЕ ИНФИНИТИВНЫЕ ОБОРОТЫ

В английском языке встречаются три типа предикативных инфинитивных оборотов, а именно:

- 1) Объектный инфинитивный оборот.
- 2) Субъектный инфинитивный оборот.
- 3) Инфинитивный оборот с предлогом for.

Эти обороты особенно часто встречаются в английской научно-технической литературе, и надлежащий перевод их имеет большое значение для правильного понимания прочитанного.

#### 1) Объектный инфинитивный оборот (The Objective Infinitive Construction)

Рассмотрим предложение:

We know the students to have visited the museum of Russian art,

в котором the students является дополнением к глаголу know, а to have visited — инфинитив, примыкающий к этому дополнению. В данном случае мы имеем дело не с простым дополнением the



students к глаголу know, а с целым сочетанием the students to have visited, образующим сложное дополнение, между составными частями которого существует тесная связь, а именно — дополнение the students представляет собой субъект действия, выраженного инфинитивом to have visited. Это сочетание дополнения с инфинитивом носит название объектного инфинитивного оборота и обычно переводится придаточным дополнительным предложением.

Таким образом, перевести предложение следует так: «Мы знаем, что студенты посетили музей русского искусства».

Объектный инфинитивный оборот (сложное дополнение) может употребляться только после определенных глаголов в действительном залоге, а именно:

а) после глаголов, выражающих физическое восприятие: to hear — слышать, to see — видеть, to feel — чувствовать, to watch — наблюдать и т. д. В этом случае перед инфинитивом глагола отпадает частица to;

б) после глаголов, выражающих умственное восприятие: to know — знать, to think — думать, to believe — верить, считать, to consider — считать, to prove — доказывать, to find — находить, to expect — ожидать, предполагать, to assume, to suppose — допускать, предполагать, to show — показывать, to mean — подразумевать, думать, to understand — понимать и т. д.;

в) после глаголов, выражающих волю, желание, принуждение, приказание, позволение: to want — хотеть, to desire, to wish — желать, хотеть, to like — хотеть, нравиться, to dislike — не хотеть, не нравиться, to cause — принуждать и т. д.

Приводим примеры перевода объектного инфинитивного оборота.

Chemical investigation has shown each element to combine with another only in definite proportions.

В приведенном предложении содержится сочетание существительного element с инфинитивом to combine после глагола to show, принадлежащего к указанным выше группам глаголов. Следовательно, в данном случае мы имеем дело с объектным инфинитивным оборотом и переводим предложение следующим образом:

«Химические исследования показали, что каждый элемент соединяется с другим только в определенных пропорциях».

We assume the applied forces to be known since they may be determined from the conditions of the problem.

Аналогично предыдущему примеру легко выделяем объектный инфинитивный оборот the applied forces to be known и переводим его так:

«Мы предполагаем, что внешние силы известны, поскольку они могут быть определены из условий задачи».

## 2) Субъектный инфинитивный оборот (The Subjective Infinitive Construction)

### Предложение

An electric current is known to be a stream of electrons in motion

характерно наличием сказуемого в пассивной форме, за которым следует инфинитив глагола. Для правильного перевода должны быть определены, в первую очередь, синтаксические связи главных членов предложения.

Подлежащее *an electric current* и сказуемое в пассивной форме *is known* найти легко. Трудности возникают только при определении синтаксической функции инфинитива *to be*. В этом случае мы будем рассматривать инфинитив в тесной связи с субъектом выраженного им действия или состояния, т. е. подлежащим. Иначе говоря, в предложениях такого типа сочетание «подлежащее + инфинитив» при сказуемом в пассивной форме выступает в роли сложного подлежащего. Такое сочетание носит название субъектного инфинитивного оборота, и для перевода его можно установить следующее простое правило: сложное подлежащее можно перевести придаточным дополнительным предложением, а пассивное сказуемое — главным предложением в неопределенно-личной или безличной форме.

Придерживаясь этого правила, нетрудно выполнить перевод указанного выше предложения: «Известно, что электрический ток представляет собою поток электронов в движении».

Отсюда легко перейти к стилистически более правильному переводу: «Электрический ток, как известно, представляет собой поток движущихся электронов».

Субъектный инфинитивный оборот особенно широко распространен в научной и технической литературе. Он так же, как и объектный инфинитивный оборот, употребляется в сочетании с определенными группами глаголов в пассивной форме, а именно:

а) с глаголами, выражающими физическое восприятие: *to see* — видеть; *to hear* — слышать, *to feel* — чувствовать, *to observe* — наблюдать;

б) с глаголами, выражающими умственное восприятие: *to know* — знать, *to think* — думать, *to believe* — верить, считать, *to consider* — считать, *to prove* — доказывать, *to find* — находить, *to expect* — ожидать, предполагать, *to assume*, *to suppose* — допускать, предполагать, *to show* — показывать, *to mean* — подразумевать, думать;

в) с глаголами *to say* — говорить, сказать, *to want* — хотеть и др.

Рассмотрим несколько примеров перевода субъектного инфинитивного оборота.

Light waves are now believed to be due to the motions of the electrons themselves within the atoms.

В этом предложении сразу бросается в глаза характерный признак субъектного инфинитивного оборота: наличие инфинитива *to be due* после сказуемого в пассивной форме *are believed*. Сочетание подлежащего *light waves* с инфинитивом *to be due* представляет собой сложное подлежащее и переводится придаточным дополнительным предложением. Пассивное сказуемое *are believed* переводится главным предложением в неопределенно-личной форме. Перевод:

«Теперь считают, что световые волны обусловлены движением электронов внутри атомов».

The work done by the applied forces may be said to be stored in the loaded body as potential energy.

Инфинитив *to be stored* после сказуемого в пассивной форме *may be said* указывает на наличие субъектного инфинитивного оборота. Сочетание подлежащего *the work* с инфинитивом *to be stored* выступает как сложное подлежащее и переводится придаточным предложением, а пассивное сказуемое передается главным предложением в безличной форме. Перевод предложения имеет следующий вид:

«Можно сказать, что работа внешних сил накапливается в нагруженном теле в форме потенциальной энергии».

В технической литературе нередко встречаются случаи, когда субъектный инфинитивный оборот как бы в скрытой форме входит в состав причастного определительного оборота. Последний тогда переводится придаточным определительным предложением по типу субъектного инфинитивного оборота. Например:

Only methods known from practical experience to be reliable have been selected for the solution of the problem.

«Только методы, которые, как известно из практического опыта, являются надежными, были выбраны для решения задачи».

Субъектный инфинитивный оборот употребляется также очень часто в сочетании с немногочисленной группой глаголов в активной форме:

*to seem, to appear* — казаться; *to turn out, to prove* — оказываться, *to happen* — случаться и с выражениями: *to be likely, to be sure, to be certain, etc.*

Рассмотрим несколько примеров:

Considerations of this sort seem (appear) to lead to the conclusion that all particles possess certain characteristics — Соображения этого рода, по-видимому, ведут к заключению, что все частицы обладают определенными характеристиками.

The beta particles turned out (proved) to be identical with the electrons — Бета-частицы оказались идентичными электронам.

The method happens to give satisfactory results — Оказывается, что этот метод дает удовлетворительные результаты.

The application of this new theory is likely (sure, certain) to give accurate results — Применение этой новой теории, кажется (обязательно), дает точные результаты.

### 3) Инфинитивный оборот с предлогом *for* (Infinitive Construction Introduced by the Preposition *for*)

Этот оборот является весьма характерным для английской научной и технической литературы. Он представляет собой сложное сочетание, состоящее из инфинитива, перед которым стоит субъект его действия или состояния, введенный предлогом *for*. Например:

It is necessary for the two metals to have the same structure.

Такая конструкция может выполнять функции любого члена предложения и обычно переводится придаточным предложением соответствующего типа. Тот или иной подчинительный союз подставляется смыслом предложения.

В приведенном выше предложении сочетание *for the two metals to have the same structure* представляет собой инфинитивный оборот с предлогом *for* в функции подлежащего к сказуемому *is necessary*. Вводное местоимение *it* играет роль формального подлежащего. Перевод выполняется так:

«Необходимо, чтобы оба материала имели одинаковую структуру».

For a body to be in equilibrium under the action of a set of forces, three conditions must be satisfied.

Здесь инфинитивный оборот с предлогом *for* (*for a body to be*) выступает в роли обстоятельства цели и переводится придаточным обстоятельственным предложением. Перевод:

«Для того чтобы тело находилось в равновесии под действием системы сил, должны удовлетворяться три условия».

### ПРИЧАСТИЕ (THE PARTICIPLE)

В современном английском языке Participle обладает свойствами прилагательного (причастия) и глагола и может выполнять в предложении соответственно две функции — определения и обстоятельства. Этим двум функциям английского Participle в русском языке соответствуют две неличные формы: причастие и деепричастие.

# І. ФОРМЫ PARTICIPLE, ИХ ФУНКЦИИ И СПОСОБЫ ПЕРЕВОДА

	Действительный залог	Страдательный залог
Причастие настоящего времени (Present Participle)	asking  <b>определение</b> — переводится причастием настоящего времени соответствующего залога или придаточным определительным предложением; <b>обстоятельство</b> — переводится деепричастием настоящего или прошедшего времени соответствующего залога или придаточным обстоятельственным предложением;	being asked
Перефектное причастие (Perfect Participle)	having asked  <b>обстоятельство</b> — переводится деепричастием прошедшего времени соответствующего залога или придаточным обстоятельственным предложением;	having been asked
Причастие прошедшего времени (Past Participle)	—	asked  <b>определение</b> — переводится причастием прошедшего времени страдательного залога или придаточным определительным предложением; <b>обстоятельство</b> — переводится придаточным обстоятельственным предложением

У непереходных глаголов, например to go — идти, to come — приходить и др., причастие прошедшего времени Past Participle самостоятельной функции не выполняет, а употребляется лишь в сочетании со вспомогательными глаголами для образования сложных форм.

Приведем несколько практических замечаний о зависимости между местом Participle в предложении и выполняемой им функцией.

В качестве определения Present Participle Active и Past Participle, как и в русском языке, обычно ставится перед определяемым словом: the growing strength of the Soviet Union — растущая мощь Советского Союза, the broken watch — сломанные часы.

Однако, в отличие от русского языка, эти формы Participle могут стоять и после определяемого слова, что особенно характерно для стиля языка научной и технической литературы. Present Participle Passive всегда стоит после определяемого слова. Например:

The method being employed\* gave a high degree of accuracy —  
Применяемый метод дал высокую степень точности.

The material being treated — материал, подвергаемый обработке.

В составе причастного определительного оборота все формы Participle занимают место после определяемого слова. Participle в функции определения легко распознается, ибо примыкает к определяемому слову и не отделяется от него запятой.

В функции обстоятельства Participle обычно стоит перед подлежащим или в конце предложения.

Рассмотрим несколько примеров.

Having discussed several cases when water and vapour behave independently, we now may examine one very important case when the presence of one affects the other.

Здесь Perfect Participle в активной форме выступает в роли обстоятельства и может быть переведен деепричастием. Перевод предложения:

«Обсудив несколько случаев, когда вода и пар ведут себя независимо друг от друга, мы теперь можем рассмотреть очень важный случай, когда наличие одного из них влияет на другое».

Having been allowed to combine with iron, sulphur forms sulphide of iron and a steel is produced that is brittle when it is hot.

Perfect Participle в пассивной форме having been allowed может выполнять только функцию обстоятельства и переводится придаточным обстоятельственным предложением времени или условия. При переводе такого типа предложений подлежащее перемещается к Participle и заменяется личным местоимением при сказуемом главного предложения:

«Когда сера имеет возможность соединяться с железом, она образует сульфид железа, и получается сталь, хрупкая, когда она нагрета».

When the particles have gained enough energy to overcome the force of cohesion tending to hold them together as a liquid, they leave the liquid, forming vapour.

В данном предложении мы имеем два Present Participle в активной форме: tending и forming. В первом случае Participle непосредственно примыкает к существительному force (of cohesion) и, следовательно, является определением к нему. Во втором случае причастие, хотя и примыкает к существительному liquid, отделяется от него запятой и поэтому выполняет функцию обстоятельства, т. е. переводится деепричастием:

«Когда частицы приобретают достаточную энергию, чтобы преодолеть силы сцепления, стремящиеся удерживать их вместе в форме жидкости, они покидают жидкость, образуя пар».

Нередко встречаются случаи, когда Past Participle сочетается с предлогом, после которого отсутствует существительное. В таких случаях предлог относится к субъекту действия или состояния, выраженного Participle, и оборот переводится при помощи придаточного определительного предложения. Например:

It is generally known that of two similar bodies the one acted upon by the larger force will experience the greater acceleration.

В придаточном дополнительном предложении, которое начинается союзом *that*, формальными признаками подлежащего и сказуемого обладают соответственно слова *the one* и *will experience*. Следовательно, *acted upon by the larger force* будет представлять собой причастный определительный оборот, входящий в состав группы подлежащего; предлог *upon* относится к субъекту воздействия (*the one*), выраженного Participle **acted**.

Перевод:

«Общеизвестно, что из двух одинаковых тел то, на которое действует большая сила, будет испытывать большее ускорение».

## II. НЕЗАВИСИМЫЙ ПРИЧАСТНЫЙ ОБОРОТ (THE ABSOLUTE PARTICIPIAL CONSTRUCTION)

Рассмотрим два предложения с причастными обстоятельственными оборотами:

1) The changes in the structure of the substance go very deep, affecting even the interior of the atoms themselves.

2) An atom in its normal state being electrically neutral, it was necessary in some way to account for the positive electricity which must exist in the atom to balance the negative electrons.

В первом предложении подлежащее является субъектом действия, выраженного Participle **affecting**. Перевод такого зависимого причастного оборота выполняется, как указано в таблице, с помощью деепричастия или причастного обстоятельного предложения:

«Изменения в строении вещества проникают очень глубоко, воздействуя даже на внутреннюю структуру самих атомов».

Во втором предложении субъект действия Participle **being** в причастном обстоятельном обороте *an atom in its normal state being electrically neutral* не зависит от главного предложения.

Такие обороты носят название независимых причастных оборотов. Характерной особенностью является то, что Participle занимает в них место сказуемого. Независимые причастные обороты всегда выделяются запятыми.

По отношению к главным членам предложения независимый причастный оборот может занимать два положения: перед ними и после них. Этим определяется связь независимого причастного оборота с остальной частью предложения. В первом случае связь будет подчинительной и независимый причастный оборот переводится придаточными обстоятельственными предложениями времени, причины, условия и т. д., вводимыми союзами *так как, когда, после того как, если* и т. п. Во втором случае связь является сочинительной и независимый причастный оборот переводится либо предложением с союзами *при этом, и, а*, либо без союза.

Следуя этому правилу, можно записать перевод второго из приведенных выше предложений следующим образом: «Так как атом в своем нормальном состоянии электрически нейтрален, то было необходимо объяснить каким-либо образом положительное электричество, которое должно находиться в атоме для того, чтобы нейтрализовать отрицательные электроны».

If the temperature is increased the molecules are given additional speeds, more of them breaking through the surface of the liquid, thus increasing the vapour density.

Participle **breaking** стоит на месте сказуемого и имеет собственный субъект выраженного им действия. Следовательно, *more of them breaking through the surface of the liquid* является независимым причастным оборотом. Второй Participle является зависимым и, выполняя функцию обстоятельства, переводится деепричастием:

«Если температура возрастает, молекулам сообщается дополнительная скорость, при этом многие из них отрываются от поверхности жидкости, увеличивая таким образом плотность пара».

When heat is applied at one spot, copper being a very good conductor, it is rapidly transferred throughout the whole mass.

В этом случае независимый причастный оборот — *copper being a very good conductor*. Перевод:

«Так как медь является очень хорошим проводником тепла, то тепло, подведенное к какой-либо точке тела, быстро распространяется по всей массе».

#### III. НЕЗАВИСИМЫЙ ПРИЧАСТНЫЙ ОБОРОТ С ПРЕДЛОГОМ *WITH* (PREPOSITIONAL ABSOLUTE PARTICIPIAL CONSTRUCTION)

В научной литературе часто встречается еще один тип независимого причастного оборота, который вводится в предложение с помощью предлога *with*. Правило перевода остается таким же, как и для беспредложных конструкций.

Структура независимого причастного оборота с предлогом *with* имеет следующий вид:



with+группа существительного+Participle.

In their nature all these radiations are similar, with gamma rays having properties nearest to those of X-rays.

В этом предложении независимый причастный оборот с предлогом with gamma rays having properties стоит после главного предложения, его можно перевести предложением с союзами *причем, при этом*:

«По своей природе все эти виды излучений подобны, причем гамма-лучи обладают свойствами, наиболее близкими к свойствам рентгеновских лучей».

With the various parts of the system clearly defined, the stability criteria can be used with full confidence.

Независимый причастный оборот с предлогом with стоит перед главным предложением и переводится обстоятельственным придаточным предложением:

«Если различные части системы четко определены, критерии устойчивости могут применяться с полной уверенностью».

IV. ОБСТОЯТЕЛЬСТВЕННЫЕ ПРИЧАСТНЫЕ ОБОРОТЫ,  
ВВОДИМЫЕ СОЮЗАМИ IF, WHEN, WHILE, UNLESS и др.  
(ADVERBIAL PARTICIPIAL CONSTRUCTIONS INTRODUCED  
BY CONJUNCTIONS IF, WHEN, WHILE, UNLESS, ETC.)

Для уточнения обстоятельного оттенка перед Participle часто ставятся союзы if, when, while, unless и др. Если в составе такого оборота содержится being в качестве связки, оно нередко опускается. Такие обороты обычно переводятся с помощью обстоятельных предложений или существительных с предлогом.

When discussing heating it should be kept in mind that the principal object is to limit and control the loss of heat from the body.

«Когда мы обсуждаем задачи отопления, необходимо помнить, что его главной целью является ограничение и регулирование потери теплоты телом».

We cannot see heat but can feel and observe its effect while being in the neighbourhood of a heated body.

«Мы не можем видеть тепла, но можем чувствовать и наблюдать его воздействие в то время, когда мы находимся вблизи нагретого тела».

In physics inertia is the property which causes bodies to remain at rest unless acted upon by some external force.

«В физике инерция представляет собой свойство, в силу которого тела остаются в состоянии покоя, пока на них не действует какая-нибудь внешняя сила».

Graphite, if present, lowers the tensile strength and increases the softness of iron.

Здесь опущено причастие being, выполняющее роль связки (if being present):

«Графит, если он содержится в железе, понижает его сопротивление растяжению и увеличивает его мягкость».

## ГЕРУНДИЙ (THE GERUND)

### I. ФОРМЫ ГЕРУНДИЯ

Виды герундия	Действительный залог	Страдательный залог
Неопределенный герундий (Indefinite Gerund)	asking	being asked
Перфектный герундий (Perfect Gerund)	having asked	having been asked

Герундий — неличная форма глагола, оканчивающаяся на **-ing** и отсутствующая в русском языке и в ряде других языков. Совпадение форм герундия и причастия объясняется историческим происхождением герундия от двух грамматических категорий — отглагольного существительного и причастия. В силу своей двойственной природы герундий может совмещать в себе признаки существительного и глагола. Как существительное, он может выполнять в предложении синтаксические функции подлежащего, дополнения, определения и обстоятельства с предлогом. Как глагол, герундий может иметь после себя прямое дополнение и определяться наречием, а также имеет временные и залоговые формы.

Обороты с герундием широко используются в научной и технической литературе. Поэтому очень важно уметь правильно определять функцию герундия в предложении и в зависимости от этого выбирать тот или иной способ перевода. В устной речи употребляются лишь простые обороты с герундием.

### II. ФУНКЦИИ ГЕРУНДИЯ В ПРЕДЛОЖЕНИИ И СПОСОБЫ ЕГО ПЕРЕВОДА

Ниже будут рассмотрены два случая перевода герундиальных оборотов, наиболее часто встречающихся в научно-технической литературе, а именно:

а) герундию непосредственно не предшествует субъект выраженного им действия или состояния;

б) герундию непосредственно предшествует субъект выраженного им действия или состояния.

#### а) 1. Герундий в функции подлежащего

В качестве подлежащего герундий может переводиться либо существительным, либо неопределенной формой глагола. Например:

Saying that an atom is the smallest particle of any substance means that no substance can exist in any more subdivided form.

В этом предложении нетрудно выделить главное и придаточные предложения:

Saying // that an atom is the smallest particle of a substance // means // that no substance can exist in any more subdivided form.

В главном предложении «saying means» ing-форма saying обладает признаками существительного, выполняя функцию подлежащего, и признаками глагола, ибо имеет после себя прямое дополнение в форме придаточного дополнительного предложения. Следовательно, saying является герундием.

