Английский язык

УЧЕБНИК

для машиностроительных специальностей вузов

АНГЛИЙСКИЙ ЯЗЫК ДЛЯ МАШИНОСТРОИТЕЛЬНЫХ СПЕЦИАЛЬНОСТЕЙ ВУЗОВ

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для студентов
машиностроительных специальностей
высших учебных заведений

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Учебник комплексный и рассчитан на I—II этапы обучения. Он включает коррективный курс, 8 основных тематических разделов, построенных по единому принципу, материал для самостоятельных занятий, лабораторные работы с использованием ТСО. Грамматический материал систематизирован и представлен в таблицах. В учебнике содержится много схем и рисунков.

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АНГЛИЙСКИЙ ЯЗЫК
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ПРЕДИСЛОВИЕ

Настоящий «Учебник английского языка для машиностроительных специальностей вузов» предназначен для студентов неязыковых вузов машиностроительного профиля.

Целью его является взаимосвязанное развитие у студентов умений и навыков чтения и устной речи на английском языке в соответствии с программой.

Учебник включает в себя 8 основных циклов (Units), раздел для работы в лингафонном кабинете, тесты и приложения.

Основные циклы объединяются по тематическому принципу и охватывают такие области, как высшее образование в нашей стране и в странах изучаемого языка; профессия «инженер»; общее машиностроение; принципы действия механизмов и машин; материалы и процессы обработки; роботизация, компьютеризация производства.

Эти циклы в структурном отношении идентичны и включают в себя три текста А, три текста В и несколько дополнительных текстов для самостоятельного чтения. Все тексты заимствованы из оригинальных источников 80-х годов.

Построение системы заданий к каждому тексту определяется методическим назначением этих текстов: задания к тексту А сгруппированы в разделы Reading and Comprehension, While-Reading Section (с подразделами Language Study и Text Study), After-Text Section, а к тексту В — в разделы Pre-Text Section, After-Text Discussion.

Каждый из основных циклов заканчивается денотатной схемой, объединяющей в систему наиболее важные понятия и положения темы цикла. Эти схемы предназначены для обобщения материала по теме, а также как дополнительная опора для закрепления активного словаря.

При разработке системы заданий и упражнений использованы элементы функционально-коммуникативного обучения иностранному языку, при котором явления языка (лексика и грамматика) рассматриваются не только как система языковых правил и правил их употребления, но и как система коммуникативных функций, выполняемых определенными языковыми единицами. Так, коммуникативные функции, типичные для текстов машиностроительного профиля — определение объекта или понятия, классификация, описание-обобщение, находят свое отражение и в текстовом материале, и в типичных грамматических моделях, и в типичном наборе лексических единиц и словосочетаний. Объем и содержание лексического и грамматического материала определены программой по английскому языку для неязыковых вузов (М., 1984).

Словарь содержит общелитературную и общетехническую лексику. При ее презентации и закреплении используется тематическая группировка.

Грамматический материал представлен в таблицах. Каждое новое явление дается с опорой на уже изученный материал. В учебнике нашли отражение все грамматические явления, предусмотренные программой. Презентация грамматического материала приведена в соответствие с теоретическими разработками последних лет в области теоретической грамматики английского языка.

Авторы выражают глубокую признательность доценту Г. Н. Николаенко, ст. преподавателям Г. И. Негродовой и Т. С. Шепотьевой за помощь в создании данного учебника.

Методическая записка

Данный курс рассчитан на 170 часов аудиторных и 85 часов самостоятельных занятий студентов и охватывает I и II этапы обучения в неязыковых вузах.

По прохождении данного курса предполагается отработка следующих умений и навыков на английском языке:

а) участие в речевом общении — умение участвовать в беседе и делать сообщение по пройденной тематике;

б) чтение текстов по пройденной тематике для получения необходимой информации.

1. Тексты А предназначены для развития навыков и умений: а) поискового, б) изучающего чтения. Предварительная установка на чтение текста дается заданиями Reading and Comprehension.

2. Раздел While-Reading Section включает в себя подразделы Language Study и Text Study.

Подраздел Language Study охватывает упражнения на развитие лексических и грамматических умений и навыков, необходимых для глубокого понимания текста А и обсуждения в дальнейшем содержания текста на английском языке.

Задания к целому ряду упражнений отсылают студентов к тексту и требуют детального изучения его содержания.