Перевод предложения:

«Говорить (или утверждение), что атом является наименьшей частицей вещества, означает, что если его делить дальше, то вещество перестает существовать как таковое».

#### 2. Герундий в функции дополнения — прямого или косвенного

В этом случае герундий также переводится существительным или неопределенной формой глагола.

Рассмотрим несколько примеров.

Engineers find using wood often more practicable than other materials.

Ing-форма using представляет собой герундий, ибо, с одной стороны, является прямым дополнением к сказуемому find, а с другой — сама имеет прямое дополнение, т. е. обладает одновременно признаками существительного и глагола. Перевод:

«Инженеры находят использование дерева часто более практичным, чем использование других материалов».

The repulsive force between the atoms aids their motion, thus keeping them from combining into molecules.

В данном предложении две ing-формы. Первая из них keeping не обладает признаками существительного, следовательно, она представляет собой Participle, который, не примыкая ни к какому существительному, выполняет функцию обстоятельства и может переводиться деепричастием.

Вторая ing-форма combining с предлогом from перед ней является предложным дополнением к глаголу keeping, что служит

признаком существительного, следовательно, combining представляет собой герундий. Перевод выполняется так:

«Силы отталкивания между атомами способствуют их движению, препятствуя им, таким образом, соединяться в молекулы».

Герундий в качестве дополнения употребляется после ряда глаголов: to avoid — избегать, to delay — медлить, to put off — откладывать, to remember — помнить, вспомнить, to neglect — пренебрегать, to forget — забывать, to suggest — предлагать, to stop — прекращать, to like — любить, нравиться, to prefer — предпочитать, to mind — быть против, to think (of) — думать, предполагать, to succeed (in) — удаваться и др., а также после: to be fond (of) — любить, to be afraid (of) — бояться, to be tired (of) — устывать, надоедать и др. Например:

I remember seeing him last year — Я помню, что видел его в прошлом году.

He stopped smoking — Он бросил курить.

We prefer working at the laboratory — Мы предпочитаем работать в лаборатории.

He is afraid of going out — Он боится выйти.

### 3. Герундий в функции определения

В английском языке встречаются два случая применения герундия в качестве определения. В первом случае герундий-определение употребляется с предлогом, стоит после определяемого слова и переводится существительным. Например:

the problem of maintaining comfortable conditions — задача поддержания комфортабельных условий;

the methods for measuring surface area — методы измерения площади поверхности;

the difficulties in designing these devices — трудности конструирования этих приборов.

Во втором случае герундий находится непосредственно перед определяемым словом. В этом случае отсутствуют формальные признаки того, что данная ing-форма является герундием, и ее легко смешать с Present Participle. Только смысл сочетания в целом «ing-форма + определяемое слово», а иногда — всего предложения, помогает выяснить, имеем ли мы дело с герундием или Present Participle; именно от этого часто зависит правильный перевод. Например:

loading crane — погрузочный (нагружающий) кран (Present Participle);

loading test — испытание под нагрузкой (герундий, ибо «нагружающее испытание» лишено смысла);

living being — живое (живущее) существо (Present Participle);

living area — жилая площадь, площадь для жилья (герундий, ибо выражение «живущая площадь» лишено смысла).

#### 4. Герундий в функции обстоятельства

Герундий в сочетании с различными предлогами часто употребляется в функции обстоятельства в научной и технической литературе. В устной речи подобные сочетания применяются редко.

Ниже приводятся практические указания для перевода герундия в различных обстоятельственных значениях.

Предлог, с которым сочетается герундий	Способы перевода
in	деепричастие настоящего времени сочетание «при+существительное»
on, upon	деепричастие прошедшего времени сочетания «при+существительное», «после+существительное»
before, after	сочетание «перед, после+существительное»;
by	деепричастие; сочетание «путем, с помощью+существительное»
without	сочетание «не+деепричастие»; сочетание «без+существительное» и т. д.

Например:

in designing the construction — при проектировании конструкции; проектируя конструкцию;

upon reaching the boiling point — после достижения точки кипения; достигнув точки кипения;

before (after) discussing the problem — перед обсуждением (после обсуждения) задачи;

by applying this method — применяя этот метод; путем применения этого метода;

without using this procedure — не применяя этого способа; без применения этого способа и т. д.

#### 6) Герундиальные обороты (Gerund Constructions)

Субъект действия или состояния в герундиальных оборотах может быть выражен притяжательным местоимением, иногда личным местоимением в объектном падеже и существительным в притяжательном, а часто в общем падеже. Герундий вместе с субъектом его действия или состояния образует единый синтаксический комплекс, который может выполнять функцию любого члена предложения и в зависимости от этого переводится придаточным предложением соответствующего типа. Например:

The author mentioned his (Prof. Clark's) having tested this material with entirely satisfactory results.

О том, что *ing*-форма *having tested* совмещает в себе признаки, присущие и существительному, и глаголу, говорит наличие притяжательного местоимения (существительного в притяжательном падеже) перед ней и прямого дополнения после нее. Следовательно, *having tested* является герундием, перед которым стоит субъект или исполнитель его действия, выраженный *his* (*Prof. Clark's*). Герундиальный оборот, состоящий из самого герундия и его субъекта, переводится в данном случае дополнительным придаточным предложением:

«Автор указал, что он (проф. Кларк) испытал этот материал с вполне удовлетворительными результатами».

Когда субъектом герундия служит существительное в общем падеже или местоимение в объектном падеже, по формальным признакам невозможно отличить герундий от причастия и только контекст в целом может показать, имеем ли мы дело с герундием или причастием. Примеры перевода:

Wood having been used as a structural material since prehistoric times shows its great value.

На основании формальных признаков может показаться, что подлежащим в данном предложении должно быть слово *wood*, как существительное, перед которым нет ни предлога, ни глагола, а вся остальная группа *having been used as...* до сказуемого *shows* является причастным определительным оборотом. Перевод «дерево, применявшееся в качестве строительного материала, доказывает его большую ценность» лишен смысла, и, следовательно, наше допущение в отношении выбора подлежащего будет неверным. Тогда единственное, что может быть подлежащим, это группа слов *wood having been used*, в которой *wood* является субъектом действия герундия *having been used*. Иначе говоря, мы имеем дело с герундиальным оборотом в функции подлежащего, который, согласно указанному выше правилу, переводится придаточным предложением — подлежащим:

«То, что дерево использовалось в качестве строительного материала с доисторических времен, доказывает его большую ценность».

Quickening the combustion results in the heat contained in the fuel being released much quicker.

В данном предложении два слова обладают формальными признаками сказуемого: *results* (окончание *s*) и *contained* (окончание *ed*). Если рассматривать *contained* как сказуемое, а *results* как существительное во множественном числе, то при переводе получится набор слов, лишенный смысла. Следовательно, сказуемым данного предложения является глагол *results*, который в сочетании с предлогом *in* имеет значение «приводить к чему-либо», а *contained* представляет собой Past Participle в функции определения к существительному *the heat*.

В группе подлежащего *quickening the combustion* собственно

подлежащим является герундий quickening, а существительное the combustion является прямым дополнением к герундию.

Для того чтобы определить функцию ing-формы being released, приходится делать два пробных перевода. Первый перевод выполняется в предположении, что being released является причастием — определением к существительному the fuel («...приводит к теплоте, высвобождающейся гораздо быстрее»), и второй перевод — в предположении, что being released — герундий, а группа the heat contained in the fuel — субъект его действия: «Ускорение сгорания приводит к тому, что теплота, содержащаяся в горючем, высвобождается гораздо быстрее».

Сравнив оба перевода, установим, что верен второй (таким образом, being released является герундием).

### III. ГЕРУНДИЙ И ОТГЛАГОЛЬНОЕ СУЩЕСТВИТЕЛЬНОЕ (VERBAL NOUN)

Неопределенный герундий (Indefinite Gerund) совпадает по форме не только с причастием настоящего времени, но также и с отглагольным существительным. Последнее, хотя и образуется от глагола с помощью окончания **-ing**, в противоположность герундию обнаруживает все формальные признаки, свойственные существительному, а именно: перед отглагольным существительным может стоять артикль, оно может определяться прилагательным, может иметь окончание множественного числа и может иметь после себя в качестве определения существительное с предлогом **of**.

Отглагольное существительное обычно переводится существительным. Например:

The launching of artificial satellites of the earth has been a great achievement of world science.

В данном случае ing-форма launching обладает не только синтаксическими, но и морфологическими признаками существительного (наличие артикля), следовательно, мы имеем дело с отглагольным существительным. Перевод:

«Запуск искусственных спутников Земли явился огромным достижением мировой науки».

### СОСЛАГАТЕЛЬНОЕ НАКЛОНЕНИЕ (THE SUBJUNCTIVE MOOD)

Сослагательное наклонение выражает предполагаемое, возможное или желательное действие.

В английском языке сослагательное наклонение выражается двумя способами:.

- а) **аналитически**, т. е. при помощи сложных глагольных форм;
- б) **синтетически**, т. е. при помощи простых глагольных форм.

1. Аналитические формы сослагательного наклонения состоят из глаголов **should, would, may, might, could** и инфинитива смыслового глагола и обычно переводятся на русский язык сослагательным наклонением.

1. **Should** и **would** употребляются в главном предложении (при наличии придаточного условного предложения) и в самостоятельных предложениях, причем **should** употребляется в первом лице единственного и множественного числа, а **would** — во втором и третьем лице единственного и множественного числа.

If I saw you, I **should** give you the book.

Если бы я увидел вас, я дал бы вам книгу.

If he saw you, he **would** give you the book.

Если бы он увидел вас, он бы дал вам книгу.

I **should** have helped you, but I was ill and could not come.

Я бы вам помог, но я был болен и не мог прийти.

2. **Should** употребляется во всех лицах:

а) в придаточных предложениях подлежащих после союза **that** (чтобы) и оборотов **it is necessary** (необходимо), **it is important** (важно) и т. п.

It is necessary that you **should** read this book.

Необходимо, чтобы вы прочли эту книгу.

б) в придаточных дополнительных после союза **that** (чтобы):

They ordered that the work **should** be done in time.

Они приказали, чтобы работа была сделана во время.

в) в придаточных предложениях цели после союзов **so that**, **in order that** (для того чтобы, с тем чтобы) и **lest** (чтобы не); здесь также употребляются **may, might**.

I opened the window so that it **should** not be so hot (или: **lest** it should be so hot).

Я открыл окно, чтобы не было так жарко.

г) в придаточных предложениях условия:

If they **should** come, we should give them the book.

Если бы они пришли, мы дали бы им книгу.

II. К синтетическим формам относится небольшое количество форм сослагательного наклонения, отличных от форм изъявительного наклонения:

1) Present Subjunctive глагола **to be**, имеющий форму **be** для всех лиц единственного и множественного числа.

I wrote him a letter in order that he **be** here.

Я написал ему письмо, для того чтобы он был здесь.

2) Past Subjunctive глагола **to be**, имеющий форму **were** для всех лиц единственного и множественного числа.

I wish he **were** here.

Я хотел бы, чтобы он был здесь.

Все остальные формы сослагательного наклонения не отличаются от форм изъявительного наклонения, за исключением того,



что в третьем лице единственного числа у них отсутствует окончание -s.

Long live the First of May!  
Да здравствует Первое Мая!

Синтетические формы сослагательного наклонения могут употребляться в тех же типах придаточных предложений, что и аналитические.

Кроме указанных выше придаточных предложений, Past Subjunctive употребляется в придаточных предложениях образа действия после союзов as if (as though) (как если бы, как будто бы).

He speaks English as if he were a real Englishman.

Он разговаривает по-английски так, как будто он настоящий англичанин.

### УСЛОВНЫЕ ПРЕДЛОЖЕНИЯ (CONDITIONAL SENTENCES)

В английском языке условные предложения бывают трех типов:

1. Предложения, выражающие реальные условия, относящиеся к настоящему, прошедшему и будущему.

2. Предложения, выражающие маловероятные условия, относящиеся к настоящему и будущему.

3. Предложения, выражающие нереальные условия, относящиеся к прошлому.

В предложениях первого типа (реальные условия) сказуемое выражается формами времени изъявительного наклонения.

В условных придаточных предложениях употребляется Present Indefinite Tense, а в главных — Future Indefinite Tense, если речь идет о будущем действии. На русский язык глагол в таких предложениях переводится формой будущего времени.

If I **have** time, I **shall** help you in your work.

Если у меня будет время, я помогу вам в вашей работе.

В предложениях второго типа (маловероятные условия) сказуемое выражается формами сослагательного наклонения; сказуемое главного предложения — сочетанием глаголов **should, would, might, could** с Indefinite Infinitive без частицы to; сказуемое условного предложения — формой сослагательного наклонения, совпадающей по форме с Past Indefinite изъявительного наклонения. При переводе на русский язык употребляем формы сослагательного наклонения.

If I **had** time (today, tomorrow), I **should** help you in your work.

Если бы у меня было время (сегодня, завтра), я бы помог вам в вашей работе.

If I **were** free (today, tomorrow), I **could** help you in your work.

Если бы я был свободен (сегодня, завтра), я мог бы вам помочь в вашей работе.

В предложениях третьего типа (нереальные условия) сказуемое выражается формами сослагательного наклонения; сказуемое главного предложения — сочетанием глаголов *should, would, might, could* с *Perfect Infinitive* без частицы *to*; сказуемое условного придаточного предложения — формой сослагательного наклонения, совпадающей с *Past Perfect* изъявительного наклонения. На русский язык переводится формами сослагательного наклонения.

**If I had had time (yesterday), I should have helped you in your work.**

Если бы у меня вчера было время, я бы вам помог в вашей работе.

В условных предложениях второго и третьего типа союз *if* перед глаголами *be, have, should* и *could* может быть опущен.

В этих случаях в придаточных предложениях применяется обратный порядок слов (инверсия), т. е. формы глаголов *be, have, should, could* ставятся перед подлежащим.

**Were I free, I should help you.**

Если бы я был свободен, я бы вам помог.

**Had I had time yesterday, I should have helped you in your work.**

Если бы у меня было время вчера, я бы вам помог в вашей работе.

Основными союзами, которые вводят условные предложения, являются: *if* (если), *provided* (при условии), *unless* (если не), *in case* (в случае).

Ask him to come if he is **not** working.

Ask him to come **unless** he is working.

Попросите его прийти, если он не работает.

## МОДАЛЬНЫЕ ГЛАГОЛЫ И СОЧЕТАНИЕ ИХ С ПРОСТЫМ И ПЕРФЕКТНЫМ ИНФИНИТИВОМ

Модальные глаголы выражают отношение лица к действию и могут употребляться только в сочетании с инфинитивом.

В английском языке модальные глаголы не имеют формы инфинитива, откуда вытекает ряд присущих им особенностей:

а) они не имеют неличных форм, образующихся путем прибавления окончаний *-ed, -ing*, а образуют только простые временные формы *Present* и *Past Indefinite*; б) не принимают окончания *-s, -es* в третьем лице единственного числа *Present Indefinite*; в) образуют вопросительную и отрицательную формы *Present Indefinite* без вспомогательного глагола *do*. Кроме того, модальные глаголы требуют после себя инфинитива другого глагола без частицы *to* (за исключением глагола *ought*, за которым следует инфинитив с частицей *to*).

## 1) Can, could

Модальный глагол **can** имеет значение, соответствующее русскому **могу** в смысле физической возможности или умения что-то делать. Ему присущи только две временные формы — настоящее и прошедшее время.

Для образования всех остальных времен **can** заменяется выражением **to be able**.

He **can** do it easily (он может сделать это легко).  
We **cannot** translate the text (мы не можем перевести текст).  
He **could** not see me, I was too far (он не мог видеть меня, я был слишком далеко).  
He **could** do it without my help (он мог сделать это без моей помощи).  
I **could** do it if I knew how to begin (я мог бы сделать это, если бы знал, как начать).

She **cannot** have done that (не может быть, чтобы она сделала это).  
He **could** have come last week (он мог бы приехать на прошлой неделе **или** он мог приехать на прошлой неделе).  
He **could** not have done such a thing (он не мог сделать такой вещи).

## 2) May, might

Модальный глагол **may** имеет значение, соответствующее русскому **могу** в смысле разрешения, возможности, допущения; он может выражать также сомнение или предположение. Он употребляется в настоящем и прошедшем временах. Остальные временные формы выражаются глаголами **to be allowed**, **to be permitted**.

You **may** use my skates (вы можете воспользоваться моими коньками).  
It **may** rain to-morrow (завтра может быть дождь **или** завтра, возможно, пойдет дождь).

You **may not** smoke here (здесь курить нельзя).

You **might** be more attentive (вы могли бы быть более внимательны).

He **may** have gone before you came (он, возможно, ушел до вашего прихода).  
You **might** have come without any invitation (вы могли бы прийти без всякого приглашения).

## 3) Must

Модальный глагол **must** выражает долженствование, а иногда — достоверное допущение. Он имеет только настоящее время, для остальных временных форм используются глаголы **to have to**, **to be to**, **to be obliged to** и т. п.

We **must** translate the text without the dictionary (мы должны перевести текст без словаря). You **must** not speak so fast (вы не должны говорить так быстро). It **must** be very late now (сейчас, должно быть, очень поздно).

He **must** have known English before (он, должно быть, знал английский язык раньше).

#### 4) Shall, should

Модальный глагол shall (should) применяется во всех лицах для выражения долженствования, принуждения, обязательства и т. п.

The panels A and B **shall** be installed vertically (панели А и В должны устанавливаться вертикально). You **should** not speak so fast (вам не следует говорить так быстро).

They **should** have been here long ago (им следовало (полагалось) быть здесь уже давно). You **should** not have quarreled with him, he was right (вам не следовало бы с ним ссориться, он был прав).

#### 5) Ought

Модальный глагол ought выражает долженствование, подобно should, и имеет только одну временную форму.

You **ought** to be more careful (вам следует быть осторожнее). This fact **ought** not to have been mentioned so often (об этом не следовало напоминать так часто).

#### СПИСОК ОСНОВНЫХ ПРЕДЛОГОВ

- |              |  |
|--------------|--|
| about        | 1. (расположение или движение - вокруг чего-либо) вокруг, кругом;                |
|              | 2. (расположение вблизи чего-либо) около, близ, у;                               |
|              | 3. (место совершения действия) по;   |
|              | 4. (приблизительность во времени) около, к;                                      |
|              | 5. о, об; насчет, относительно;  |
| above        | 1. над;  |
|              | 2. выше, больше; выше;   |
| according to | 1. согласно, в соответствии с;   |
|              | 2. по утверждению, по словам, по мнению;   |
| across       | сквозь, через; на другой стороне, по другую сторону;                             |
| after        | 1. (местонахождение позади предмета или движение вдогонку) за, позади;           |
|              | 2. (последовательность во времени, промежуток времени) после, за, через, спустя; |
|              | 3. (сходство с чем-либо или подражание кому-либо) по, с, согласно;               |
| against      | 1. (противоположное направление или положение) против;                           |
|              | 2. (опора, фон, препятствие) о, об, по, на, к;                                   |

along	3. (непосредственное соседство) рядом, у;
among	4. (столкновение или соприкосновение) на, с; вдоль, по;
around (round)	среди, между; 1. вокруг;
at	2. по; за; около; 3. около; приблизительно; 1. (местонахождение) в, на, у, при; 2. (движение в определенном направлении) в, к, на; 3. (момент, время действия) в, на; 4. (действие, занятие) за; 5. (состояние, положение) в, на;
before	1. (местонахождение) перед; 2. (время) до, перед;
behind	за, сзади, позади; после;
below	ниже, под;
beside	рядом с; около, близ;
besides	помимо, кроме;
between	между;
beyond	1. по ту сторону; за; 2. вне; сверх, выше;
by	1. (близость) у, при, около; 2. (прохождение мимо предмета или через определенное место) мимо; 3. (приближение к определенному моменту, сроку и т. д.) к; 4. (указание на автора; предложный оборот передается твор. или род. падежом) a book by Tolstoy; 5. (указание на средство передвижения, предложный оборот переводится твор. падежом) by plane; 6. (причина, источник) через, посредством, от, по; посредством; относительно, касательно; вниз; (вниз) по; вдоль по; благодаря; в течение, в продолжение; во время; исключая, кроме; за исключением, кроме;
by means of	1. для, ради;
concerning	2. за;
down	3. (направление) к, в;
due to	4. из-за, по причине, вследствие;
during	5. в течение, в продолжение;
except	1. (пространственное значение) от, из, с;
except for	2. (временное значение) с, от, из;
for	1. (пребывание внутри или в пределах чего-либо) в(о), на, у; 2. (вхождение или внесение в пределы или внутрь чего-либо, проникновение в какую-либо среду) в, на; 3. (временное значение), в, во время, в течение, через; 4. (условия, окружающая обстановка, обстоятельства совершения действия) в, при, с, на; в соответствии с, согласно;
from	вдобавок, в дополнение к, кроме того, к тому же;
in	перед, впереди; несмотря на, невзирая на; вместо; (движение или направление внутрь, в сферу или область чего-либо) в, на;
in accordance with	подобно, как;
in addition to	возле, у, около;
in front of	1. указывает на принадлежность; предложный оборот переводится род. падежом) the wall of the room;
in spite of	
instead of	
like	
near	
of	

on	2. (указывает на отношение части и целого) из;
	3. о, об, относительно;
	1. (пребывание на поверхности) на (то же upon);
	2. направление) на (то же upon);
opposite out of over	3. (временное значение) в;
	4. (последовательность наступления действий) по, после;
	5. (состояние, процесс, характер действия) в, на;
	6. (основание, причина, источник) из, на, в, по, у;
owing to past	7. о, об, относительно, касательно;
	против, напротив;
	вне, за, из;
	1. над, выше;
since thanks to through	2. по ту сторону, за, через;
	3. (характер движения) через, по; поверх, на; по, по всей поверхности;
	4. (промежуток времени, в течение которого происходит действие) за, в течение;
	5. (количественное или числовое превышение) свыше, сверх, больше;
throughout	из-за, вследствие, по причине, благодаря;
	1. мимо;
	2. за, по ту сторону;
	3. (о времени) после, за, спустя, более;
till (until) to	с, после, спустя;
	благодаря;
	1. (пространственные отношения) через, сквозь, по;
	2. (временные отношения) в течение, в продолжение;
toward(s)	3. по причине, вследствие, из-за, благодаря;
	1. через, по всему;
	2. в продолжение (всего времени);
	до, до тех пор пока;
under	1. (направление) к, в, на;
	2. (предел движения, расстояния, времени, количества) на, до;
	3. (указание на лицо, по отношению к которому совершается действие; предложный оборот переводится дательным падежом) a letter to a friend;
	1. к, по направлению к;
until up	2. (время) к, около;
	1. (положение одного предмета ниже другого, направление действие вниз) под, ниже;
	2. (условия, обстоятельства, при которых совершается действие) при, под, на;
	см. till;
up to upon with	1. вверх, по, на;
	2. вдоль, по; вглубь;
	вплоть до;
	см. on;
within	1. (связь, совместность, согласованность) с;
	2. (указание на предмет действия или орудие, при помощи которого совершается действие; предложный оборот переводится творит. падежом) to write with a pen;
	3. (обстоятельство, сопутствующее действию) а, причем; he fell asleep with his candle lit;
	1. в, в пределах;
without	2. в, внутри;
	3. не далее (как), не позднее, в течение;
	1. без;
	2. вне, за;
	3. (перед герундием или отглагольным сущ.) без того, чтобы

# СПИСОК ОСНОВНЫХ СОЮЗОВ И СОЮЗНЫХ СЛОВ

after	после того как;
although	см. though;
and	и, а, но;
as	когда, в то время как; так как; хотя;
as...as	так же... как и;
as far as	поскольку, насколько;
as if (as though)	как будто, как если бы;
as long as (so long as)	(до тех пор) пока, если только, при условии что;
as soon as	как только
as though	см. as if;
as well as	так же, как (и);
because	потому что, так как;
before	прежде чем;
both... and	и... и, как... так и;
but	но, а, однако, тем не менее;
either... or	или... или;
for	так как, ибо; ввиду того, что;
hardly (scarcely)... when	едва только... как;
hence (thence)	следовательно;
how	как;
however	однако;
if	если, если бы; ли;
in case	если; в случае если;
in order	для того чтобы;
in order that	для того чтобы;
lest	чтобы не; как бы не;
neither... nor	ни... ни;
nevertheless	тем не менее;
no sooner... than	как только, едва только... как;
nor	и... не; также... не;
not only... but also	не только... но и;
notwithstanding	несмотря на;
now (that)	теперь, когда; поскольку;
on condition (that)	при условии если;
once	раз уж, стоит только... как (и);
or	или, иначе;
(or) else	в противном случае, иначе;
otherwise	в противном случае, иначе;
provided (that)	при условии если;
providing (that)	при условии если;
seeing	поскольку, так как;
since	с тех пор как; так как; хотя;
so	так что, итак;
so as	чтобы, для того чтобы;
so long as	см. as long as;
so... that	так что;
still	тем не менее, все же;
supposing	если, предположим (что); допустим (что);
than	чем;
that	что;
that is why	вот почему; поэтому;
thence	см. hence
therefore	поэтому;
though (although)	хотя, несмотря на; даже если бы; хотя бы;
thus	таким образом;
till (until)	до тех пор пока;
unless	если только не, разве только;
until	см. till;
what	что;
when	когда;

where  
whereas  
whether  
which  
while  
who  
whose  
why  
yet

где;  
тогда как; поскольку;  
ли;  
который;  
в то время как, пока;  
кто, который;  
чей;  
почему;  
тем не менее, все же.

## МНОГОЗНАЧНОСТЬ НЕКОТОРЫХ СЛУЖЕБНЫХ СЛОВ

### AS

#### 1. as (Adverb) как

By applying the principles of elementary mechanics and making assumption that each molecule weighs exactly the same as another molecule of the same gas, the following equation will be obtained.

as a rule как правило

As a rule the applied forces are considered to be known, since they may be determined from the conditions of the problem.

as usual как обычно

As usual the celebration of the anniversary of the Great October Socialist Revolution began at 10 o'clock in the morning.

#### 2. as (Adverb) как, в качестве

Prevailing geological theory views the origin of minerals (oil, precious metals, ores, etc.), as a single geological process which begins and terminates within a given epoch.

#### 3. as ...as (Adverb) так же ...как

Even when it is at opposition, Mars is 150 times as far from us as the Moon (150 times as far ...as — в 150 раз дальше).

The electronic radio valve is comparatively old — it was invented as far back as 1904 (as far back as 1904 — еще в 1904 г.).

#### 4. as (Conjunction) когда

As the sum of forces acting at a point becomes zero, the forces are said to be in equilibrium.

#### 5. as (Conjunction) по мере того как

As each particle becomes heated it expands, becomes lighter than the remainder and rises, leaving room for other particles to move down and be heated in their turn.

#### 6. as (Conjunction) так как

The atoms must cooperate in their relative movement as otherwise there is no space for an atom to move into.

#### 7. as to, as for (Conjunction) относительно, что касается

The question as to the most desirable conditions to be maintained in summer in air-conditioned buildings is not yet satisfactorily answered.



## FOR

1. **for (Preposition)** для, ради, за; переводится также дат. пад.  
Grades of steel are available having properties adapted **for** resistance to corrosion.

Since the very first days of its existence the Soviet Union has been fighting **for** peace throughout the world.

The Great October Socialist Revolution, which was the logical outcome of social development, blazed a wide trail **for** all mankind to Communism.

2. **for (Preposition)** в течение, в продолжение

Space flights prove that it is possible **for** man to tolerate the conditions of space flight **for** prolonged periods.

**for the first time** в первый раз

On November 1, 1962, **for the first time** in history, an automatic interplanetary station, the "Mars-1" was launched from the Soviet Union in the direction of Mars.

3. **for (Conjunction)** ибо; ввиду того, что

A liquid has a definite size, **for** it will fill a container to a certain level, forming a free surface, but it does not have a definite shape.

In studying nature systematically the scientist has to proceed carefully **for** nature is full of surprises.

## BEFORE

1. **before (Preposition)** до, перед

Shortly **before** the beginning of operation the machine was carefully inspected and checked.

2. **before (Conjunction)** до того как, перед тем как

Shortly **before** the machine was set in operation, it was carefully inspected and checked.

## AFTER

1. **after (Preposition)** после, за, через, спустя

If you look at the cloudless sky **after** midnight, you will notice a rather bright, reddish star. This is the planet Mars.

If a body returns to its original state **after** being slightly displaced, the equilibrium is known to be stable.

2. **after (Conjunction)** после того как

**After** the concept of temperature became understood, there were many centuries of scientific development before the real nature of heat was established.

## SINCE

1. **since (Preposition)** с, после

The Weather Bureau usually finds it convenient to use a maximum or minimum thermometer which registers the highest and lowest temperatures reached **since** the last setting.

since then с тех пор

The first decree of Soviet power was the Decree on Peace. **Since then** the Soviet Union has been carrying on a policy of peace and friendship with all the peoples of our planet.

2.. **since (Conjunction)** с тех пор как; так как; поскольку; хотя

**Since** the power station was opened it has operated continuously.

The great ideas of the October Revolution are spreading far and wide. This is not surprising **since** they liberate people from social injustice, from all forms of oppression and exploitation, from the horrors of war, and proclaim Peace, Labour, Freedom, Equality, Fraternity and Happiness for all nations.

## IT

1. **it (Pronoun Personal)** он, она, оно (о предметах).

The summer temperature at the equator of Mars does not exceed 25°C. and in winter, at the poles, **it** drops to 100°C. below zero and even more.

2. **it (Pronoun Impersonal)** (не переводится)

**It** is possible to observe sunrises and sunsets on Mars just as on the Earth.

The atom, **it** will be remembered, consists of a central nucleus around which electrons are revolving.

In many cases, especially when the temperature is relatively low, **it** would take a long time for the state of stability to occur.

3. **it** (входит в состав усилительного оборота **it is(was) ...that** — именно)

**It** is physics **that** has given us countless mechanical and electrical inventions of the modern world.

## THAT

1. **that (Pronoun Demonstrative)** тот, та, то; этот, эта, это

The primary source of body heat is the food we eat, but the rate at which **that** heat is generated depends to a great extent on our activities.

2. **that (Pronoun)** (заменяет существительное во избежание повтора)

Whether the temperature of a given object is raised or lowered due to radiation depends on the temperature of **that** object in comparison with **that** of the surrounding bodies.

Every machine wastes energy because of friction; consequently, the work put into the machine is always more than **that** obtained from it.

3. **that (Conjunctive и Relative Pronoun)** что; который (служит для введения придаточных предложений дополнительных, определенных, подлежащих, сказуемых, обстоятельственных).

Lenin's policy of peaceful coexistence means **that** the two anta-

gonistic systems that exist on our planet, the socialist and the capitalist, recognize that they can get along without wars.

That a large amount of energy is liberated by even a speck of radium is known to most people.

Atomic energy is different from all other types of energy in that mass is converted into energy.

now that (Conjunctive) теперь, когда

Now that the three types of radioactive location have been discovered they can be described more fully.

4. that (входит в состав усилительного оборота it is(was) ...that — именно)

In our days it is no longer imperialism, but the world socialist system with its ideals of peace and progress that is becoming the decisive factor in world development.

## ONE

### 1. one (Numeral Cardinal) один

The mean distance from Mars to the Sun is 227 million kilometres, one and a half times the distance from the Earth to the Sun.

one of один из

One of the greatest problems thrown up by our era is that of outer space.

2. one (слово-заменитель, употребляется во избежание повторения ранее упомянутого существительного; не переводится):

Our planet is an incredibly beautiful one, from the heights of space it looks wonderful.

3. one (Pronoun Indefinite) (употребляется в неопределенно-личных предложениях; не переводится):

It is an easy matter to calculate the thermal efficiency of a boiler if one knows the weight and temperature of the steam produced.

## НАИБОЛЕЕ УПОТРЕБИТЕЛЬНЫЕ СУФФИКСЫ И ПРЕФИКСЫ

### 1. СУФФИКСЫ ИМЕН СУЩЕСТВИТЕЛЬНЫХ

а) Суффиксы существительных, обозначающих национальность, профессию, действующее лицо или орудие действия.

-ian	Russian mechanician librarian historian	русский механик библиотекарь историк
-ent, -ant	student assistant	студент помощник

-ist	specialist socialist	специалист социалист
-er, -or	writer driver inventor	писатель водитель изобретатель

б) Суффиксы существительных, обозначающих отвлеченные понятия, процессы, действия и т. п.

-age	passage leakage	прохождение утечка
-ance, -ence, -ancy, -ency	resistance difference constancy efficiency	сопротивление различие постоянство эффективность
-ion (-ation, -tion, -sion, -ssion)	collection production dictation division transmission	собрание производство диктовка деление передача
-ism	socialism Marxism	социализм марксизм
-ment	requirement achievement	требование достижение
-ness	usefulness readiness	полезность готовность
-ty, -ity	safety possibility speciality	безопасность возможность специальность
-th	length growth	длина рост
-ure (-ture, -sure, -ssure)	mixture measure pressure	смесь мера давление
-ics, -ic	mathematics characteristic	математика характеристика
-ship	friendship leadership	дружба руководство
-ate	delegate	делегат

## II. СУФФИКСЫ ИМЕН ПРИЛАГАТЕЛЬНЫХ

-able -ible	measurable comparable possible visible	соизмеримый сравнимый возможный видимый
-al	central industrial	центральный промышленный
-ant, -ent	different important	различный важный
-ful	peaceful useful	мирный полезный
-less	useless powerless	бесполезный бессильный
-ic	historic patriotic	исторический патриотический
-ive	active comparative	активный сравнительный
-ous	courageous dangerous	смелый опасный
-y	cloudy dirty	облачный грязный
-ate	separate adequate	отдельный соответствующий

## III. СУФФИКСЫ ИМЕН ЧИСЛИТЕЛЬНЫХ

-teen	fifteen sixteen	пятнадцать шестнадцать
-ty	forty seventy	сорок семьдесят
-th	the fifteenth the fiftieth	пятнадцатый пятидесятый

## IV. СУФФИКСЫ ГЛАГОЛОВ

-ate -ute	communicate indicate contribute	сообщать указывать способствовать
-en	strengthen lengthen	усиливать удлинять

<b>-(i)fy</b>	<b>solidify</b> <b>intensify</b>	твердеть усиливать
<b>-ize (-ise)</b>	<b>mechanize</b> <b>characterize</b>	механизировать характеризовать

## V. СУФФИКСЫ НАРЕЧИЙ

<b>-ly</b>	<b>rapidly</b> <b>uselessly</b>	быстро бесполезно
<b>-ward(s)</b>	<b>forward</b> <b>towards</b>	вперед по направлению

## ОСНОВНЫЕ ПРЕФИКСЫ

### а) Префиксы со значением отрицания

<b>un-</b>	<b>unpleasant</b> <b>unequal</b>	неприятный неравный
<b>in-, il-, ir-, im-</b>	<b>indirect</b> <b>illiterate</b> <b>irregular</b> <b>impossible</b>	косвенный неграмотный неправильный невозможный
<b>dis-</b>	<b>dislike</b> <b>disorder</b>	нелюбовь беспорядок
<b>de-</b>	<b>demobilize</b>	демобилизировать
<b>non-</b>	<b>non-conductor</b> <b>non-standard</b>	непроводник нестандартный

### б) Префиксы с разными значениями

<b>re-</b>	<b>rewrite</b> <b>reconstruct</b>	переписать перестроить
<b>mis-</b>	<b>misunderstand</b> <b>mislead</b>	неправильно понять вводить в заблуждение
<b>en-</b>	<b>enlarge</b> <b>enrich</b>	увеличивать обогащать
<b>over-</b>	<b>overload</b> <b>overproduction</b>	перегрузить перепроизводство

under-	<b>underground</b> <b>underestimate</b>	подземный недооценивать
co-	<b>co-operation</b> <b>co-existence</b>	сотрудничество существование
inter-	<b>international</b> <b>interaction</b>	международный взаимодействие
sub-	<b>submarine</b> <b>subway</b>	подводная лодка подземная железная дорога (метро)
pre-	<b>pre-war</b> <b>pre-fabricated</b>	довоенный заранее изготовленный (сборный)
post-	<b>post-war</b> <b>post-revolutionary</b>	послевоенный послереволюционный

**ТАБЛИЦА НАИБОЛЕЕ УПОТРЕБИТЕЛЬНЫХ  
НЕСТАНДАРТНЫХ ГЛАГОЛОВ**

Infinitive	Past Indefinite	Past Participle
arise возникать be быть bear носить; выдерживать beat бить become становиться begin начинать, -ся bend гнуть, -ся; изгибать, -ся bind связывать bite кусать blow дуть break ломать, -ся; разбивать, -ся bring приносить build строить burn гореть buy покупать catch ловить, схватывать choose выбирать come приходить cut резать deal иметь дело do делать draw тащить; чертить drive везти, приводить в движение eat есть fall падать feed кормить feel чувствовать find находить	arose was (were) bore beat became began bent bound bit blew broke brought built burnt bought caught chose came cut dealt did drew drove ate fell fed felt found	arisen been born beaten become begun bent bound bitten blown broken brought built burnt bought caught chosen come cut dealt done drawn driven eaten fallen fed felt found

Infinitive	Past Indefinite	Past Participle
fly летать	flew	flown
forget забывать	forgot	forgotten
forgive прощать	forgave	forgiven
freeze замерзать, замораживать	froze	frozen
get получить; становиться	got	got
give давать	gave	given
go идти	went	gone
grind точить; молоть	ground	ground
grow расти	grew	grown
hang висеть; вешать	hung	hung
have иметь	had	had
hear слышать	heard	heard
hide прятать	hid	hid, hidden
hit ударять, поражать	hit	hit
hold держать	held	held
keep держать, хранить	kept	kept
know знать	knew	known
lay класть	laid	laid
lead вести	led	led
learn учиться	learnt, learned	learnt, learned
leave оставлять, покидать	left	left
lend одолаживать	lent	lent
let позволять	let	let
lie лежать	lay	lain
light зажигать, освещать	lit, lighted	lit, lighted
lose терять	lost	lost
make делать	made	made
mean значить; подразумевать	meant	meant
meet встречать	met	met
pay платить	paid	paid
put класть	put	put
read читать; давать показания (о приборе)	read	read
ring звонить, звенеть	rang	rung
rise подниматься	rose	risen
run бежать; работать (о машине)	ran	run
say говорить; сказать	said	said
see видеть	saw	seen
sell продавать	sold	sold
send посылать	sent	sent
shake трясти	shook	shaken
shine сиять	shone	shone
shoot стрелять	shot	shot
show показывать	showed	shown
shut закрывать	shut	shut
sing петь	sang	sung
sink погружаться	sank	sunk
sit сидеть	sat	sat
sleep спать	slept	slept
slide скользить	slid	slid
speak говорить	spoke	spoken
spend тратить	spent	spent
split расщеплять	split	split
spread распространять, -ся	spread	spread
spring прыгать	sprung	sprung
stand стоять	stood	stood



steal красть stick приклеивать, -ся strike ударять swim плавать swing качать, -ся take брать teach обучать, учить tear рвать tell рассказывать think думать throw бросать understand понимать wear носить win выигрывать wind наматывать; заводить write писать	stole stuck struck swam swung took taught tore told thought threw understood wore won wound wrote	stolen stuck struck swum swung taken taught torn told thought thrown understood worn won wound written

## АНГЛО-РУССКИЙ СЛОВАРЬ

### А

**ability** [ə'biliti] способность  
**able** ['eibl] способный  
**abolish** [ə'bɒlɪʃ] отменять, уничто-  
 жать  
**abolition** [æbə'liʃn] уничтожение  
**about** [ə'baʊt] 1) о, об; 2) около, при-  
 близительно, почти  
**above** [ə'baʊ] над  
**absent** ['æbsənt] отсутствующий  
**absorb** [əb'sɔ:b] поглощать  
**abstract** ['æbstrækt] резюме, выдерж-  
 ка (из книги)  
**academy** [ə'kædəmi] академия  
**accelerate** [æk'seləreit] ускорять  
**accelerator** [æk'seləreitə] ускоритель  
**accessories** [æk'sesəriz] принадлеж-  
 ности  
**accomplish** [ə'kɒmplɪʃ] совершать, вы-  
 полнять  
**accordance** [ə'kɔ:dəns] соответствие  
**according to** [ə'kɔ:diŋ tə] в соответ-  
 ствии с, соответственно  
**accounting** [ə'kaʊntɪŋ] учет, отчет-  
 ность  
**accumulate** [ə'kju:mjuleit] собирать,  
 накапливать  
**accuracy** ['ækjʊrəsi] точность  
**accurate** ['ækjʊrɪt] точный  
**achieve** [ə'tʃi:v] достигать  
**achievement** [ə'tʃi:vmənt] достижение  
**acid** ['æsid] кислота  
**across** [ə'krɒs] через  
**act** [ækt] действовать  
**action** ['ækʃn] действие  
**active** ['æktɪv] активный  
**actually** ['æktʃʊəli] в действительнос-  
 ти, фактически  
**acute** [ə'kju:t] острый  
**add** [æd] добавлять  
**additional** [ə'dɪʃənəl] дополнительный  
**address** [ə'dres] обращаться  
**adopt** [ədɒpt] принимать  
**advance** [əd'vɑ:ns] развиваться  
**advanced** [əd'vɑ:nst] передовой