Функции языковых явлений текста и их языковое выражение закрепляются в упражнениях на трансформацию, дополнение, перевод и др. Эта работа подготавливает студентов к прохождению подраздела Text Study, упражнения которого носят речевой характер и направляют внимание студентов только на содержание текста и на содержание устных высказываний в пределах темы текста.

Выполнение упражнений раздела While-Reading Section должно обеспечить точное понимание текста А и развитие навыков и умений устной речи в пределах данной темы.

3. Раздел After-Text Section включает в себя Text Discussion и Active Vocabulary. Назначение этого раздела — развитие творческих умений говорения на иностранном языке с элементами обобщения, систематизации. Активный словарь сгруппирован по тематическому принципу и представлен в таблицах, которые могут быть использованы как опора при ведении беседы на иностранном языке и для повторения и окончательного закрепления лексики.

4. Тексты В предназначены для развития навыков и умений ознакомительного чтения. Задания раздела Reading and Comprehension не только обеспечивают необходимую установку, но и снимают языковые трудности, мешающие пониманию текста. Раздел After-Text Discussion, как и аналогичный раздел, следующий за текстами А, направлен на развитие навыков устной речи.

5. Раздел Self-Training Practice каждого цикла включает в себя несколько текстов с предтекстовыми и послетекстовыми заданиями.

Характер заданий определяется содержанием и языковыми особенностями текстов. Цель этого раздела — выработка у студентов навыков и умений самостоятельной работы с текстом при последующем контроле правильности выполнения заданий со стороны преподавателя.

Тематика дополнительных текстов соответствует тематике основных текстов каждого цикла, а их объем обеспечивает возможность регулярного чтения студентами литературы на английском языке и соответствует программе для неязыковых вузов.

6. При работе с денотатными схемами предполагаются задания типа:

1) Ориентируясь на основные блоки денотатной схемы, составьте план сообщения по определенной теме.

2) Сделайте краткое сообщение на английском языке по каждому пункту плана, ориентируясь на «подблоки» схемы.

7. Раздел Laboratory Work направлен на развитие навыков говорения и аудирования на английском языке в процессе занятий в лингафонном кабинете. При этом студентами самостоятельно отрабатываются следующие устные темы: специальность «инженер»; научно-исследовательская работа в вузе; инженер и технология производства.

Послетекстовые задания к текстам на аудирование проверяются преподавателем в аудитории.

8. Тесты предназначены для проверки языковых умений студентов при проведении итогового контроля.

В них включены все основные грамматические и лексические явления учебника, а выполнение 80% заданий свидетельствует о хорошем усвоении языкового материала.

9. Приложение включает в себя:

а) частотные суффиксы и префиксы;

б) меры измерений;

в) правила чтения некоторых математических символов.

Авторы

CONTENTS

UNIT I

Higher Education in the USSR and English-Speaking Countries

Text 1A

READING AND COMPREHENSION

Прочитайте текст и определите:

1. что обозначают все цифровые данные, приведенные в тексте;
2. в каком абзаце говорится о техническом оснащении учебных аудиторий современного вуза;
3. в каком абзаце говорится о взаимосвязи между изучением основных и специальных предметов.

Higher Schools in the USSR

There are 890 higher schools in the USSR with over five million students (1985 sources). Every year over 800,000 specialists graduate in 430 fields.

There are 68 universities with 600,000 students. They train specialists in the natural and exact sciences and the humanities.

There are specialised institutes training engineers, doctors, teachers, etc.

Every year about 50,000 students come from other countries to study at Soviet universities and institutes.

Today a student must assimilate large amounts of new information and it is growing all the time. Study rooms are now equipped with TV sets, computers, video tape-recorders, etc. Lectures and seminars alternate with laboratory work, discussions, research work and their self-training.

A large part of study time is devoted to basic subjects. This enables future specialists to attain greater professional knowledge and assimilate more modern methods of scientific research, advanced production technology, its organisation and management. This provides a basis for the study of special subjects and the organisation of practice.

Training highly-skilled specialists with a wide theoretical and political outlook is the main task of higher education.

WHILE-READING SECTION

Language Study

Practice 1. a) Прочитайте следующие слова, имеющие общий корень со словами русского языка, и догадайтесь об их значениях. Значения выделенных слов уточните по словарю (это так называемые «ложные друзья переводчика»). Найдите предложения с данными словами в тексте 1А и проверьте правильность найденных вами значений.