**advantage** [əd'vɑ:ntɪdʒ] преимуще-  
 ство  
**advise** [əd'vaɪz] советовать  
**aerodynamics** ['æəroudaɪ'næmiks] аэро-  
 динамика  
**affair** [ə'feə] дело  
**affect** [ə'fekt] влиять, действовать,  
 воздействовать; to be affected by  
 подвергаться (воз)действию чего-  
 либо  
**afternoon** ['ɑ:ftə'nu:n] день  
**again** [ə'geɪn, ə'gen] опять  
**against** [ə'geɪnst, ə'genst] против  
**age** [eɪdʒ] век; возраст  
**agency** ['eɪdʒənsi] фактор  
**agriculture** ['ægrɪkʌltʃə] сельское хо-  
 зяйство  
**aid** [eɪd] 1. помощь; учебное пособие;  
 2. помогать  
**aim** [eɪm] 1. цель; 2. направлять  
**air** [ɛə] воздух  
**aircraft** ['ɛəkrɑ:ft] самолет  
**airliner** ['ɛə,laɪnə] рейсовый самолет  
**air navigation** ['ɛə,nævi'geɪʃn] аэро-  
 навигация  
**alchemist** ['ælkemɪst] алхимик  
**all** [ɔ:l] весь  
**allow** [ə'laʊ] позволять, разрешать,  
 давать возможность; (for) при-  
 нять во внимание, учитывать  
**allowance** [ə'laʊəns] стипендия  
**alloy** ['ælɔɪ] сплав  
**all-round** ['ɔ:l'raʊnd] всесторонний  
**almost** ['ɔ:l'mʌʊst] почти  
**alone** [ə'ləʊn] один; только  
**already** [ɔ:l'reɪdɪ] уже  
**also** [ɔ:l'səʊ] также  
**alter** ['ɔ:lteɪ] изменять  
**although** ['ɔ:l'dəʊ] хотя  
**altitude** ['æltɪtju:d] высота  
**altogether** [ɔ:l'tə'geðə] совсем; в об-  
 щем  
**aluminium** [ælju'mɪnɪəm] алюминий  
**always** ['ɔ:lweɪz] всегда

amber ['æmbə] янтарь  
 among [ə'mʌŋ] среди  
 amount [ə'maʊnt] величина; количе-  
 ство  
 amplify ['æmplɪfaɪ] усиливать  
 analogue computer ['ænəlɒg kəm'pjʊ-  
 tər] аналоговая вычислительная ма-  
 шина  
 analogy [ə'nælədʒi] аналогия  
 analyse(-lyze) ['ænəlaɪz] анализиро-  
 вать  
 analysis [ə'nælɪsɪs] анализ  
 analyzer ['ænəlaɪzər] анализатор  
 ancient ['eɪnfənt] древний  
 angular ['æŋɡjʊlə] угловой  
 animal ['ænɪmə] животное  
 another [ə'nʌðər] другой  
 answer ['ɑ:nsə] 1. ответ; 2. отвечать  
 anywhere ['eniweə] везде  
 apart from [ə'pɑ:t frəm] кроме  
 apparatus [ˌæpə'reɪtəs] прибор, аппа-  
 рат, аппаратура  
 apparently [ə'pærəntli] очевидно, по-  
 видимому  
 appear [ə'piə] появляться, казаться  
 appearance [ə'piərəns] появление  
 application [ˌæplɪ'keɪʃn] применение  
 apply [ə'plai] применять  
 apply corrections [ə'plai kə'rekʃənz]  
 вносить исправления  
 appreciate [ə'pri:ʃeɪt] ценить  
 approach [ə'prəʊtʃ] 1. подход, прибли-  
 жение; 2. приближаться  
 appropriate [ə'prəʊpriɪt] подходящий,  
 надлежащий  
 approximate [ə'prɒksɪmət] приближи-  
 тельный, приближенный  
 approximation [ə'prɒksɪ'meɪʃn] прибли-  
 жение  
 architectural [ˌɑ:kɪ'tektʃərəl] архитек-  
 турный  
 area ['eəriə] район; площадь  
 arise [ə'raɪz] (arose, arisen) возни-  
 кать  
 arithmetic [ə'riθmətɪk] арифметика  
 armament ['ɑ:məmənt] вооружение  
 armchair ['ɑ:m'tʃeə] кресло  
 around [ə'raʊnd] вокруг  
 arrange [ə'reɪndʒ] располагать(ся)  
 arrangement [ə'reɪndʒmənt] устрой-  
 ство, расположение  
 arrive [ə'raɪv] прибывать  
 art [ɑ:t] искусство  
 article ['ɑ:tɪkl] изделие; статья  
 artificial [ˌɑ:tɪ'fɪʃəl] искусственный

artistic [ɑ:'tɪstɪk] художественный  
 as [æz, əz] как; так как; когда, по-  
 мере того как  
 ask [ɑ:sk] спрашивать  
 assassinate [ə'sæseɪneɪt] убивать  
 assemble [ə'sembəl] собирать  
 assist [ə'sɪst] помогать  
 assistance [ə'sɪstəns] помощь  
 assistant professor [ə'sɪstənt prə'fesər]  
 доцент  
 associated with [ə'souʃɪeɪtɪd] связан-  
 ный с  
 assume [ə'sju:m] предполагать  
 astronautics [ˌæstrə'nɒ:tɪks] астронав-  
 тика  
 astronomer [əs'trɒnəmər] астроном  
 astronomy [əs'trɒnəmɪ] астрономия  
 as yet [əz 'jet] пока, до сих пор  
 atheistic [ˌeɪθɪ'stɪk] атеистический  
 Athens ['æθɪnz] Афины  
 atmosphere [ˌætməsfiə] атмосфера  
 atmospheric [ˌætməs'ferɪk] атмосфер-  
 ный  
 atom ['ætəm] атом  
 atomic [ə'tɒmɪk] атомный, ядерный  
 atomic engineering [ə'tɒmɪk ˌendʒɪ'nɪ-  
 ərɪŋ] ядерная техника  
 attempt [ə'tempt] 1. попытка; 2. пы-  
 таться, пробовать  
 attend [ə'tend] посещать  
 attention [ə'tenʃn] внимание  
 attraction [ə'trækʃn] притяжение  
 attractive [ə'træktɪv] притягивающий  
 attractiveness [ə'træktɪvnɪs] привлека-  
 тельность  
 author [ˈɔ:θər] автор  
 automate ['ɔ:təmeɪt] автоматизиро-  
 вать  
 automatic [ˌɔ:tə'mætɪk] автоматиче-  
 ский  
 automatic control [ˌɔ:tə'mætɪk kən'tro-  
 ʊl] автоматическое управление или  
 регулирование  
 automatic pilot [ˌɔ:tə'mætɪk 'paɪlət]  
 автопилот  
 automation [ˌɔ:tə'meɪʃn] автоматика  
 automobile [ˌɔ:tə'məbi:l] автомобиль  
 autumn [ˈɔ:təm] осень  
 availability [ə'veɪlə'bɪləti] наличие  
 available [ə'veɪləbl] имеющийся в на-  
 личии  
 average [ˈævərɪdʒ] средний  
 avoid [ə'vɔɪd] избегать  
 azimuth [ˈæzɪməθ] азимут

## В

back [bæk] назад, обратно  
 bacteria [bæk'tɪəriə] бактерии  
 ball [bɔ:l] шар, шарик  
 bank [bæŋk] банк

banner ['bæpən] знамя  
 bar [bɑ:] брусок  
 base [beɪs] 1. основа, основание 2.  
 основывать, базировать

**base oneself** ['beɪs wʌn'self] основываться, руководствоваться  
**basic** ['beɪsɪk] основной  
**basis** ['beɪsɪs] основа  
**bath** [bɑːθ] ванна  
**bathroom** ['bɑːθrʊm] ванная  
**battery** ['bætəri] батарея  
**battle** ['bætl] битва, бой  
**beam** [biːm] луч, пучок лучей  
**beauty** ['bjʊti] красота  
**because of** [bi'kɔz əv] из-за, благодаря  
**become** [bi'kʌm] (became; become) становиться, делаться  
**bed** [bed] кровать  
**bedroom** ['bedrʊm] спальня  
**begin** [bi'ɡɪn] (began; begun) начинать  
**beginning** [bi'ɡɪnɪŋ] начало  
**Belgium** ['beldʒəm] Бельгия  
**believe** [bi'li:v] верить, считать, думать  
**below** [bi'lou] ниже, внизу  
**besides** [bi'saɪdz] кроме, кроме того  
**between** [bi'twi:n] между  
**beyond** [bi'jɒnd] за, по ту сторону  
**big** [bɪɡ] большой  
**billion** ['bɪljən] биллон, миллиард  
**binary** ['baɪnəri] двоичный  
**bind** [baɪnd] (bound, bound) привязывать, связывать, соединять  
**biological** [baɪə'lɒdʒɪkəl] биологический  
**biologist** [baɪə'lɒdʒɪst] биолог  
**biopolymer** ['baɪəu'pɒlɪmə] биополимер  
**block** [blɒk] преграждать, задерживать  
**block of flats** ['blɒk əv 'flæts] жилой дом  
**blue** [blu:] синий; голубой  
**body** ['bɒdi] тело  
**boil** [bɔɪl] кипятить; кипеть  
**boiling point** точка кипения  
**bold** [bəʊld] смелый

**boldness** ['bəʊldnɪs] смелость  
**bombard** [bɒm'bɑːd] бомбардировать  
**bond** [bɒnd] связь  
**book-case** ['bukkeɪs] книжный шкаф  
**bookshelves** ['bukʃelvz] этажерка  
**born** [bɔːn] рожденный  
**both** [bəʊθ] оба  
**bourgeoisie** [buəʒwa:'zi:] буржуазия  
**boy** [bɔɪ] мальчик  
**brain** [breɪn] мозг  
**branch** [brɑːntʃ] отрасль, область  
**break** [breɪk] (broke, broken) ломать, разрушать, разбивать(ся), разрывать(ся), распадаться(ся)  
**break down** ['breɪk'daʊn] раскладывать (на составные части)  
**breakfast** ['brekfəst] завтрак  
**break up** ['breɪk'ʌp] расщепляться  
**breathe** [briːð] дышать  
**bridge** [brɪdʒ] мост  
**bright** [braɪt] яркий  
**brilliant** ['brɪljənt] блестящий  
**bring** [brɪŋ] (brought, brought) приносить, приводить  
**British Museum** ['brɪtɪʃ mjuː'ziəm] Британский музей  
**brittle** [brɪtl] хрупкий  
**broad** [brɔːd] широкий  
**broadcast** ['brɔːdkɑːst] передавать (по радио)  
**broadcasting** ['brɔːdkɑːstɪŋ] радиопередача  
**brother** ['brʌðə] брат  
**build-in** ['bɪld'ɪn] встраивать (в конструкцию)  
**building** ['bɪldɪŋ] здание  
**building site** ['bɪldɪŋ'saɪt] строительный участок  
**burn** [bɜːn] гореть  
**burning** ['bɜːnɪŋ] горение  
**bus** [bʌs] автобус  
**business** ['biznɪs] дело  
**buy** [baɪ] (bought, bought) покупать  
**by-product** ['baɪ,prɒdʌkt] побочный продукт

## С

**calcium** ['kælsiəm] кальций  
**calculation** [ˌkælkju'leɪʃn] вычисление  
**call** [kɔːl] звать; называть  
**call for** ['kɔːl'fɔː] требовать  
**camera** ['kæməɹə] камера  
**capable** ['keɪpəbl] способный  
**capital** ['kæpɪtl] столица  
**capacity** [kə'pæsɪti] мощность  
**capitalist** ['kæpɪtəlɪst] капиталист  
**carbon** ['kɑːbən] углерод  
**care** [keə] забота

**career** [kə'riə] карьера  
**careful** ['keəfʊl] тщательный  
**carpenter** ['kɑːpɪntə] плотник  
**carry** ['kæri] нести  
**carry on** ['kæri'ɒn] проводить, вести; продолжать  
**carry out** ['kæri'aʊt] выполнять, проводить (опыт)  
**case** [keɪs] случай  
**cast** [kɑːst] (cast, cast) 1. отливать, лить, 2. литой  
**catalyst** ['kætəlɪst] катализатор

**cathode-ray tube** ['kæθəʊdreɪ'tju:b] электронно-лучевая трубка  
**cause** [kɔ:z] 1. причина; дело; 2. вызывать, заставлять, причинять  
**celestial** [si'lestjəl] небесный  
**cell** [sel] элемент; клетка  
**central heating** ['sentrəl 'hi:tiŋ] центральное отопление  
**centre** ['sentə] 1. центр; 2. концентрировать, сосредотачивать(ся)  
**century** ['sentʃəri] столетие, век  
**ceramics** [si'gæmiks] керамика  
**certain** ['sə:tn] определенный; один, некий, некоторый  
**certainly** ['sə:tnli] конечно  
**certainly** ['sə:tnli] достоверность, уверенность  
**chain** [tʃein] цепь  
**chair** [tʃɛə] стул  
**chance** [tʃɑ:ns] возможность  
**change** [tʃeɪndʒ] 1. изменение; 2. изменять(ся)  
**change in**(to) ['tʃeɪndʒ (in)tə] преобразовываться, превращаться  
**chaos** ['keɪɔs] хаос  
**characteristic** (of) [ˌkærɪktə'rɪstɪk (əv)] 1. характеристика, характерная особенность; 2. характерный (для)  
**characterize** ['kærɪktəraɪz] характеризовать  
**charge** [tʃɑ:dʒ] 1. заряд; 2. зарядить  
**cheap** [tʃi:p] дешевый  
**check** [tʃek] проверять  
**chemical** ['kemɪkəl] химический  
**chemist** ['kemɪst] химик  
**chemistry** ['kemɪstri] химия  
**chiefly** ['tʃi:fli] главным образом  
**chlorine** ['klɔ:ri:n] хлор  
**choice** [tʃɔɪs] выбор  
**choose** [tʃu:z] (chose, chosen) выбирать  
**cinema** ['sɪnɪmə] кино  
**circuit** ['sə:kɪt] цепь (электрическая)  
**circulate** ['sə:kjuleɪt] циркулировать  
**citizen** ['sɪtɪzn] гражданин  
**city** ['sɪti] город  
**civilization** [ˌsɪvɪlaɪ'zeɪʃn] цивилизация  
**civilized** ['sɪvɪlaɪzd] цивилизованный  
**classes** ['kla:sɪz] занятия  
**classical** ['klæsɪkəl] классический  
**clean** [kli:n] 1. чистить, убирать; 2. чистый  
**clear** [kliə] ясный  
**clink** [kliŋk] звенеть  
**close** [klaʊs] близкий, тесный  
**cloud** [klaʊd] облако  
**club** [klʌb] клуб  
**coarse** [kɔ:s] грубый

**co-existence** ['kəʊɪg'zɪstəns] сосуществование  
**cold** [kəʊld] холодный; холод  
**colleague** ['kəli:g] коллега  
**collect** [kə'lekt] собирать  
**college** ['kɒlɪdʒ] колледж  
**collide** [kə'laɪd] сталкиваться  
**colossal** [kə'lɒsl] колоссальный  
**colour** ['kʌlə] 1. цвет; 2. окрашивать  
**colourless** ['kʌlələs] бесцветный  
**column** ['kɒləm] колонна, столб  
**combination** [ˌkɒmbɪ'neɪʃn] сочетание  
**combine** [kəm'baɪn] сочетать, соединять  
**combustion** [kəm'bʌstʃn] горение  
**come** [kʌm] (came, come) приходить, приезжать  
**come back** ['kʌm'bæk] возвращаться  
**come true** ['kʌm'tru:] осуществляться  
**comfort** ['kʌmfət] удобство, комфорт  
**comfortable** ['kʌmfətəbl] комфортабельный, уютный, удобный  
**commerce** ['kɒmə:s] торговля  
**commercial** [kə'mɜ:ʃəl] торговый  
**common** ['kɒmən] обычный, общий  
**committee** [kə'mɪti] комитет  
**communicate** [kə'mju:nikeɪt] сообщать, передавать, сообщаться  
**communication** [kə'mju:nɪ'keɪʃn] связь  
**communist** ['kɒmjunist] коммунист  
**compact** [kəm'pækt] компактный, плотный  
**comparable** ['kɒmpərəbl] сравнимый  
**comparative** [kəm'pærətɪv] сравнительный  
**compare** [kəm'preə] сравнивать, сравниваться  
**compass** ['kʌmpəs] компас  
**compete** [kəm'pi:t] соревноваться, конкурировать  
**complete** [kəm'pli:t] весь, полный  
**completely** [kəm'pli:tli] полностью, совершенно  
**complex** ['kɒmpleks] сложный  
**complexity** ['kɒm'pleksɪli] сложность  
**complicated** ['kɒmplɪkeɪtɪd] сложный  
**component** [kəm'pəʊnənt] составная часть  
**compose** [kəm'pəʊz] составлять  
**composite** ['kɒmpəzɪt] сложный  
**composition** [ˌkɒmpə'zɪʃn] состав  
**compound** ['kɒmpaʊnd] соединение (хим.)  
**comprehensive automation** [ˌkɒmpri'hensɪv,ə:tə'meɪʃn] комплексная автоматизация  
**compression** [kəm'preʃn] сжатие  
**compute** [kəm'pjʊ:t] вычислять  
**computer** [kəm'pjʊ:tə] электронная вычислительная машина  
**comradely** ['kɒmɪdli] товарищеский

**concentrate** ['kɒnsentreɪt] сосредоточивать(ся), концентрировать(ся)  
**concert** ['kɒnsət] концерт  
**conclusion** [kən'kli:ʒn] заключение; вывод  
**condition** [kən'dɪʃn] состояние; условие  
**conduct** [kən'dʌkt] проводить  
**conductor** [kən'dʌktə] проводник  
**confine** [kən'faɪn] ограничивать  
**confront** [kən'frʌnt] стоять перед  
**confuse** [kən'fju:z] смешивать, спутывать  
**congress** ['kɒngres] съезд; конгресс  
**connect** [kə'nekt] соединять, связывать  
**connection** [kə'nekʃn] связь  
**conquer** ['kɒŋkə] завоевать, победить  
**conquest** ['kɒŋkwɛst] завоевание  
**consequence** ['kɒnsɪkwəns] следствие  
**consequently** ['kɒnsɪkwəntli] следовательно  
**consider** [kən'sɪdə] считать; рассматривать  
**considerable** [kən'sɪdərəbl] значительный  
**consideration** [kən,sɪdə'reɪʃn] соображение  
**consist (of)** [kən'sɪst (əv)] состоять (из)  
**consist (in)** [kən'sɪst (ɪn)] заключаться (в)  
**constant** ['kɒnstənt] постоянный  
**constituent** [kən'stɪtjuənt] составная часть  
**constitute** ['kɒnstɪtju:t] составлять  
**construct** [kən'strʌkt] строить  
**construction** [kən'strʌkʃn] строительство  
**consultation** [ˌkɒnsəl'teɪʃn] консультация  
**contact** ['kɒntækt] контакт, соприкосновение  
**contain** [kən'teɪn] содержать  
**continual** [kən'tɪnjuəl] непрерывный  
**continue** [kən'tɪnju:] продолжать  
**continuous** [kən'tɪnjuəs] непрерывный  
**contradiction** [ˌkɒntrə'dɪkʃn] противоречие  
**contrary to** ['kɒntrəri tə] в противоречии с  
**contribute** [kən'trɪbjʊ:t] способствовать, содействовать  
**contribution** [ˌkɒntrɪ'bju:ʃn] вклад  
**control** [kən'trəʊl] 1. контроль, управление; орган управления или регулирования; 2. управлять  
**controller** [kən'trəʊlə] контроллер, регулятор  
**convection** [kən'vekʃn] конвекция  
**conveniences** [kən'vi:njənsɪz] удобства