Образец: assimilate [ə'sɪmɪleɪt] ассимилировать, усвоить

student ['stu:dnt], university [ˌju:nɪ'vɜ:sɪtɪ], information [ˌɪnfə'meɪʃn], video ['vɪdɪəʊ], seminar ['semɪnɑ:], laboratory [lə'bɒrətərɪ], *basic* ['beɪsɪk], method ['meθəd]; *technology* [tek'nɒlədʒɪ], theoretical [θɪə'retɪkl], million ['mɪljən], specialist ['speʃəlɪst], institute ['ɪnstɪtju:t], computer [kəm'pju:tə], lecture ['lektʃə], *alternate* [ɔ:ltəneɪt], discussion [dɪs'kʌʃn], professional [prə'feʃənl], *production* [prə'dʌkʃn], organisation [ˌɔ:gənaɪ'zeɪʃn], practice ['præktɪs], political [pə'lɪtɪkl]

b) Каким русским сочетанием букв передаются английские буквосочетания:

-ion (organisation), -y (laboratory), -al (political)

Practice 2.

Значение незнакомого слова можно понять не только по форме, но и из контекста.

a) Прочитайте следующие предложения и догадайтесь о значении выделенных слов.

1. This institute *trains* engineers. 2. Study rooms are *equipped* with computers. 3. Much time is *devoted* to basic subjects.

b) Прочитайте предпоследний абзац текста и догадайтесь по контексту о значении глаголов to enable, to get, to provide.

Practice 3. a) Переведите следующие сочетания, образованные по модели: N + N (какой?) или N + N (для чего?) (где N — существительное).

study room, laboratory work, research work, study time, production technology

b) Найдите эти сочетания в тексте и укажите формальные показатели, определяющие начало и конец группы существительного.

Practice 4. a) Изучите следующую схему, показывающую различные функции глагола to be в английском предложении. Какое окружение определяет функции этого глагола?

	+	V ing	The information is growing...
	+	V ed	A large part of study time is devoted to...
to be	+	N	Training specialists is the task of higher education.
	+	Inf.	a) His task is to study. b) He is to study this subject.
	+	Prep. N	He is at the Institute.

b) Прочитайте внимательно текст 1A и переведите все предложения с глаголом to be.

c) Подчеркните в данных примерах слова или группы слов, которые выражаются в английском языке при помощи глагола to be.

1. Цель состояла в том, чтобы создать много специализированных заводов. 2. Мы должны закончить испытания на этой неделе. 3. Выход из строя этой установки явился для нас неожиданностью. 4. Гибкая автоматизированная линия внедряется на этом участке. 5. Один из первых изобретателей автомобиля за рубежом — Бенц. 6. Двигатель — это машина, преобразующая тепловую энергию в механическую. 7. Студенты наблюдают сейчас за работой ЭВМ.

Practice 5.

Глагол to be

Настоящее время (Present Tense)

I He, she	am is	a worker.	We You They	are	workers.

Прошедшее время (Past Tense)

I, he, she We, you, they	was were	a worker workers	last year.

Будущее время (Future Tense)

I, we He, she, you, they	shall be will be	here	tomorrow.

Вопросо-ответная модель

Время		Вопрос		Ответ	
Наст.	Прош.			Краткий	Полный
Am Is	(was)	I he	a worker?	Yes, I am Yes, he is (was) No, I am not No, he isn't (wasn't)	a worker.
Are	(were)	you	workers?	Yes, we are (were) No, we are not (were not)	workers.

Время		Вопрос		Ответ	
Будущее				Краткий	Полный
Shall Will	I he	be	here?	Yes, I shall No, I shan't Yes, he will No, he won't	be here.

Раскройте скобки, поставив глагол to be в нужную форму.

1. The biggest research centre in the USSR (to be) the Academy of Sciences of the Soviet Union. 2. Every student (to be) interested in this problem last year. 3. They (to be) at the plant tomorrow. 4. We (to be) in the workshop now. 5. In April 1984 21.5 percent of young people

under 25 (to be) unemployed in England. 6. You (to be) in the chemical laboratory a week ago? — No, we (not to be). We (to be) there only the day after tomorrow.

Practice 6.

Порядок слов в предложении (Word Order)

	Центр предложения			
	I He	work. studies.		
Обстоятельство О	Подлежащее П	Сказуемое С	Дополнение Д	Обстоятельство О
0	1	2	3	4
Last year	we	had	many lectures	at the Institute.
	He	will give	his report	tomorrow.
Now	my friend	studies		at school.
Yesterday	she	translated	this text	quite well.

Запомните, что в английском языке, в отличие от русского, строгий порядок слов в предложении.

Ядром в английском предложении является П + С, поэтому в английском языке, как правило, невозможно предложение без подлежащего, в отличие от русского языка.

Порядок слов в английском предложении — это один из формальных показателей, который может вам помочь при переводе с английского языка на русский. Главное — найти сказуемое (С), а по его окружению легко воссоздать всю структуру предложения. Помните, что левую позицию от сказуемого (С) занимает подлежащее (П).

Перестройте русские предложения в соответствии со строгим порядком слов в английском языке.

1. Эти изменения сейчас специалисты объясняют действием сильного магнитного поля. 2. Проблему влияния солнечного излучения на биологические процессы изучают многие лаборатории. 3. Выделение тепла сопровождает многие из этих процессов. 4. Теоретическим отделом астрофизической лаборатории руководит проф. Смит. 5. Статистический анализ имеющихся фактов

в будущем даст ясную картину состояния нашей области исследования.

Practice 7. Составьте предложения из следующих слов, руководствуясь таблицей.

1. Work, leading scientists, at this problem, now. 2. New, factories, construction, of, will continue. 3. Soviet, major, an industry, auto-making, is, at present. 4. Became, main, the material, metal, the engineer, of. 5. A great number, the plant, engines, of, produces.

Practice 8. Переведите на русский язык, обращая внимание на выделенные слова.

1. Our Soviet industry has *specialized* operation. 2. This plant *specialized* in producing cars long ago. 3. In this field of industry they *start* from nothing. 4. The *start* was given, the competition began. 5. The scientific *centre* of our country is the USSR Academy of Sciences. 6. Our thoughts *centre* on one idea. 7. My friend *works* at the Likhachev automobile *works*.

Text Study

Practice 1. Завершите предложения, подобрав соответствующие окончания в правом столбце.

1. There are...	...a basis for the study of special subjects.
2. There are...	...890 higher schools in the USSR.
3. Students have...	...theoretical studies and practical work.
4. Lectures and seminars...	...alternate with laboratory work, discussions, research work and self-training.
5. TV sets, computers, video tape-recorders, etc. ...	...universities and specialized institutes.
6. Basic subjects are...	...help students in their studies.

Practice 2. Пользуясь информацией текста, заполните следующую таблицу.

Тип учебного заведения	Назначение
Universities	
Specialized institutes	

AFTER-TEXT SECTION

Text Discussion

Practice 1. Ответьте на вопросы по теме "Higher Education".

1. Name the basic types of higher schools in the USSR. 2. What kinds of studies are included into the educational process? 3. What is the role of specialized and basic subjects in the system of education?

Practice 2. Расскажите о системе высшего образования в СССР по следующему плану, используя приведенные в скобках слова и словосочетания.

1. Типы высших учебных заведений и их назначение. (There are... in the USSR. ... train ... .) 2. Виды учебных занятий. (The students ... theoretical ... and ... . alternate with ... .) 3. Предметы обучения. (There are ... and ... subjects.) 4. Основная цель обучения в вузе. (The main task of ... is to ... highly-skilled ... .)

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы
род занятий, специальность, профессия	**specialist** **engineer** **doctor** **agronomist** **student** **teacher**	**to exist** **to equip** **to devote** **to discuss** **to train** **to provide** **to assimilate** **to grow** **to graduate**
область знания, область науки	**natural science** **exact science** **humanities** **basic subjects** **special subjects** **technology production**	
место занятий, учреждения	**Institute** **laboratory** **study room**	
деятельность в области науки	**self-training** **research work** **management** **organisation**	
оборудование	**equipment** **tape-recorder**	

Продолжение

Область применения	Существительные и сочетания с существительными	Глаголы
абстрактные существительные, используемые в общенаучных текстах	**task** **outlook**	

Text 1B

PRE-TEXT SECTION

Practice 1. Прочитайте следующие предложения и догадайтесь о значении выделенных слов.

1. *Colleges* are technical or professional schools which prepare students for specific job or offer a specialist qualification. 2. *Technical college* is a college, specializing in technical subjects. 3. *College of technology* also specializes in technical subjects but provides more advanced courses than a traditional technical college. 4. *Polytechnics* are centres for advanced courses in a wide range of subjects. 5. *A course* is a complete (полный, законченный) period of studies. 6. *Sandwich courses* are courses in which students alternate studies with practical work in industry.

Practice 2. Прочитайте следующие слова и словосочетания. Они помогут вам полнее понять содержание текста.

academic учебный, tutorial консультация, particular feature отличительная черта, strong links прочные связи

Practice 3. Прочитайте текст и выполните следующие за ним упражнения.