**conventional** [kən'venʃənl] обычный, обыкновенный  
**conversation** [ˌkɒnvə'seɪʃn] разговор, беседа  
**conversion** [kən'və:ʃn] превращение  
**convert (into)** [kən'vɔ:t] (ɪntə)] превращать, преобразовывать  
**conviction** [kən'vɪkʃn] убеждение  
**cook** [kuk] готовить, варить  
**cool** [ku:l] охлаждать  
**co-operation** [kou,əpə'reɪʃn] сотрудничество  
**copper** ['kɒpə] медь  
**corner** ['kɔ:nə] угол  
**correction** [kə'rekʃn] исправление, поправка  
**correspondence** [ˌkɒrɪs'pɒndəns] переписка; соответствие  
**correspondence education** [ˌkɒrɪs'pɒndəns 'edju:'keɪʃn] заочное образование  
**corresponding** [ˌkɒrɪs'pɒndɪŋ] соответствующий  
**corridor** ['kɒrɪdɔ:] коридор  
**corrosion** [kə'rouʒn] коррозия  
**cosmic** ['kɒzmɪk] космический  
**cosmonaut** ['kɒzməno:t] космонавт  
**cost** [kɒst] 1. стоить, цена; 2. стоить  
**council** ['kaʊnsɪl] совет  
**count** ['kaʊnt] считать  
**counter** ['kaʊntə] счетчик  
**countless** ['kaʊntlɪs] бесчисленный  
**country** ['kʌntri] страна, родина; сельская местность  
**course** [kɔ:s] курс; направление, русло, ход, течение  
**cradle** ['kreɪdl] колыбель  
**create** [kri:'eɪt] создавать  
**creation** [kri:'eɪʃn] созидание; создание; творчество  
**creative** [kri:'eɪtɪv] творческий  
**critical** ['krɪtɪkəl] критический; дефицитный  
**cryogenic** [kraɪə'dʒenɪk] криогенный  
**cryogenics** [kraɪə'dʒenɪks] криогеника, техника низких температур  
**crystal** ['krɪstl] кристалл  
**cultural standard** ['kʌltʃərəl 'stændəd] культурный уровень  
**culture** ['kʌltʃə] культура  
**cup** [kʌp] чашка  
**cupboard** ['kʌbəd] буфет  
**current** ['kʌrənt] течение; ток  
**cushion** ['kuʃən] подушка  
**cut** [kʌt] (cut, cut) резать  
**cybernetics** [ˌsaɪbə'netɪks] кибернетика  
**cycle per second** ['saɪkl pə'sekənd] герц  
**cyclotron** ['saɪklətrɒn] циклотрон

**daily** ['deili] ежедневный  
**danger** ['deindʒə] опасность  
**dangerous** ['deindʒrəs] опасный  
**dare** [dæ] сметь, иметь смелость  
**dark** [dɑ:k] 1. темнота; 2. темный  
**darkness** ['dɑ:knis] темнота  
**data** ['deitə] данные  
**daughter** ['dɔ:tə] дочь  
**day** [dei] день  
**dead** [ded] мертвый  
**deal (with)** [di:l (wið)] иметь дело (с)  
**dear** [diə] дорогой  
**decade** ['dekeid] десятилетие  
**decay** [di'kei] 1. разрушение; 2. разрушаться  
**decisive** [di'saisiv] решающий  
**decorate** ['dekəreit] награждать; украшать  
**decrease** ['dikri:s] 1. уменьшение, понижение; [di:'kri:s] 2. уменьшать(ся), понижать(ся)  
**decree** [di'kri:] декрет  
**deep** [di:p] глубокий; темный (о краске)  
**define** di'fain] определять (давать определение)  
**definite** ['definit] определенный  
**definition** [,defi'niʃn] определение  
**deformation** [,di:fɔ:'meiʃn] деформация  
**degree** [di'gri:] степень; градус  
**delegate** ['deligit] делегат  
**deliver** [di'livə] доставлять  
**to ~ a lecture** читать лекцию  
**demand** [di'mɑ:nd] 1. требование, запрос, спрос, потребность; 2. требовать  
**democracy** [di'mɒkrəsi] демократия  
**democratic** [,demə'krætik] демократический  
**demonstrate** ['demənstreit] демонстрировать, показывать  
**density** ['densiti] плотность  
**department** [di'pɑ:tmənt] факультет, отделение  
**depend (on, upon)** [di'pend (ən, ə'pən)] зависеть (от)  
**descend** [di'send] спускаться  
**descent** [di'sent] спуск  
**describe** [dis'kraib] описывать  
**desert** ['dezət] пустыня  
**design** [di'zain] проект, план, чертеж, конструкция; 2. рассчитывать, проектировать  
**designer** [di'zainə] конструктор  
**desirable** [di'zaiərəbl] желаемый  
**desire** [di'zaɪə] желать  
**destroy** [dis'trɔi] разрушать

**destruction** [dis'trʌkʃn] разрушение  
**detail** ['di:teɪl] деталь, подробность  
**detect** [di'tekt] обнаруживать  
**detector** [di'tektə] детектор  
**determination** [di,təmi'neiʃn] определение  
**determine** [di'tə:min] определять  
**develop** [di'veləp] развивать(ся); конструировать, разрабатывать (машину, конструкцию)  
**development** [di'veləpmənt] развитие; усовершенствование  
**device** [di'vais] прибор, устройство  
**devise** [di'vaiz] придумывать, разрабатывать  
**diagnose** ['daɪəgnəʊz] ставить диагноз  
**diamagnetic** [,daɪəmæg'netik] диамагнитный  
**diameter** [daɪ'æmitə] диаметр  
**dictatorship** [dik'teitəʃɪp] диктатура  
**dictionary** ['dikʃənri] словарь  
**differ** ['difə] различать(ся)  
**difference** ['difrəns] разни́ца, различие; разность  
**different** ['difrənt] различный  
**difficult** ['difɪkəlt] трудный  
**difficulty** ['difɪkəlti] трудность  
**digital computer** ['dɪdʒɪtəl kəm'pjʊ:tə] цифровая вычислительная машина  
**dimension** [di'menʃn] размер  
**dining-hall** ['daɪnɪŋhɔ:l] столовая  
**dining-room** ['daɪnɪŋru:m] столовая  
**diode** ['daɪəʊd] диод  
**dioxide** ['daɪ'ɒksaɪd] двуокись  
**dip** [dɪp] окунуть, опустить  
**diploma** [di'pləʊmə] диплом  
**direct** [di'rekt] прямой, непосредственный  
**direct (toward)** [di'rekt tə'wɔ:d] направлять (на)  
**direction** [di'rekʃn] направление  
**dirty** ['dɜ:ti] грязный  
**discover** [dis'kʌvə] открывать; раскрывать (тайну)  
**discovery** [dis'kʌvəri] открытие  
**discrimination** [dis,krimi'neiʃn] дискриминация  
**discuss** [dis'kʌs] обсуждать  
**disease** [di'zi:z] болезнь  
**displace** [dis'pleɪs] смещать  
**display** [dis'pleɪ] показывать, обнаруживать  
**dissociation** [di,sousi'eɪʃn] диссоциация  
**dissolve** [di'zɒlv] растворять  
**distance** ['distəns] расстояние  
**distant** ['distənt] дальний, далекий

distinguish [dis'tɪŋɡwɪʃ] различать, отличать  
 district ['dɪstrɪkt] район  
 disturb [dis'tə:b] нарушать  
 disturbance [dis'tə:bəns] нарушение  
 divide [di'vaɪd] делить(ся)  
 divisibility [di'vɪzɪ'bɪlɪti] делимость, способность делиться  
 divisible [di'vɪzɪbl] делимый  
 division [di'vɪʒn] деление  
 dock [dɒk] док  
 document ['dɒkjʊmənt] документ  
 door [dɔ:] дверь  
 double [dʌbl] двойной  
 doubt [daʊt] сомнение  
 dozen [dʌzn] дюжина  
 draw up ['drɔ:ʌp] составлять

dream [dri:m] (dreamt, dreamt) 1. мечта, 2. мечтать  
 dressing-table ['dresɪŋ,teɪbl] туалетный столик  
 drill [drɪl] сверлить  
 drive a car (drove, driven) ['draɪv ə'kɑ:] водить машину  
 drive nails ['draɪv 'neɪlz] забивать гвозди  
 drop [drɒp] ронять; падать  
 due to ['dju: tə] благодаря, вследствие  
 dull [dʌl] глухой (звук)  
 duplicate ['dju:plikeɪt] дублировать  
 durable ['djuərəbl] прочный, выносливый  
 during ['djuəriŋ] в течение  
 dye [daɪ] краска

## Е

each [i:tʃ] каждый  
 early ['ɜ:li] ранний; рано  
 earth [ɜ:θ] земля  
 ease [i:z] легкость  
 east [i:st] восток  
 easy ['i:zi] легкий  
 eat [i:t] (ate, eaten) есть  
 echo ['ekəʊ] эхо, сигнал  
 economy [i:'kɒnəmi] хозяйство; экономия  
 edifice ['edɪfɪs] здание  
 edition [i'dɪʃn] издание  
 education [edju:'keɪʃn] образование  
 effect ['ɪfekt] 1. эффект, действие, влияние; 2. выполнять, совершать, осуществлять  
 effective [ɪ'fektɪv] эффективный  
 efficiency [ɪ'fɪʃənsi] коэффициент полезного действия (КПД)  
 efficient [ɪ'fɪʃənt] эффективный, производительный  
 effort ['efət] усилие  
 either... or ['aɪðə ...ɔ:] или... или  
 electric [ɪ'lektrɪk] электрический  
 electricity [ɪlek'trɪsɪti] электричество  
 electrify [ɪ'lektrɪfaɪ] электрифицировать  
 electron [ɪ'lektrɒn] электрон  
 electronic [ɪlek'trɒnɪk] электронный  
 element ['elɪmənt] элемент  
 elementary [ɪli'mentəri] элементарный  
 eliminate [ɪli'mɪneɪt] уничтожать, ликвидировать  
 elimination [ɪli'mɪneiʃn] уничтожение, ликвидация  
 emit [ɪ'mɪt] испускать, излучать  
 employ [ɪm'plɔɪ] использовать, применять  
 empty ['empti] пустой  
 enable [ɪ'neɪbl] давать возможность

enclose (in) [ɪn'klaʊz] (in) заключать (в)  
 end [end] конец  
 endanger [ɪn'deɪndʒə] подвергать опасности  
 energy [enədʒi] энергия  
 enough [ɪ'nʌf] достаточный; достаточно, довольно  
 enrichment [ɪn'rɪʃmənt] обогащение  
 ensure [ɪn'sʊə] обеспечивать  
 enter ['entə] входить, вступать  
 enterprise ['entəpraɪz] предприятие  
 enthusiasm [ɪn'θju:ziæzəm] энтузиазм  
 entire [ɪn'taɪə] весь, целый  
 entirely [ɪn'taɪəli] полностью, совершенно  
 entrance ['entrəns] поступление; вход  
 equal [ɪ'kwəl] равный  
 equality [ɪ'kwɒləti] равенство  
 equipment [ɪ'kwɪpmənt] оборудование  
 equivalent [ɪ'kwɪvələnt] 1. эквивалент; 2. эквивалентный  
 era ['ɪərə] эра  
 erect [ɪ'rekt] соорудить, выдвигать  
 especial [ɪs'peʃəl] особенный  
 essence ['esns] сущность  
 essential [ɪ'sensjəl] существенный  
 establish [ɪs'tæblɪʃ] устанавливать; учреждать  
 establishment [ɪs'tæblɪʃmənt] учреждение, заведение, основание  
 etc.=and so on [ɪt'setə=ænd sɒ ə'n] и так далее  
 eternally [ɪ:'tə:nəli] вечно  
 ethylene [ɪ'θɪli:n] этилен  
 evaporate [ɪ'væpəreɪt] испарять  
 even [i:vən] даже  
 even though [ɪ:'vɒnθəʊ] даже если  
 even with [ɪ:'vɒn wɪð] на одном уровне с



**evening** ['i:vniŋ] вечер  
**event** ['i:vent] событие  
**eventually** ['i:ventʃuəli] в конце концов  
**ever** ['evə] когда-либо  
**every** ['evri] каждый  
**everybody** ['evribɒdi] каждый  
**everything** ['evriθiŋ] все  
**everywhere** ['evriweə] везде  
**evident** ['evidənt] очевидный  
**exact** [ig'zækt] точный  
**examination** [ig,zæmi'neiʃn] экзамен  
**examine** [ig'zæmin] рассматривать, исследовать  
**example** [ig'zɑ:mpl] пример  
**exceedingly** [ik'si:diŋli] чрезвычайно, очень  
**excellent** ['eksələnt] отличный  
**except** [ik'sept] за исключением  
**exchange** [iks'tʃeindʒ] обмен  
**exceed** [ik'si:d] превышать  
**exciting** [ik'saitiŋ] захватывающий  
**execution** [eksi'kju:ʃn] казнь  
**exist** [ig'zist] существовать  
**existence** [ig'zistəns] существование  
**expand** [iks'pænd] расширяться  
**expect** [iks'pekt] ожидать  
**expensive** [iks'pensiv] дорогой  
**experience** [iks'piəriəns] опыт

**experiment** [iks'perimənt] опыт, эксперимент  
**experimental** [eks,peri'mentl] экспериментальный  
**experimentation** [eks,perimen'teiʃn] экспериментирование  
**experimenter** [eks,peri'mentə] экспериментатор  
**expert** ['ekspə:t] эксперт, специалист  
**explain** [iks'plein] объяснять  
**explanation** [eksplə'neiʃn] объяснение  
**exploitation** [eksplɔi'teiʃn] эксплуатация  
**exploration** [eksplə'reiʃn] исследование  
**express** [iks'pres] выражать  
**expression** [iks'preʃn] выражение  
**extend** [iks'tend] расширять, распространять, простирается  
**extension** [iks'tenʃn] расширение  
**extensive** [iks'tensiv] обширный  
**extra** ['ekstrə] дополнительный  
**extra-mural department** ['ekstrə 'mjuərəl di'pɑ:tmənt] заочный факультет  
**extraordinary** [iks'trɔ:dnri] необычайный  
**extremely** [iks'tri:mli] чрезвычайно  
**eye** [ai] глаз

## F

**face** [feis] стоять лицом к, сталкиваться с (опасностью)  
**facilities** [fə'silitiz] льготы, благоприятные возможности, удобства  
**factor** ['fæktə] фактор  
**factory** ['fæktəri] фабрика, завод  
**Fahrenheit** ['færənheit] по Фаренгейту  
**fail** [feil] разрушаться  
**failure** ['feiljə] разрушение, авария  
**fall** [fɔ:l] (fell, fallen) падать  
**fall behind** [fɔ:l bi'haind] отставать  
**familiar** [fə'miljə] знакомый  
**family** ['fæmili] семья  
**famous** ['feiməs] известный, знаменитый  
**far** [fɑ:] далекий, далеко, гораздо  
**fast** [fɑ:st] быстрый; быстро  
**father** ['fɑ:ðə] отец  
**feature** ['fi:tʃə] особенность, характер  
**feedback circuit** ['fi:dbæk] схема обратной связи  
**feedback control** ['fi:dbæk] управление или регулирование с обратной связью  
**feedback control system** система регулирования или управления с обратной связью

**feel** [fi:l] (felt, felt) чувствовать  
**few** [fju:] мало; a few [ə'fju:] несколько  
**fibre** ['faibə] волокно  
**field** [fi:ld] поле; область (науки, техники)  
**fighter** ['faitə] истребитель  
**figure** ['figə] фигура  
**fill** [fil], наполнять, заполнять; **fill the needs** ['fil ðə'ni:dz] удовлетворять нужды  
**filler** ['filə] заполнитель  
**final** ['faɪnəl] окончательный  
**finally** ['faɪnəli] наконец  
**find** [faɪnd] (found, found) находить  
**find out** ['faɪnd'aut] узнавать, обнаруживать  
**fine** [faɪn] красивый; мелкий  
**finish** ['finiʃ] кончать  
**finished material** ['finiʃt mə'tiəriəl] готовое изделие  
**fire** [faɪə] огонь  
**fireproof** ['faɪəpru:f] огнеупорный  
**frist** ['fɜ:st] сначала, сперва  
**fission** ['fiʃn] расщепление  
**fitter** ['fitə] слесарь  
**flat** [flæt] квартира; плоский  
**flaw** [flɔ:] дефект  
**flight** [flaɪt] полет

float [flaʊt] плавать  
 floor [flɔ:] этаж; пол  
 flow [fləʊ] 1. течение; 2. течь, литься  
 fluorescent [fluə'resnt] флуоресцентный  
 fly a plane [flai ə'pleɪn] управлять самолетом  
 fluid-tight ['flu:ɪd-taɪt] непроницаемый для жидкости, плотный  
 focus ['foukəs] фокусировать  
 fog [fɒg] туман  
 follow ['fɒləʊ] следовать  
 food [fu:d] пища  
 foot, on foot [fʊt, ɒn 'fʊt] пешком  
 for [fɔ:, fə] для, потому что, так как  
 for ever [fə'evə] вечно  
 force [fɔ:s] 1. сила; 2. заставлять  
 foreign ['fɔ:rɪn] иностранный  
 forget ['fə'get] (forgot, forgotten) забывать  
 form [fɔ:m] 1. форма; 2. образовывать  
 formal logic ['fɔ:məl 'lɒdʒɪk] формальная логика  
 former ['fɔ:mə] первый (из двух)  
 formulate ['fɔ:mjuleɪt] формулировать  
 found [faʊnd] обосновывать  
 foundation [faʊn'deɪʃn] основание, фундамент  
 founder ['faʊndə] основатель, основоположник  
 four [fɔ:] четыре  
 fraction ['frækʃn] доля, часть  
 fragment ['frægmənt] осколок  
 France [frɑ:ns] Франция  
 fraternity [frə'tɛ:nɪti] братство

free [fri:] 1. свободный; 2. освободить; 3. бесплатный  
 free of charge ['fri:əv'tʃɑ:dʒ] бесплатный  
 freeze [fri:z] (froze, frozen) заморозить; замораживать  
 frequency ['fri:kwənsi] частота  
 frequently ['fri:kwəntli] часто  
 friction ['frɪkʃn] трение  
 friend [frend] друг  
 friendship ['frendʃɪp] дружба  
 front [frʌnt] фронт  
 fruitful ['fru:tʃʊl] плодотворный  
 fuel [fjuəl] топливо, горючее  
 full [fʊl] полный  
 full-time post-graduate course ['fʊl-taɪm 'pəʊst 'grædʒueɪt 'kɔ:s] аспирантура с отрывом от производства  
 full-time study ['fʊl-taɪm 'stʌdi] стационарное обучение  
 fully ['fʊli] полностью  
 function ['fʌŋkʃən] 1. действовать, 2. функция  
 fundamental [fʌndə'mentl] основной  
 fundamentally [fʌndə'mentəli] коренным образом  
 furnish ['fɜ:nɪʃ] меблировать, обставлять  
 furniture ['fɜ:nɪtʃə] мебель  
 further ['fɜ:ðə] дальнейший, далее  
 furthermore ['fɜ:ðə'mɔ:] далее, кроме того  
 fusion ['fju:ʒn] синтез, слияние  
 future ['fju:tʃə] 1. будущее; 2. будущий

## G

gain [geɪn] получать, приобретать (опыт)  
 gas [gæs] газ  
 gaseous ['geɪzjəs] газообразный  
 gas pipeline ['gæs'paɪp,lain] газопровод  
 general ['dʒenərəl] общий  
 generate ['dʒenəreɪt] производить, выработать, генерировать  
 generator ['dʒenəreɪtə] генератор  
 genius ['dʒi:njəs] гений  
 genuine ['dʒenjuɪn] подлинный, настоящий  
 geochemistry [dʒi:ou'kemɪstri] геохимия  
 geometry [dʒi'ɒmɪtri] геометрия  
 geophysicist [dʒi:ə'fɪzɪst] геофизик  
 germanium [dʒə'meɪniəm] германий  
 get [get] (got, got) доставать, получать  
 get along ['get ə'lɒŋ] поживать, жить  
 giant ['dʒaɪənt] гигант

gigantic [dʒaɪ'gæntɪk] гигантский  
 girl [gɜ:l] девочка  
 give [gɪv] (gave, given) давать; при-  
 давать  
 give off ['gɪv'ɔ:f] испускать, выделять  
 glass [glɑ:s] стекло  
 global ['gləʊbəl] глобальный  
 glue [glu:] клей  
 go in for sports ['gou 'ɪn fə'spɔ:ts] заниматься спортом  
 gold [gəʊld] золото  
 go on ['gou 'ɒn] продолжать  
 govern [gəvən] управлять  
 government ['gævənmənt] правительство  
 governor ['gævənə] регулятор  
 gradual ['grædʒʊəl] постепенный  
 graduate (from) ['grædʒueɪt ('frɒm)] оканчивать (высшее учебное заведение); [grædʒueɪt] выпускник (учебного заведения)

grain [greɪn] зерно  
 grammar ['græmə] грамматика  
 gravity ['grævɪti] сила тяжести  
 great [greɪt] большой, великий  
 greatly ['greɪtli] очень, значительно  
 Greek [gri:k] греческий  
 grind [graɪnd] шлифовать, дробить

ground [graʊnd] земля  
 group [gru:p] 1. группа; кружок; 2. группировать(ся)  
 grow [grou] (grew, grown) расти, развиваться  
 growth [graʊθ] рост, развитие  
 guide [gaɪd] управлять