Higher Education in Great Britain

There are 46 universities, 30 polytechnics and numerous colleges for more specialized needs, such as colleges of technology, technical colleges, colleges of arts and agricultural colleges in England and Wales.

They all provide a wide range of courses from lower-level technical and commercial courses through specialized courses of various kinds to advanced courses for those who want to get higher-level posts in commerce, industry and administration, or take up one of a variety of professions.

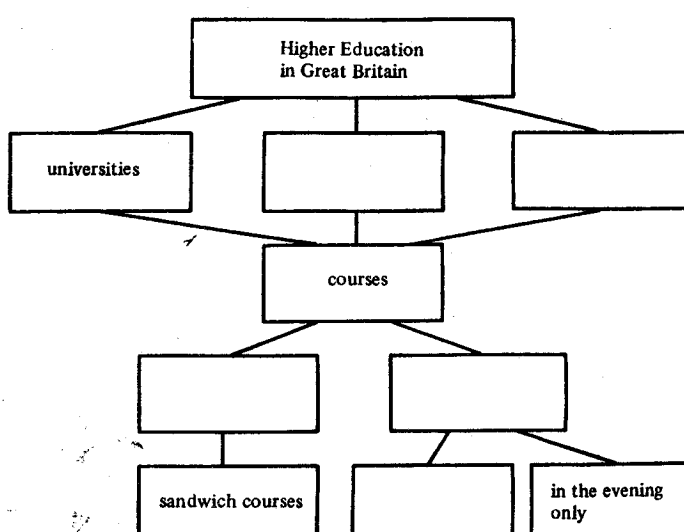
Courses are a combination of lectures, seminars, tutorials and laboratory work. In a lecture the student is one of a large number of students. He listens to the lecturers, takes notes, asks no questions. In a seminar he raises problems and discusses them with his fellow students under the direction of one of the teachers. In a tutorial he is accompanied by only a handful of students and discusses his personal academic problems with a teacher.

Study in courses may be full-time and part-time. Full-time education includes sandwich courses in which periods of full-time study (for example, six months) alternate with full-time practical work and training in industry. Full-time and sandwich courses now are an important part of higher education in England and Wales. Part-time education may be taken during the day (for example, one day a week or full-time for short periods) or in the evening only. Particular feature of the higher education is its strong links with commerce and industry.

The system of higher education permits students to get whatever qualification they need.

AFTER-TEXT DISCUSSION

Practice 1. На основании полученной информации заполните следующую схему.



Practice 2. Расскажите о системе высшего образования в Великобритании, воспользовавшись составленной вами схемой.

Practice 3. Сравните систему высшего образования в СССР и Великобритании. Воспользуйтесь при этом планом из Practice 2 на с. 14 и Practice 1 на с. 16.

Text 2A

READING AND COMPREHENSION

Прочитайте текст и определите:

1. в каких абзацах приводятся общие сведения об учреждениях вечернего и заочного высшего образования;
2. в каких абзацах говорится о льготах, предоставляемых студентам вечерних и заочных институтов администрацией их предприятий;
3. в каком абзаце подчеркивается эффективность данных форм обучения.

For Those Who Work

The rapid development of science and engineering makes us continue learning as long as possible.

After their working day thousands of Soviet citizens attend classes at institutes. These are evening and correspondence students. They study at institutes without leaving their jobs at plants and on collective farms.

There are 16 large specialized correspondence institutes and 632 correspondence departments at regular higher schools. The courses of studies at such institutes and departments do not differ from those of regular higher schools and therefore their diplomas are of the same value.

The evening and correspondence education systems have their own advantages. Their students are people with experience in their field, who have already chosen their career.

Experience shows that correspondence and evening education is an effective form of getting a higher education. It is, however, not easy to both work and study. Therefore the heads of higher schools as well as the heads of enterprises try to find ways to improve this form of education.

Students are provided with all the necessary teaching material. Besides this the students receive state benefits.

They are given additional holidays with full pay. This extra time off is to enable them to do laboratory work and to take their tests and receive their higher-school diplomas.

Factory and office managers are allowed to give correspondence students one or two days a week off without pay for ten study months before they write their theses.

Correspondence education is arranged to make training as easy as possible. It brings tuition nearer to the factories where the students are employed.