## Н

habitable ['hæbɪtəbl] обитаемый  
 half [hɑ:f] половина  
 hall [hɔ:l] зал  
 hand [hænd] рука  
 handle ['hændl] (зд.) обрабатывать, управлять  
 hand over ['hænd'ouəv] передавать  
 happen ['hæpn] случаться, происходить  
 happiness ['hæpɪnis] счастье  
 hard [hɑ:d] твердый, прочный; трудный  
 hardly [hɑ:dli] едва, едва ли  
 hardness ['hɑ:dnɪs] твердость; прочность  
 headquarters ['hed'kwɔ:təz] штаб  
 health [helθ] здоровье  
 health service [helθ 'sɜ:vɪs] медицинское обслуживание  
 hear [hɪə] (heard, heard) слышать  
 heart [hɑ:t] сердце  
 heat [hi:t] 1. тепло; 2. нагревать  
 heavenly ['hevnlɪ] небесный  
 heavy ['hevi] тяжелый  
 height [haɪt] высота  
 helium ['hi:lɪəm] гелий  
 help [help] помогать  
 helpless ['helpɪs] беспомощный  
 hence [hens] отсюда, следовательно  
 here [hɪə] здесь, сюда  
 heroic [hi'rouɪk] героический  
 hidden ['hɪdn] от hide [haɪd] прятать  
 high [haɪ] высокий  
 higher education ['haɪə ,edju:'keɪʃn] высшее образование

higher learning ['haɪə 'lɜ:nɪŋ] высшее образование  
 highly ['haɪli] очень  
 historic [hɪs'tɒrɪk] исторический  
 historical [hɪs'tɒrɪkəl] исторический  
 history ['hɪstəri] история  
 holiday home ['hɒlɪdi 'həʊm] дом отдыха  
 honest ['ɒnɪst] честный  
 honour ['ɒnə] почитать, чтить  
 hope [haʊp] 1. надежда; 2. надеяться  
 hostel ['hɒstəl] общежитие  
 hot [hɒt] горячий  
 hotel [həʊ'tel] гостиница  
 hour [aʊə] час  
 housing ['haʊzɪŋ] жилищное строительство  
 housing block ['haʊzɪŋ 'blɒk] домовый блок, квартал  
 housing conditions ['haʊzɪŋ kən'dɪʃnz] жилищные условия  
 how [haʊ] как  
 however [haʊ'evə] однако; какой бы ни  
 h. p. (horse power) ['hɔ:s 'paʊə] лошадиная сила  
 huge [hju:dʒ] огромный  
 human ['hju:mən] человеческий  
 human being ['hju:mən 'bi:ɪŋ] человек  
 humanities [hju:'mænɪtɪz] гуманитарные науки  
 humanity [hju:'mænɪti] человечество  
 hundred ['hʌndrəd] сто  
 hydrogen ['haɪdrɪdʒən] водород

## И

ice [aɪs] лед  
 ice-breaker ['aɪs,breɪkə] ледокол  
 idea [aɪ'diə] мысль, идея  
 ideal [aɪ'diəl] идеальный  
 identical [aɪ'dentɪkəl] идентичный, тождественный  
 illegal [i'li:gəl] нелегальный; незаконный  
 illiterate [ɪ'lɪtərɪt] неграмотный  
 illuminate [ɪ'lju:mɪneɪt] освещать  
 illustration [ɪ,ləs'treɪʃn] иллюстрация  
 image ['ɪmɪdʒ] изображение

imagination [ɪ,mædʒɪ'neɪʃn] воображение  
 imagine [ɪ'mædʒɪn] представлять себе; предполагать, полагать  
 immediate [ɪ'mɪ:dʒət] немедленный, непосредственный  
 immense [ɪ'mens] огромный  
 imperative [ɪm'perətɪv] настоятельно необходимый  
 imply [ɪm'plaɪ] подразумевать  
 importance [ɪm'pɔ:təns] значение, важное значение

**important** [im'pɔ:tənt] важный, значительный  
**impossible** [im'pɔsəbl] невозможный  
**impracticable** [im'præktikəbl] практически неосуществимый  
**impractical** [im'præktikəl] непрактичный  
**improve** [im'pru:v] улучшать, усовершенствовать  
**improvement** [im'pru:vmənt] усовершенствование, улучшение  
**inaccessible** [inæk'sesəbl] недоступный  
**incandescent lamp** [inkæn'desnt 'læmp] лампа накаливания  
**incandescent light bulb** [inkæn'desnt 'laɪt 'bʌlb] лампа накаливания  
**inch** [ɪntʃ] дюйм  
**include** [in'klud] включать  
**incomparable** [in'kɒmpərəbl] несравненный  
**incompatible** [inkəm'pætabl] несовместимый  
**inconceivable** [inkən'si:vəbl] невероятный, невообразимый  
**increase** [in'kri:s] увеличивать (ся)  
**incredible** [in'kredəbl] невероятный  
**indeed** [in'di:d] действительно, в действительности  
**indefinite** [in'defɪnɪt] неопределенный  
**independent** [ɪndɪ'pendənt] независимый  
**indicate** ['ɪndikeɪt] указывать  
**indication** [ɪndɪ'keɪʃn] указание  
**indicator** ['ɪndikeɪtə] индикатор  
**indirect** [ɪndɪ'rekt] косвенный  
**indispensable** [ɪndɪs'pensəbl] необходимый  
**individual** [ɪndɪ'vɪdʒuəl] отдельный; индивидуальный  
**indivisible** [ɪndɪ'vɪzəbl] неделимый  
**industrial** [ɪn'dʌstriəl] промышленный  
**industrially** [ɪn'dʌstriəli] в промышленности  
**industry** ['ɪndəstri] промышленность  
**inequality** [ɪni:'kwɒlɪti] неравенство  
**inevitable** [ɪn'evɪtəbl] неизбежный  
**inexhaustible** [ɪnɪg'zɔ:stəbl] неисчерпаемый  
**infinite** ['ɪnfɪnɪt] бесконечный, безграничный  
**influence** ['ɪnfluəns] 1. влияние; 2. влиять

**jet** [dʒet] струя  
**jet engine** ['dʒet'endʒɪn] реактивный двигатель  
**job** [dʒɒb] работа  
**joint** [dʒɔɪnt] соединение, объединенный

**information** [ɪnfə'meɪʃn] сведения, данные  
**infrared** [ɪnfra'red] инфракрасный  
**inhabit** [ɪn'hæbɪt] населять  
**inhabitant** [ɪn'hæbɪtənt] житель  
**inquire** [ɪn'kwaɪə] спрашивать  
**inside** [ɪn'saɪd] внутри  
**insoluble** [ɪn'sɒljubl] неразрешимый  
**installation** [ɪnstə'leɪʃn] установка  
**instance** ['ɪnstəns] случай, пример  
**instead of** [ɪn'sted əv] вместо  
**institute** ['ɪnstɪtju:t] институт  
**institution** [ɪnstɪ'tju:ʃn] заведение, учреждение  
**instrument** ['ɪnstrumənt] прибор, инструмент  
**insufficient** [ɪnsə'fɪʃənt] недостаточный  
**insulating** ['ɪnsjuleɪtɪŋ] изоляционный, изолирующий  
**insulation** [ɪnsju'leɪʃn] изоляция  
**insulator** [ɪnsjuleɪtə] изолятор  
**intellectual** [ɪntɪ'lektʃuəl] умственный  
**intend** [ɪn'tend] иметь в виду, намереваться, предназначать  
**intense** [ɪn'tens] интенсивный  
**interaction** [ɪntər'ækʃn] взаимодействие  
**inter-continental** ['ɪntə,kɒntɪ'nentl] межконтинентальный  
**interest** ['ɪntrɪst] интерес; интересно-вать  
**interesting** ['ɪntrɪstɪŋ] интересный  
**intermediate** [ɪntə'mi:djət] промежуточный  
**international** [ɪntə'næʃənl] международный, интернациональный  
**interplanetary** [ɪntə'plænɪtəri] межпланетный  
**introduce** [ɪntrə'dju:s] вводить  
**invent** [ɪn'vent] изобретать  
**introduction** [ɪntrə'dʌkʃn] введение  
**investigation** [ɪn'vestɪ'geɪʃn] исследование  
**invisible** [ɪn'vɪzəbl] невидимый  
**ionize** ['aɪənaɪz] ионизировать  
**iron** ['aɪən] железо  
**iron and steel** ['aɪən ənd 'sti:l] металлургический  
**irradiate** ['ɪreɪdeɪt] излучать  
**irrespective of** [ɪrɪs'rektɪv əv] независимо от  
**irrigate** ['ɪrɪgeɪt] орошать  
**isotope** ['aɪsɒtəʊp] изотоп

J

**Jupiter** ['dʒu:pɪtə] Юпитер  
**just** [dʒʌst] 1. справедливый; 2. именно, только, как раз; только что  
**justify** ['dʒʌstɪfaɪ] оправдывать

# K

keep [ki:p] (kept, kept) держать, сохранять  
 key [ki:] клавиша  
 kind [kaɪnd] вид, род

kitchen ['kɪtʃɪn] кухня  
 know [nou] (knew, known) знать  
 knowledge ['nɒlɪdʒ] знание

# L

laboratory (lab) [lə'bɒrətəri (ləb)] лаборатория  
 labour ['leɪbə] труд  
 labour productivity ['leɪbə,prɒdæk'tɪvɪti] производительность труда  
 lamp [læmp] лампа  
 land [lənd] земля; страна  
 landing ['lændɪŋ] посадка (самолета, космического корабля)  
 landlord ['lændlɔ:d] помещик  
 language ['læŋɡwɪdʒ] язык  
 large [lɑ:dʒ] большой  
 last [lɑ:st] 1. длиться, продолжать-ся; 2. последний  
 lasting ['lɑ:stɪŋ] длительный, прочный  
 late [leɪt] 1. поздний; 2. поздно  
 latter ['lætə] последний (из двух)  
 launch [lɔ:ntʃ] развязывать (войну); запускать (спутник, ракету, корабль); спускать на воду (корабль)  
 law [lɔ:] закон  
 lay [leɪ] (laid, laid) класть; заклады-вать  
 lead [li:d] (led, led) вести  
 lead [led] 1. свинец; 2. свинцовый  
 learn [lɜ:n] учить; узнавать  
 leave [li:v] (left, left) 1. отпуск; 2. оставлять, покидать  
 lecture ['lektʃə] лекция  
 length [leŋθ] длина  
 lens [lenz] линза  
 lesson ['lesn] урок; лекция  
 level ['levl] уровень  
 liberate ['libəreɪt] освобождать, вы-делять  
 liberation [libə'reɪʃən] освобождение  
 library ['laɪbrəri] библиотека  
 life [laɪf] жизнь  
 lift [lɪft] поднимать  
 light [laɪt] 1. свет; 2. зажигать; 3. светлый, легкий  
 light beam ['laɪt'bi:m] световой луч

lightning ['laɪtnɪŋ] молния  
 like [laɪk] 1. подобный; 2. подобно  
 limit ['lɪmɪt] 1. предел; 2. ограничи-вать  
 limitation [lɪmɪ'teɪʃn] ограничение  
 limitless ['lɪmɪtlɪs] неограниченный  
 line of force ['laɪn əv 'fɔ:s] силовая линия  
 liner ['laɪnə] лайнер  
 link [lɪŋk] 1. звено; 2. связывать  
 lip [lɪp] губа; носик (трубки)  
 liquid ['lɪkwɪd] жидкость, жидкий  
 listen (to) ['lɪsn (tə)] слушать  
 listener ['lɪsnə] слушатель  
 literally ['lɪtərəli] буквально  
 literary ['lɪtərəri] литературный  
 literature ['lɪtəɪtʃə] литература  
 little ['lɪtl] маленький; мало  
 live [lɪv] жить  
 live [laɪv] живой  
 living-room ['lɪvɪŋ rum] гостиная  
 living standard ['lɪvɪŋ 'stændəd] жи-зненный уровень  
 load [ləʊd] 1. нагрузка; 2. нагружать  
 locate [ləu'keɪt] определять местопо-ложение  
 location [ləu'keɪʃn] местоположение  
 long [lɒŋ] длинный  
 long ago ['lɒŋ ə'ɡəʊ] давно  
 look after ['lʊk ə'fɪtə] заботиться  
 look for ['lʊk 'fɔ:] искать  
 look into ['lʊk 'ɪntu] заглядывать  
 lose [lu:z] (lost, lost) терять  
 loss [lɒs] потеря  
 loudspeaker ['laʊd'spi:kə] громкогово-ритель  
 love [lʌv] любить  
 low [ləʊ] низкий  
 lower ['ləʊə] понижать, уменьшать  
 lump [lʌmp] кусок  
 luxurious [lʌg'zjuəriəs] роскошный  
 luxury ['lʌkʃəri] роскошь

# M

machine [mə'si:n] 1. машина; 2. обра-батывать механически  
 machinery [mə'si:nəri] механизм  
 magnetohydrodynamic [mæɡ'nɪ:tou-  
 'haɪdrədaɪ'næmɪk] магнитогидро-динамический  
 magnification [mæɡnɪfɪ'keɪʃn] увели-чение

magnify [mæɡnɪfai] увеличивать  
 magnitude [mæɡnɪtɪju:d] величина  
 main [meɪn] главный, основной  
 maintain [meɪ'teɪn] поддерживать  
 maintenance [meɪntɪnəns] эксплуата-ция, уход за чем-либо  
 major ['meɪdʒə] важный  
 majority [mə'dʒɔrɪti] большинство

**make** [meɪk] (made, made) делать  
**make up** ['meɪk 'ʌp] составлять  
**make use of** ['meɪk 'ju:z əv] использовать, воспользоваться  
**man** [mæn] человек  
**management** ['mænɪdʒmənt] управление  
**mankind** [mæn'kaɪnd] человечество  
**man-made** ['mæn,meɪd] искусственный  
**manner** ['mænə] способ  
**manual** ['mænjuəl] ручной  
**manufacture** [ˌmænju'fæktʃə] 1. производство; 2. производить, изготавливать  
**manufacturing plant** [ˌmænju'fæktʃəriŋ 'plɑ:nt] завод-изготовитель  
**manufacturing process** [ˌmænju:'fæktʃəriŋ 'prəʊses] производственный процесс  
**many** ['meni] много  
**map** [mæp] 1. карта; 2. наносить на карту  
**mark** [mɑ:k] отмечать  
**marry** ['mæri] женить(ся)  
**mass** [mæs] масса  
**master** ['mɑ:stə] овладевать  
**masterpiece** ['mɑ:stəpi:s] шедевр  
**match** [mætʃ] спичка  
**matchbox** ['mætʃbɒks] спичечная коробка  
**material** [mə'tiəriəl] 1. материал; 2. материальный  
**materialist** [mə'tiəriəlist] материалист  
**mathematician** [ˌmæθi'mætɪfɪn] математик  
**mathematics** [ˌmæθi'mætɪks] математика  
**matter** ['mætə] дело, вопрос; матери́я, вещество  
**minimum** ['miniməm] минимум  
**mean** [mi:n] (meant, meant) означать, подразумевать  
**meaning** ['mi:nɪŋ] значение  
**means** [mi:nz] средство, способ  
     by means of [baɪ 'mi:nz əv] посредством  
**measure** ['meʒə] измерять  
**measurement** ['meʒəmənt] измерение  
**mechanization** [ˌmekənaɪ'zeɪʃn] механизация  
**medicine** ['medsɪn] медицина  
**medium** ['mi:diəm] среда  
**meet** [mi:t] (met, met) встречать  
**meeting** ['mi:tiŋ] собрание  
**melt** [melt] плавиться  
**member** ['membə] член; элемент, часть (конструкции)  
**memory** ['meməri] память  
**mention** ['menʃn] упоминать  
**mercury** ['mæ:kjuri] 1. ртуть; 2. ртутный

**Mercury** ['mæ:kjuri] Меркурий  
**merely** ['miəli] лишь, только  
**metal** ['metl] металл  
**metallic** [mi'tælik] металлический  
**meteor** ['mi:tjə] метеор  
**method** ['meθəd] метод  
**micron** ['maɪkrən] микрон  
**microscope** ['maɪkrəskəʊp] микроскоп  
**microscopic** [ˌmaɪkrə'skɒpɪk] микроскопический  
**Middle Ages** ['midl 'eidʒɪz] средние века  
**mile** [maɪl] миля  
**mind** [maɪnd] ум  
**mineral** ['mɪnərəl] минерал  
**minimum** ['miniməm] минимум  
**ministry** ['minɪstri] министерство  
**minute** ['minɪt] минута  
**minute** [maɪ'nju:t] мелкий, мельчайший  
**miracle** ['mɪrəkl] чудо  
**miraculous** [mɪ'rækjələs] удивительный  
**mirror** ['mɪrə] зеркало  
**missile** ['mɪsəl] управляемый снаряд  
**mix** [mɪks] смешивать  
**mixing-up** ['mɪksɪŋ 'ʌp] смешивание  
**mixture** ['mɪkstʃə] смесь  
**modern** ['mɒdən] современный, новейший  
**modernize** ['mɒdənaɪz] модернизировать  
**modest** ['mɒdɪst] скромный  
**moist** [moɪst] влажный  
**molecular** [məʊ'lekjələ] молекулярный  
**molecule** ['mɒlɪkjʊ:l] молекула  
**molten** ['məʊltən] расплавленный  
**monolithic** [ˌmɒnəʊ'liθɪk] монолитный  
**monomer (unit)** ['mɒnəmə ('ju:nɪt)] мономер  
**month** [mʌnθ] месяц  
**monthly** ['mʌnθli] ежемесячный  
**moon** [mu:n] луна  
**moral** ['mɒrəl] моральный  
**more** [mɔ:] больше  
**moreover** [mɔ:'rəʊvə] кроме того  
**most of** ['məʊst əv] большинство  
**mother** ['mʌðə] мать  
**motion** ['məʊʃn] движение  
**motor-car** ['məʊtə:kɑ:] автомобиль  
**mould** [maʊld] 1. форма; 2. формовать, отливать в форму  
**mountain** ['maʊntɪn] гора  
**move** [mu:v] двигаться  
**movement** ['mu:vmənt] движение  
**much** [mʌtʃ] много  
**muscle** [mʌsl] мускул  
**mutual** [mju:tʃuəl] взаимный

# N

**name** [neim] 1. фамилия, имя; 2. называть  
**namely** ['neimli] а именно  
**narrow** ['nærou] узкий  
**nation** ['neifn] нация, народ  
**nationality** [næʃə'nælitɪ] национальность  
**nationalize** ['næʃnəlaɪz] национализировать  
**natural** ['nætʃrəl] естественный  
**nature** ['neɪtʃə] природа; характер  
**navigation** [nævi'geɪʃn] навигация, судоходство  
**near** [niə] близкий  
**nearily** ['niəli] почти  
**necessarily** ['nesisəri] обязательно  
**necessary** ['nesisəri] необходимый  
**necessity** [ni'sesiti] необходимость  
**negative** ['negətiv] отрицательный  
**neither... nor** ['naɪðə'nɔ:] ни... ни  
**Netherlands** ['neðələndz] Нидерланды  
**network** ['netwɜ:k] сеть; система  
**neutral** ['nju:trəl] нейтральный  
**neutron** ['nju:trɒn] нейтрон  
**never** ['nevə] никогда  
**new** [nju:] новый

**next** [nekst] следующий  
**night** [nait] ночь  
**Nile** [nail] Нил  
**nitrogen** ['naitridʒən] азот  
**nobody** ['nəʊbədi] никто  
**none** [nʌn] ни один  
**nonmetallic** ['nɒnmɪ'tælik] неметаллический  
**noonday temperature** ['nu:ndeɪ 'temp-ritʃə] полуденная температура  
**normal** ['nɔ:məl] нормальный, обычный  
**north** [nɔ:θ] север  
**note** [nəʊt] замечать, обращать внимание, отмечать  
**notice** ['nəʊtɪs] замечать  
**now** [naʊ] теперь  
**nowhere** ['nəʊwɛə] нигде  
**nuclear** ['nju:kliə] ядерный  
**nucleus** (pl. nuclei) ['nju:kliəs ('nju:kliə)] ядро  
**number** ['nʌmbə] число, количество; номер  
**numerical** [nju:'merikəl] числовой  
**numerous** ['nju:mərəs] многочисленный

# O

**obey** [ə'bei] подчиняться  
**object** ['ɒbdʒɪkt] объект, предмет, цель  
**obligatory** [ɒ'bligətəri] обязательный  
**observation** [ɒbzə'veɪʃn] наблюдение  
**observatory** [əb'zə:vətɪ] обсерватория  
**observe** [əb'zə:v] наблюдать  
**obstacle** [ɒbstəkl] препятствие  
**obtain** [əb'tein] получать  
**obvious** [ɒbvɪəs] очевидный, явный  
**occure** [ɒkju:reɪ] занимать  
**occur** [ə'kɜ:] происходить, случаться; возникать; встречаться  
**ocean** ['əʊʃn] океан  
**odd** [ɒd] странный  
**odour** ['əʊdə] запах  
**odourless** ['əʊdəlis] без запаха  
**offer** ['ɒfə] предлагать  
**office** ['ɒfis] учреждение  
**often** ['ɒ:fən] часто  
**oil** [ɔɪl] нефть  
**old** [əʊld] старый  
**once** [wʌns] (один) раз; когда-то, однажды; если, раз (для усиления)  
**only** [əʊnli] только; the only единственный  
**opaque** [əu'peɪk] непрозрачный  
**open** ['əʊpən] открывать  
**operate** ['ɒpəreɪt] приводить в действие; работать

**operate at** ['ɒpəreɪt ət] работать со скоростью (о машине)  
**operation** [ɒpə'reɪʃn] операция, действие  
**operator** ['ɒpəreɪtə] оператор  
**opinion** [ə'pinjən] мнение, взгляд  
**opportunity** [ɒpə'tju:niti] возможность  
**oppress** [ə'pres] угнетать  
**oppression** [ə'presjən] угнетение  
**optical** ['ɒptɪkl] оптический  
**optics** ['ɒptɪks] оптика  
**order** ['ɔ:də] порядок; приказ; орден  
**ordinary** ['ɔ:dnri] обычный, обыкновенный  
**organism** ['ɔ:gənɪzəm] организм  
**organization** [ɔ:gənai'zeɪʃn] организация  
**organizational** [ɔ:gənai'zeɪʃnəl] организационный  
**organize** ['ɔ:gənaɪz] организовать  
**organizer** ['ɔ:gənaɪzə] организатор  
**original** [ə'ridʒənəl] первоначальный  
**other** ['ʌðə] другой  
**ounce** ['aʊns] унция  
**outer** ['aʊtə] внешний  
**outer space** ['aʊtə 'speɪs] 1. космос; 2. космический

output ['aʊtput] продукция; мощность  
 outside ['aʊt'saɪd] снаружи  
 outstanding [aʊt'stændɪŋ] выдающийся  
 over ['oʊvə] над; по; выше, через;  
 в продолжение  
 over-all ['oʊvəɹɔ:l] общий, всеобщий

overcome [ˌoʊvə'kʌm] преодолевать  
 overhead radiator [ˌoʊvə'hed 'reɪdɪeɪ-  
 tə] воздушный радионизлуча-  
 тель  
 overthrow [ˌoʊvə'θrou] свергнуть  
 own [aʊn] собственный  
 oxygen ['ɒksɪdʒən] кислород

## Р

page [peɪdʒ] страница  
 palace ['pælɪs] дворец  
 paper ['peɪpə] бумага; статья (науч-  
 ная); газета  
 parabolic [ˌpærə'bɒlɪk] параболиче-  
 ский  
 parents ['pæərənts] родители  
 park [pɑ:k] парк  
 part [pɑ:t] часть  
 partial ['pɑ:ʃl] частичный  
 particle ['pɑ:tɪkl] частица  
 particular [pə'tɪkjələ] особый, особен-  
 ный  
 part-time students ['pɑ:t'taɪm 'stju-  
 dənts] студенты-вечерники  
 party ['pɑ:ti] партия  
 pass [pɑ:s] проходить, пролетать  
 path [pɑ:θ] путь  
 pay [peɪ] (paid, paid) платить  
 peace [pi:s] мир  
 peaceful ['pi:sfʊl] мирный  
 peasant ['pezənt] крестьянин  
 penetrate ['penɪtreɪt] проникать  
 people [pi:pl] народ; люди  
 per cent [pə'sent] процент  
 perform [pə'fɔ:m] выполнять; совер-  
 шать  
 performance [pə'fɔ:məns] работа  
 perhaps [pə'hæps] может быть, воз-  
 можно  
 period ['piəriəd] период  
 periodic [ˌpiəri'ɒdɪk] периодический  
 permit [pə'mɪt] позволять  
 person [pə:sn] человек  
 petroleum refinery [pɪ'trɒljəm rɪ'fai-  
 nəri] нефтеочистительный завод  
 phenomenon (pl. phenomena) [fɪ'fə-  
 nɪnəm] явление  
 philosopher [fɪ'lɒsəfə] философ  
 philosophy [fɪ'lɒsəfi] философия  
 phosphorus ['fɒsfərəs] фосфор  
 photoelectric cell [ˌfəʊtəɪ'lektrɪk'sel]  
 фотоэлемент  
 photograph [ˌfəʊtə'grɑ:f] 1. фотогра-  
 фия; 2. фотографировать  
 physical [ˈfɪzɪkəl] физический  
 physics [ˈfɪzɪks] физика  
 picture ['pɪktʃə] картина; фотография;  
 кинофильм  
 piece [pi:s] кусок

pioneer [ˌpaɪə'niə] пионер  
 pipe [paɪp] труба  
 place [pleɪs] место  
 plan [plæn] план; планировать  
 plane [pleɪn] самолет  
 planet ['plænɪt] планета  
 planetary [ˌplænɪ'təri] планетный. пла-  
 нетарный  
 planned [plænd] плановый  
 plant [plɑ:nt] растение; завод  
 plastics ['plæstɪks] пластик, пласт-  
 масса  
 play [pleɪ] играть  
 pleasure ['pleʒə] удовольствие  
 plenty of ['plenti əv] много  
 pocket ['pɒkɪt] 1. карман; 2. карман-  
 ный  
 poet ['pəʊɪt] поэт  
 point [pɔɪnt] точка  
 point out [ˌpɔɪnt'aʊt] указывать  
 pole [pəʊl] полюс  
 policy ['pɒləsi] политика  
 polymer ['pɒlɪm] полимер  
 polymerization [pɒ,lɪməraɪ'zeɪʃn] по-  
 лимеризация  
 polymerize [ˌpɒlɪməraɪz] полимеризо-  
 вать  
 poor [puə] бедный; плохой  
 population [ˌpɒpjə'leɪʃn] население  
 porcelain [ˌpɔ:səlɪn] фарфор  
 porous ['pɔ:ərəs] пористый  
 portion [pɔ:ʃn] часть, участок  
 position [pə'zɪʃn] положение  
 positive ['pɒzətɪv] положительный  
 possess, [pə'zes] обладать  
 possibility [ˌpɒsə'bɪlɪti] возможность  
 possible ['pɒsəbl] возможный  
 post-graduate [ˌpəʊst'grædʒuɪt] аспи-  
 рант  
 pound ['paʊnd] фунт  
 pour [pɔ:] лить, отливать (в форму)  
 poverty ['pɒvəti] бедность  
 powder ['paʊdə] порошок  
 power [paʊə] сила, энергия; власть;  
 держава, государство; степень  
 power engineering [ˌpaʊə ,endʒɪ'niə-  
 rɪŋ] энергетика  
 powerful ['paʊəfʊl] могущественный;  
 сильный



power plant ['paʊə, plɑ:nt] электростанция  
 power station ['paʊə, steɪʃn] см. power plant  
 practical ['præktikəl] практический  
 precede ['pri:'si:d] предшествовать, здесь опережать  
 precision ['pri:'si:ʒn] точность  
 predict ['pri'dikt] предсказывать  
 prefabrication ['pri:fæbrɪ'keɪʃn] сборное строительство  
 preferable ['prefərəbl] предпочтительный  
 preparation [ˌprepə'reɪʃn] подготовка  
 preparatory [ˌpri:pə'retɔ:ri] подготовительный  
 prepare ['pri:pəə] готовить(ся)  
 present ['preznt] настоящий, современный  
 to be p. присутствовать  
 present ['pri:'zent] представлять  
 present a thesis ['pri:'zent ə'ti:sɪs] защищать диссертацию  
 preservation [ˌprezə'veɪʃn] сохранение  
 pressed together ['prest tə'geðə] прижать друг к другу  
 pressure ['prefə] давление; (электр.) напряжение  
 prevent ['pri'vent] предотвращать, препятствовать  
 previous ['pri:vjəs] предварительный  
 pride [praɪd] гордость  
 primarily ['praɪməri] первоначально  
 primary ['praɪməri] основной  
 primitive ['prɪmɪtɪv] примитивный  
 principal ['prɪnsəpəl] главный  
 principle ['prɪnsəpl] принцип  
 print [prɪnt] 1. печать; 2. печатать  
 printer ['prɪntə] печатающее устройство  
 probable ['prəbəbl] вероятный  
 problem ['prəbləm] задача, проблема  
 proceed [pri:'si:d] происходить  
 process 1. ['prouses] процесс; 2. ['grə'ses] обрабатывать  
 process controller ['prouses kən'trəʊlə] регулятор производственного процесса

processing [prə'sesiŋ] обработка  
 produce [prə'dju:s] производить  
 product ['prɒdəkt] изделие, продукт, продукция  
 production [prə'dʌkʃn] производство  
 productivity [ˌprɒdʌk'tɪvɪti] производительность  
 professor [prə'fesə] профессор  
 profitable ['prɒfɪtəbl] выгодный  
 profound [prə'faʊnd] глубокий  
 program(me) ['prəʊgræm] программа  
 progress ['prəʊgres] прогресс, развитие  
 progressive [prə'gresɪv] прогрессивный  
 project ['prɒdʒekt] проект  
 proletarian [ˌprəʊlə'teəriən] пролетарият  
 prominent ['prɒmɪnənt] выдающийся  
 promise ['prɒmɪs] обещать  
 proof [pru:f] доказательство  
 propagate ['prɒpəgeɪt] распространять  
 proper ['prɒpə] надлежащий, соответствующий, правильный  
 property ['prɒpəti] свойство  
 proportion [prə'pɔ:ʃn] соотношение, пропорция  
 propose [prə'pəʊz] предлагать  
 prospect ['prɒspekt] перспектива  
 protect [prə'tekt] защищать  
 proton ['prəʊtɒn] протон  
 proud [praʊd] гордый  
 prove [pru:v] доказывать  
 provide [prə'vaɪd] снабжать, обеспечивать  
 provided [prə'vaɪdɪd] при условии  
 provision [prə'vɪʒn] обеспечение  
 public (life) ['pʌblɪk] общественный  
 publication [ˌpʌbli'keɪʃn] издание  
 publish ['pʌblɪʃ] издавать  
 pure [pjʊə] чистый  
 purpose ['pʊrəs] цель  
 push [puʃ] толкать  
 put into effect ['put ɪntə ɪ'fekt] осуществлять, выполнить, проводить в жизнь  
 put together ['put tə'geðə] составлять, соединять  
 pyramid ['pɪrəˌmɪd] пирамида

## Q

qualification [ˌkwɒlɪfɪ'keɪʃn] квалификация  
 qualified ['kwɒlɪfaɪd] квалифицированный  
 qualitative ['kwɒlɪteɪtɪv] качественный  
 quality ['kwɒlɪti] качество

quantity ['kwɒntəti] количество; величина  
 question ['kwɛstʃn] вопрос  
 quiet ['kwaɪət] тихий, спокойный  
 quite [kwaɪt] совсем, вполне

**racial** ['reɪʃəl] расовый  
**radar** ['reɪdɑ:] радар; радиолокатор  
**radiant** ['reɪdɪənt] лучистый  
**radiation** ['reɪdɪ'eɪʃn] радиация, излучение  
**radiator** ['reɪdɪ'eɪtə] радиатор  
**radio** ['reɪdiəʊ] радио  
**radioactive** ['reɪdiəʊ'æktɪv] радиоактивный  
**radioactivity** ['reɪdiəʊ'æktɪvɪti] радиоактивность  
**radio message** ['reɪdiəʊ 'mesɪdʒ] радиодиаграмма  
**radio set** ['reɪdiəʊ'set] радиоприемник  
**railway** ['reɪlweɪ] железная дорога  
**raise** [reɪz] повышать, увеличивать; поднимать  
**range** [reɪndʒ] 1. пределы изменения; диапазон; радиус, дальность действия; 2. изменяться в пределах  
**rapid** ['ræpɪd] быстрый  
**rare** [ræə] редкий  
**rate** [reɪt] скорость; цена  
**rather** ['rɑ:ðə] довольно, до некоторой степени  
**rational** ['ræʃnəl] рациональный  
**raw materials** ['rɔ:mə'tɪəriəlz] сырье  
**ray** [reɪ] луч  
**reach** [ri:tʃ] достигать  
**reaction** [ri:'ækʃn] реакция  
**reactor** [ri:'æktə] реактор  
**read** (read, read) [ri:d] читать; снимать показания (с прибора)  
**readily** ['redɪli] легко  
**reading-room** ['ri:dn̩ rʊm] читальный зал  
**reagent** [ri:'eɪdʒənt] реактив, реагент  
**real** ['riəl] действительный  
**reality** [ri:'ælɪti] реальность, действительность  
**realization** [ri'ælaɪ'zeɪʃn] осуществление  
**realize** ['ri:əlaɪz] осуществлять; ясно понимать  
**reason** [ri:zn̩] причина, основание  
**receiver** [ri:'si:və] приемник  
**recent** [ri:snt] недавний, новый, современный  
**recognize** ['rekəɡnaɪz] признавать  
**recollection** [ri'ekəl'ekʃn] воспоминание  
**recommend** [ri'ekə'mend] рекомендовать, советовать, предлагать  
**record** [ri'kɔ:d] записывать  
**recording** [ri'kɔ:dɪŋ] запись  
**red** [red] красный  
**reduce** [ri'dju:s] уменьшать, понижать

**reduction** [ri'dʌkʃn] уменьшение, снижение  
**refer (to)** [ri'fə:(tə)] ссылаться (на); относиться (к)  
**reflect** [ri'flekt] отражать(ся)  
**refrigerator** [ri'frɪdʒəreɪtə] холодильник  
**refuse** [ri'fju:z] отказывать, -ся  
**region** [ri:dʒən] район; область  
**regular** ['regjələ] правильный, регулярный  
**regulator** ['regjuleɪtə] регулятор  
**relation** [ri'leɪʃn] отношение  
**relative** ['relatɪv] относительный  
**release** [ri'li:s] 1. выделение, высвобождение; 2. выделять(ся), высвобождать(ся)  
**reliable** [ri'laɪəbl̩] надежный  
**relieve of** [ri'li:v əv] избавлять от  
**remain** [ri'meɪn] оставаться  
**remarkable** [ri'mɑ:kəbl̩] замечательный  
**remember** [ri'membə] помнить  
**remote** [ri'məʊt] отдаленный  
**remove** [ri'mu:v] удалять  
**rent** [rent] квартирная плата  
**repeat** [ri'pi:t] повторять  
**repel** [ri'pel] отталкивать  
**replace** [ri'pleɪs] заменять  
**represent** [repri'zent] представлять  
**reproduce** [ri:prə'dju:s] воспроизводить(ся)  
**require** [ri'kwaɪə] требовать  
**requirement** [ri'kwaɪəmənt] требования  
**research** [ri'sə:tʃ] исследование, научная работа  
**resemble** [ri'zembl̩] быть похожим, походить на  
**reshape** [ri'ʃeɪp] переделывать, изменять  
**resin** ['rezɪn] смола  
**resist** [ri'zɪst] сопротивляться  
**resistant, to be r.** [ri'zɪstənt] сопротивляться  
**resistance** [ri'zɪstəns] сопротивление  
**resort** [ri'zɔ:t] курорт; также health resort  
**resource(s)** [ri'sɔ:s(ɪz)] ресурсы, средства, возможности  
**respective** [ris'pektɪv] соответствующий  
**responsibility** [res,pɒnsə'bɪlɪti] ответственность  
**rest** [rest] отдых  
**restaurant** ['restərɒŋ] ресторан  
**restore** [ri'stɔ:] восстанавливать  
**restrict** [ris'trikt] ограничивать  
**result** [ri'zʌlt] результат

**result from** [ri'zʌlt frəm] получаться  
 в результате  
**result in** [ri'zʌlt in] давать в результате, приводить к  
**retort** [ri'tɔ:t] реторта  
**return** [ri'tə:n] возвращать(ся)  
**reveal** [ri'vi:l] открывать, обнаруживать  
**reverse** [ri'və:s] обратный  
**revolution** [ˌrevə'lu:ʃn] революция; оборот  
**revolutionary** [ˌrevə'lu:ʃənəri] 1. революционер; 2. революционный  
**revolve** [ri'vɒlv] вращаться  
**rheostat** [ˌri'əʊstæt] реостат  
**rich** [ritʃ] богатый  
**richness** [ˌritʃnis] богатство  
**right** [raɪt] правый; правильный, верный  
**rigidity** [ri'dʒɪdɪti] жесткость  
**ring** [rɪŋ] (rang, rung) звонить, звенеть; кольцо

нуть; кольцо  
**rise** [raɪz] (rose, risen) поднимать(ся); возрастать  
**river** ['rɪvə] река  
**road** [rəʊd] дорога, путь  
**robot** ['rəʊbɒt] автомат; робот  
**rocket** ['rɒkɪt] ракета  
**role** [rəʊl] роль  
**room** [ru:m] комната  
**root** [ru:t] корень  
**rotate** [rəʊ'teɪt] вращать(ся)  
**rotation** [rəʊ'teɪʃn] вращение  
**round** [raʊnd] вокруг  
**rubber** ['rʌbə] 1. резина; 2. резиновый  
**ruin** [ruɪn] разрушать  
**ruinous** ['ruɪnəs] разрушительный  
**rule** [ru:l] правило  
**run** [rʌn] (ran, run) бежать; управлять; работать  
**rust** [rʌst] ржавчина

## S

**safe** [seɪf] безопасный, надежный  
**safety** ['seɪfɪ] безопасность  
**salt** [sɔ:lt] соль  
**satellite** ['sætəlaɪt] спутник  
**same** [seɪm] такой же  
**satisfy** ['sætɪsfai] удовлетворять  
**save** [seɪv] спасать; экономить  
**say** [seɪ] (said, said) (sed) сказать, говорить  
**scale** [skeɪl] масштаб  
**scan** [skæn] развешивать, рассматривать  
**school** [sku:l] школа  
**science** ['saɪəns] наука  
**scientific** ['saɪən'tɪfɪk] научный  
**scientist** ['saɪəntɪst] ученый  
**screen** [skri:n] экран  
**sea** [si:] море  
**seal** [si:l] 1. запайка; 2. запаивать  
**seaport** ['si:pɔ:t] морской порт  
**search** [sɜ:tʃ] искать  
**season** ['si:zn] сезон, время года  
**secondary education** ['sekəndəri ˌedju:'keɪʃn] среднее образование  
**secret** ['si:krit] тайна; секрет  
**section** ['sekʃn] часть  
**see** [si:] (saw, seen) видеть  
**seem** [si:m] казаться  
**seldom** ['seldəm] редко  
**select** [sɪ'lekt] выбирать  
**selection** [sɪ'lekʃn] выбор  
**selenium** [sɪ'li:nɪəm] селен  
**semi-** ['semi] полу-  
**semiconductor** ['semɪkən'dʌktə] полупроводник  
**send** [send] (sent, sent) посылать

**sensitive** ['sensɪv] чувствительный  
**sensitivity** [sensɪ'tɪvɪti] чувствительность  
**sentence** ['sentəns] предложение  
**separate** ['sepəreɪt] отделять(ся), разделять(ся)  
**series** ['siəri:z] серия, а series of ряд  
**servant** ['sɜ:vənt] слуга  
**serve** ['sɜ:v] служить  
**service** ['sɜ:vɪs] служба  
**servo-mechanism** ['sɜ:vəu,mekənɪzəm] сервомеханизм  
**set** (set, set) [set] устанавливать  
**set a problem** ['set ə'prɒbləm] (по)ставить задачу  
**set forth** ['set 'fɔ:θ] излагать; выдвигать (идею)  
**set-up** ['set 'ʌp] устройство  
**several** ['sevrəl] несколько  
**severe conditions** [si'viə kən'dɪʃnz] трудные условия  
**shade** [ʃeɪd] тень; оттенок  
**shaft** [ʃɑ:ft] вал  
**shake** [ʃeɪk] трясти, встряхивать  
**shape** [ʃeɪp] форма  
**share** [ʃeə] делиться  
**sheet** [ʃi:t] лист  
**shine** [ʃaɪn] светить(ся)  
**ship** [ʃɪp] корабль; транспортировать  
**shop** [ʃɒp] магазин; мастерская, цех  
**short** [ʃɔ:t] короткий  
**shortage** ['ʃɔ:tɪdʒ] нехватка, недостаток  
**show** [ʃəʊ] (showed, shown) показывать

shower bath ['ʃaʊə bɑ:θ] душ  
 shut off (shut, shut) ['ʃʌt'ɔ:f] отключать  
 side [saɪd] сторона  
 sign [saɪn] 1. подпись; 2. подписывать  
 signal ['sɪgnəl] 1. сигнал; 2. сигнализировать, подавать сигнал  
 significance [sɪɡ'nɪfɪkəns] значение  
 significant [sɪɡ'nɪfɪkənt] значительный, важный  
 silicon ['sɪlɪkən] кремний  
 silvery ['sɪlvəri] серебристый  
 similar ['sɪmɪlə] подобный  
 similarly ['sɪmɪləli] аналогично, подобно этому  
 simple [sɪmpl] простой  
 simplicity [sɪm'plɪsɪti] простота  
 simulate ['sɪmjuleɪt] имитировать  
 simultaneous [sɪmə'lteɪnjəs] одновременный  
 single ['sɪŋɡl] один, единственный  
 sister ['sɪstə] сестра  
 site [saɪt] строительный участок  
 sitting-room ['sɪtɪŋ-rʊm] гостиная  
 situation [sɪtʃu'eɪʃn] положение  
 size [saɪz] размер, величина  
 skill [skɪl] искусство, мастерство  
 sky [skaɪ] небо  
 sleep [sli:p] (slept, slept) спать  
 slogan ['sləʊɡən] лозунг  
 slow [sləʊ] медленный  
 slow down ['sləʊ 'daʊn] замедлять  
 slums [slʌmz] трущобы  
 small [smɔ:l] маленький  
 smash [smæʃ] расщеплять, разбивать, разрушать  
 so-called ['sou'kɔ:lɪd] так называемый  
 socialism ['səʊʃəlɪzəm] социализм  
 socialist ['səʊʃəlɪst] социалистический  
 society [sə'saɪəti] общество  
 sodium ['səʊdɪəm] натрий  
 sofa ['səʊfə] диван  
 soil [soɪl] почва  
 solar ['səʊlə] солнечный  
 solid ['sɒlɪd] 1. твердое тело; 2. твердый, прочный, сплошной  
 solubility [sɒlju'bɪlɪti] растворимость  
 soluble ['sɒljubl] растворимый  
 solution [sə'lu:ʃn] решение; раствор  
 solve a problem ['sɒlv ə'prɒbləm] разрешить вопрос, задачу  
 solvent ['sɒlvənt] растворитель  
 some [sʌm] какой-то, какой-нибудь; несколько; около; приблизительно  
 somewhat ['sʌmwaʊt] до некоторой степени, несколько  
 son [sʌn] сын  
 soon [su:n] скоро  
 sound [saʊnd] звук  
 source [sɔ:s] источник

south [sauθ] юг  
 Soviet Union ['səʊvjət 'ju:njən] Советский Союз  
 space [speɪs] 1. пространство; 2. пространственный  
 space pilot ['speɪs 'paɪlət] летчик-космонавт  
 spaceship ['speɪsʃɪp] космический корабль  
 special ['speʃəl] специальный  
 specialist ['speʃəlist] специалист  
 specialized ['speʃəlaɪzd] специальный, специализированный  
 spectroscopic [ˌspektrə'skɒpɪk] спектроскопический  
 spectrum ['spektrəm] спектр  
 speed [spi:d] скорость  
 speed up ['spi:d 'ʌp] ускорять  
 speedy ['spi:di] скоростной  
 spend [spend] (spend, spent) тратить; проводить (время)  
 sphere [sfɪə] область, сфера  
 splendid ['splendɪd] прекрасный, роскошный, великолепный  
 split [splɪt] (split, split) расщеплять  
 spoon [spu:n] ложка  
 spot [spɒt] место; пятно  
 spread [spred] (spread, spread) расширяться  
 spring [sprɪŋ] пружина  
 square [skweə] 1. площадь; квадрат; 2. квадратный  
 stabilize ['steɪbalaɪz] стабилизировать, делать устойчивым  
 stable [steɪbl] устойчивый  
 stage [steɪdʒ] ступень, стадия  
 stand [stænd] (stood, stood) стоять  
 standard ['stændəd] 1. стандарт; 2. стандартный, обычный  
 star [stɑ:] звезда  
 start [stɑ:t] начинать  
 state [steɪt] состояние; государство  
 State Planning Commission ['steɪt 'plænɪŋ kə'mɪʃn] Госплан  
 stationary ['steɪʃnəri] неподвижный  
 stay on ['steɪ 'ɒn] оставаться  
 steady ['stedi] постоянный, неуклонный  
 steam [sti:m] пар  
 steel [sti:l] сталь  
 step [step] шаг; ступень этап  
 still [stɪl] еще, все еще; все же, однако  
 stone [stəʊn] камень  
 store [stɔ:] запасать, накапливать  
 storey ['stɔ:ri] этаж  
 storm [stɔ:m] буря  
 strain [streɪn] деформация  
 strange [streɪndʒ] странный  
 stream [stri:m] поток  
 street [stri:t] улица

**strength** [streŋθ] сопротивление, прочность; сила  
**strengthen** ['streŋθən] усиливать, укреплять, укреплять  
**stress** [stres] усилие  
**stretch** [stretʃ] растягивать(ся), тянуть(ся)  
**strike** [straɪk] (struck, struck) ударять  
**strive** [straɪv] (strove, striven) стараться, прилагать усилия  
**strong** [strɒŋ] сильный; прочный  
**structure** ['strʌktʃə] строение; структура; конструкция  
**struggle** ['strʌgl] борьба  
**student** ['stju:dənt] студент  
**studies** ['stʌdiz] занятия  
**study** ['stʌdi] 1. исследование; 2. учить; изучать  
**subdivide** ['sʌbdɪ'vaɪd] подразделять  
**subdivision** ['sʌbdɪ'vɪʒn] деление, подразделение  
**subject** ['sʌbdʒɪkt] предмет  
**subsequent** ['sʌbsɪkwənt] последующий  
**substance** ['sʌbstəns] вещество  
**substitute** ['sʌbstɪtju:t] 1. заменитель; 2. заменять  
**subway** ['sʌbwei] метро  
**succeed (in)** ['sək'sɪ:d (in)] удавать-ся  
**success** [sək'ses] успех  
**such** [sʌtʃ] такой; s. as такой как, например  
**sudden** [sʌdn] внезапный  
**sufficient** [sə'fɪʃənt] достаточный  
**sugar** ['ʃʊgə] сахар  
**suggest** [sə'dʒest] предлагать  
**suitable** ['sju:təbl] подходящий, соответствующий, пригодный

**sulphur** ['sʌlfə] сера  
**sum** [sʌm] сумма  
**summer** ['sʌmə] лето  
**sun** [sʌn] солнце  
**superconductive** ['sju:pə,kən'dʌktɪv] сверхпроводящий  
**superfluid** ['sju:pə'flu:ɪd] сверхтекучий  
**superior** [sju:'piəriə] наилучший  
**superiority** [sju:'piəri'ɔrɪti] превосходство  
**supervise** ['sju:pəvaɪz] контролировать  
**supper** ['sʌpə] ужин  
**supply** [sə'plaɪ] 1. запас; 2. снабжать; подавать  
**suppose** [sə'pəʊz] предполагать  
**surface** [sə:'fɪs] поверхность  
**surprise** [sə'praɪz] 1. удивление; 2. удивлять, поражать  
**surround** [sə'raʊnd] окружать  
**survive** [sə'vaɪv] выживать, переживать  
**Sweden** [swi:dn] Швеция  
**switch off** ['swɪtʃ'ɔ:f] выключать  
**switch on** ['swɪtʃ'ɒn] включать  
**Switzerland** ['swɪtsələnd] Швейцария  
**symbol** ['sɪmbəl] символ  
**synchrocyclotron** ['sɪnkərə'saɪklətrɒn] фазотрон  
**synchronizer** ['sɪnkronaɪzə] синхронизатор  
**synchrophasotron** ['sɪnkərə'fæzətrɒn] синхрофазотрон  
**synthesis** ['sɪnθɪsɪs] синтез  
**synthesize** ['sɪnθəsaɪz] синтезировать  
**synthetic** [sɪn'θetɪk] синтетический  
**synthetics** [sɪn'θetɪks] синтетические материалы  
**system** ['sɪstɪm] система

## T

**table** [teɪbl] стол; таблица  
**take** [teɪk] (took, taken) брать, взять  
**take a post-graduate course** поступить в аспирантуру  
**take examinations** сдавать экзамены  
**take into account** учитывать, принимать во внимание  
**take-off** ['teɪkɔ:f] взлет  
**take part** ['teɪk 'pɑ:t] принимать участие  
**take turns** ['teɪk 'tɜ:nz] делать поочередно  
**talk** [tɔ:k] говорить, разговаривать  
**tap** [tæp] постукивать  
**tape** [teɪp] лента  
**tape-recorder** ['teɪpri'kɔ:də] магнитофон  
**target** ['tɑ:gɪt] цель

**task** [tɑ:sk] работа, задача  
**taste** [teɪst] вкус  
**tasteless** ['teɪstlɪs] безвкусный  
**teach** [ti:tʃ] (taught, taught) [tɔ:tʃ] обучать, учить  
**teacher** ['ti:tʃə] преподаватель, учитель  
**technical** ['teknɪkəl] технический  
**technique** [tek'ni:k] способ, метод; техника  
**technological** [tek'nɒlədʒɪkəl] технический  
**technology** [tek'nɒlədʒɪ] техника; технология  
**telephone** ['telɪfəʊn] телефон  
**television set** ['telɪ'vɪʒn'set] телевизор  
**temperature** ['temprɪtʃə] температура

**tempo** ['tempou] темп, быстро  
**test** [test] 1. опыт, испытание; 2. испытывать  
**test tube** ['test tju:b] пробирка  
**textbook** ['tekstbuk] учебник  
**textile** ['tekstail] ткань  
**theatre** ['θiətə]- театр  
**then** [ðən] тогда  
**theoretical** [θiə'retikəl] теоретический  
**theory** ['θəri] теория  
**there** [ðeə] там  
**therefore** ['ðeəfɔ:] поэтому, следовательно  
**thermal** ['θə:məl] тепловой  
**thermo-emission** ['θə:mou'ɪmɪʃn] термоэлектронная эмиссия  
**thermo-ionic** ['θə:mouaɪ'ɒnik] термоэлектронный  
**thermometer** [θə'mɒmɪtə] термометр  
**thermonuclear** ['θə:mou'nju:kliə] термоядерный  
**thermostat** ['θə:moustæt] термостат  
**thesis (theses)** ['θi:sis] ([θi:si:z]) дипломная работа, дипломный проект, диссертация  
**thickness** ['θɪknɪs] толщина  
**thin** [θɪn] тонкий  
**thing** [θɪŋ] вещь  
**think** [θɪŋk] (thought, thought) думать  
**thinker** ['θɪŋkə] мыслитель  
**thorough** ['θɒrə] совершенный; тщательный  
**though** [ðou] хотя  
**thought** [θɔ:t] мысль  
**thousand** ['θauzənd] тысяча  
**threshold** ['θreʃəʊld] порог  
**through** [θru:] через  
**throw** [θrou] (threw, thrown) бросать  
**thus** [ðʌs] таким образом  
**tide** [taɪd] прилив  
**time** [taɪm] время  
**timer** ['taɪmə] синхронизатор  
**tiny** ['taɪni] крошечный  
**tip** [tɪp] конец, кончик  
**titanic** [taɪ'tænik] титанический, гигантский  
**title** [taɪtl] заглавие  
**today** [tə'deɪ] сегодня; в настоящее время  
**together** [tə'geðə] вместе  
**toiler** ['tɔɪlə] трудящийся  
**ton** [tʌn] тонна  
**too** [tu:] слишком; также  
**tool** [tu:l] инструмент; орудие  
**touch** [tʌtʃ] касаться  
**tourist** ['tuəɪst] турист  
**trace** [treɪs] след  
**tracer (atom)** ['treɪsə ('ætəm)] меченый атом

**traffic** ['træfɪk] движение (уличное, дорожное)  
**tragic** ['trædʒɪk] трагический  
**train** [treɪn] поезд  
**train** [treɪn] обучать, готовить (специалистов)  
**training** [treɪnɪŋ] обучение; тренировка  
**transfer** ['trænsfə] передача  
**transform (in) to** [træns'fɔ:m] преобразовать, превращать в  
**transformation** [trænsfɔ:'meɪʃn] превращение, преобразование  
**transformer** [træns'fɔ:mə] трансформатор  
**transistor** [træn'zɪstə] полупроводник, транзистор  
**translate** [trɑ:ns'leɪt] переводить; преобразовывать  
**translator** [trɑ:ns'leɪtə] переводчик, переводящее устройство  
**transmitter** [trænz'mɪtə] передатчик  
**transparent** [træns'pæərənt] прозрачный  
**transport(ation)** [træns'pɔ:'teɪʃn] транспорт  
**transuranium** [trænzjuə'reɪniəm] трансурановый, заурановый  
**travel** [trævl] путешествие  
**traveller** ['trævlə] путешественник  
**treatment** ['tri:tmənt] обработка  
**treasure** ['treʒə] сокровище  
**tremendous** [tri'mendəs] огромный  
**triumph** ['traɪəmf] триумф, торжество, победа; торжествовать  
**true** [tru:] верный, истинный, действительный  
**truly** ['tru:lɪ] поистине  
**try** [traɪ] пробовать, пытаться; испытывать  
**tube** [tju:b] лампа (электронная); метро  
**tuition** [tju:'ɪʃn] обучение  
**tungsten** ['tʌŋstən] вольфрам  
**turbine** ['tɜ:bin] турбина  
**turn** ['tɜ:n] 1. оборот; 2. поворачивать(ся)  
**turn to science** обращаться к науке  
**turner** ['tɜ:nə] токарь  
**T. V.=television** ['teli'vɪʒn] 1. телевизор; 2. телевизионный  
**TV set** телевизор  
**type** [taɪp] тип, вид  
**type** [taɪp] печатать на машинке  
**typewriter** ['taɪp.raɪtə] пишущая машинка  
**typical (of)** ['tɪpɪkəl (əv)] типичный (для)  
**typist** ['taɪpɪst] машинистка; оператор, пишущий на машинке

## U

**ultimate** ['ʌltɪmɪt] конечный  
**ultimately** ['ʌltɪmɪtli] в конце концов  
**ultrasonics** ['ʌltrə'sɒnɪks] ультразвук, ультраакустика  
**ultrathin** ['ʌltrə'θɪn] ультратонкий, сверхтонкий  
**ultraviolet** ['ʌltrə'vaɪələt] ультрафиолетовый  
**unbelievably** [ʌnbɪ'li:vəbli] невероятно  
**unbreakable** [ʌn'breɪkəbl] неразрывный  
**undergo** [ʌndə'ɡəʊ] подвергаться  
**underground** [ʌndə'graʊnd] подземный  
**understand** (understood, understood) [ʌndə'stænd] понимать  
**understanding** [ʌndə'stændɪŋ] понимание  
**undertake** [ʌndə'teɪk] предпринимать  
**unexpected** [ʌnɪks'pektɪd] неожиданный  
**unimaginable** [ʌnɪ'mædʒɪnəbl] невообразимый

**union** ['ju:njən] соединение; объединение; союз  
**unit** ['ju:nɪt] единица; устройство; частица (вещество); отряд  
**unite** [ju:'naɪt] соединять (ся)  
**universal** [ˌju:ni'vɜ:səl] всеобщий, универсальный  
**universe** [ˌju:ni'vɜ:s] вселенная  
**university** [ˌju:ni'vɜ:sɪti] университет  
**unless** [ən'les] если не  
**unsuitable** [ʌn'sju:təbl] непригодный  
**unthinkable** [ʌn'θɪŋkəbl] немислимый  
**uranium** [juə'reɪniəm] уран  
**use** 1. [ju:s] применение, использование; 2. [ju:z] применять, использовать  
**useful** ['ju:sfʊl] полезный  
**usefulness** ['ju:sfʊlnɪs] полезность  
**user** ['ju:zə] потребитель  
**usual** ['ju:zuəl] обычный, обыкновенный  
**utilization** [ˌju:tɪlaɪ'zeɪʃn] использование  
**utilize** ['ju:tɪlaɪz] использовать

## V

**vacation** [və'keɪʃn] отпуск, каникулы  
**vacuum** ['vækjuəm] вакуум  
**vacuum-cleaner** ['vækjuəm'kli:nə] пылесос  
**valley** ['væli] долина  
**valuable** ['væljuəbl] ценный  
**value** ['vælju:] величина, значение; ценность; цена;  
 to be of v. иметь значение  
**vapour** ['veɪpə] пар  
**vapourization** ['veɪpəraɪ'zeɪʃn] испарение  
**variable** ['vɛəriəbl] переменная, параметр  
**variation** [ˌvɛəri'eɪʃn] изменение  
**various** ['vɛəriəs] различный  
**vast** [vɑ:st] громадный, обширный  
**velocity** [vɪ'lɒsɪti] скорость  
**Venus** ['vi:nəs] Венера  
**versatile** ['vɜ:sətaɪl] многосторонний

**version** [vɜ:ʃn] вариант  
**very** ['veri] очень  
**vessel** [vesl] судно; сосуд  
**vibrate** [vaɪ'breɪt] колебаться  
**vibration** [vaɪ'breɪʃn] колебание  
**vice versa** ['vaɪsɪ'vɜ:sə] наоборот  
**victorious** [vɪk'tɔ:riəs] победоносный  
**victory** ['vɪktəri] победа  
**viewer** ['vjʊə] зритель  
**village** ['vɪlɪdʒ] село, деревня  
**violence** ['vaɪələns] сила  
**violet** ['vaɪələt] фиолетовый  
**viscous** ['vɪskəs] вязкий  
**vision** [vɪʒn] зрение  
**visit** ['vɪzɪt] 1. посещение; 2. посещение  
**vital** ['vaɪtɪl] жизненный, насущный; существенный  
**volume** ['vɒljʊm] объем  
**voltage** ['vəʊltɪdʒ] (эл.) напряжение

## W

**walk** [wɔ:k] ходить  
**war** [wɔ:] война  
**wardrobe** ['wɔ:droub] платяной шкаф  
**warm** [wɔ:m] 1. нагревать; 2. теплый  
**washing machine** ['wɒʃɪŋ mə'ʃi:n] стиральная машина  
**watch** [wɒtʃ] наблюдать, следить, смотреть

**water** ['wɔ:tə] вода; **w. supply** водоснабжение  
**watt** [wɒt] ватт  
**wave** [weɪv] волна  
**way** [wei] путь, метод, способ  
**W. C.** ['dʌblju:'si:] уборная  
**weak** [wi:k] слабый  
**weakness** ['wi:knɪs] слабость

**wealth** [welθ] богатство  
**weapon** ['wepən] оружие  
**weather** ['weðə] погода  
**week** [wi:k] неделя  
**weight** [weit] вес  
**weightlessness** ['weitlisnis] невесомость  
**weld** [weld] сваривать  
**welfare** ['welfeə] благосостояние, благополучие  
**well** [wel] хорошо  
**wellbeing** ['welbi:ɪŋ] благополучие, благосостояние  
**west** [west] запад  
**whatever** [wət'evə] какой бы ни  
**wherever** [weə'evə] где бы ни, куда бы ни  
**whether** ['weðə] ли  
**while** [wail] в то время как  
**white** [wait] белый  
**whole** [houl] весь, целый  
**why** [wai] почему  
**wide** [waid] широкий  
**wife** [waif] жена  
**wild** [waild] дикий; очень сильный  
**win** [win] побеждать

## X

**X-rays** ['eks'reiz] рентгеновские лучи

**window** ['windəu] окно  
**winter** ['wintə] зима  
**wire** ['waɪə] провод  
**wireless** ['waɪəlis] радио  
**wisdom** ['wɪzdəm] мудрость  
**wish** [wiʃ] хотеть, желать  
**with** [wið] с; при  
**within** [wið'in] в, внутри; в течение; через  
**without** [wið'aut] без  
**withstand** [wið'stænd] (withstood, withstood) [wið'stʊd] сопротивляться, противостоять; выдерживать  
**wonder (at)** ['wʌndə (ət)] удивляться чему-нибудь  
**wonderful** ['wʌndəfʊl] чудесный  
**wood** [wud] дерево  
**word** [wɜ:d] слово  
**work** [wɜ:k] 1. работа; 2. работать  
**work out** ['wɜ:k'au] разрабатывать  
**workshop** ['wɜ:kʃɒp] мастерская  
**world** [wɜ:ld] мир, свет  
**worry** ['wʌri] беспокоиться  
**worse** [wɜ:s] хуже  
**write** [rait] (wrote, written) писать

## Y

**year** [jə:, jiə] год  
**yet** [jet] тем не менее, однако; еще  
**young** [jʌŋ] молодой

## Z

**zero** ['ziərou] ноль



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