WHILE-READING SECTION

Language Study

Practice 1. Прочитайте следующие слова, имеющие общий корень со словами русского языка, и догадайтесь об их значениях. Значения выделенных слов уточните по словарю. Найдите предложения с данными словами в тексте 2A и проверьте правильность найденных вами значений.

class [klɑːs], collective farm [kə'lektɪv fɑːm], *correspondence* [ˌkɒrɪ'spɒndəns], *department* [dɪ'pɑːtmənt], diploma [dɪ'ploʊmə], manager ['mænɪdʒə], factory ['fæktərɪ], office ['ɒfɪs], regular ['regjʊlə]

Practice 2. Переведите следующие словосочетания на русский язык.

correspondence institute, office manager, higher-school diploma

Найдите эти сочетания в тексте и укажите формальные показатели, определяющие начало и конец группы существительного.

Practice 3. Определите значения следующих слов по словарю. Предварительно разместите их в алфавитном порядке. У выделенных слов определите сначала исходную форму.

development, citizen, leave, course, experience, *higher*, both ... and, improve, *widespread*, allow, necessary, receive, benefit, state, pay, time off, arrange, possible, employ, besides, *nearer*, rapid

Найдите предложения с данными словами в тексте 2A и проверьте правильность найденных вами значений.

Practice 4.

Во многих предложениях текста использована модель N is/are V ed, которая означает, что действие выполняется не N, а над N, или направлено на N.

а) Определите, какие из высказываний, включающих вышеуказанную модель, соответствуют содержанию текста 2A.

1. Evening and correspondence institutes are attended by thousands of Soviet citizens. 2. State benefits are received by evening and correspondence students. 3. Evening and correspondence students are allowed to take additional holidays with full pay. 4. These students are given one or two days a week with pay off before they write their theses. 5. Laboratory work is done by the students during their additional holidays.

b) Переведите отрывки, следуя образцу.

Model: Students were provided with...

1. Студентов обеспечивали...
2. Студенты обеспечивались...
3. Студенты были обеспечены...

1. They are given... 2. They were allowed to... 3. Education is arranged... 4. Students will be employed... 5. The materials were studied...

c) Найдите в трех последних абзацах текста предложения с приведенными выше отрывками и переведите их.

Practice 5. Переведите следующие предложения на русский язык.

1. Specialists for automobile industry are trained at the Automechanical Institute. 2. Soviet radio sets are exported to many foreign countries. 3. A total of only 10,000 specialists with higher education were employed in the economy of pre-revolutionary Russia. 4. Teachers are trained at the Teachers' Training College. 5. Some additional information will be reported in the newspaper. 6. Modern methods of teaching are hotly debated now. 7. Cambridge is situated at a distance of seventy miles from London. 8. Every college is headed by a dean.

Practice 6. Заполните таблицу по образцу.

to show	to be shown	is shown	was shown	will be shown
to make				
to train				
to take				
to work				
to produce				
to do				
to use				
to leave				
to choose				
to provide				
to improve				

Practice 7. Дайте три формы следующих глаголов. Сгруппируйте те глаголы, которые образуют II и III формы по одинаковой модели.

to speak, to feel, to deal, to come, to grow, to send, to set, to leave, to become, to bring, to shut, to choose, to think, to know, to smell, to learn, to teach, to break, to spend, to put, to build, to let, to show, to give

Practice 8. Переделайте предложения по следующей схеме, меняя при этом логику высказывания.

Many examples *illustrate* this rule.

This rule *is illustrated* by many examples.

1. Two laboratories will study this problem. 2. Several examples illustrated this idea. 3. The Academy of Sciences organized the conference. 4. Each faculty controls the various subjects of study at this college. 5. The Cambridge University trains about 7,000 students in different specialities.

Text Study

Practice 1. Завершите предложения, подобрав соответствующие окончания в правом столбце.

1. Thousands of Soviet citizens attend...	...to both work and study.
2. They study...	...try to improve this form of education.
3. The evening and correspondence education systems have...	...people with experience in their fields.
4. Evening and correspondence students are...	...evening and correspondence institutes and departments.
5. It is not easy...	...after their working day.
6. The heads of higher schools and enterprises...	...for their laboratory work, tests and diplomas.
7. Students are given additional holidays...	...their own advantages.

Practice 2. Пользуясь информацией текста, заполните следующую таблицу.

Тип системы образования		Курс обучения		Предоставляемые льготы	
англ.	русск.	англ.	русск.	англ.	русск.
Evening and correspondence education system					

AFTER-TEXT SECTION

Text Discussion

Practice 1. Ответьте на вопросы по теме "Evening and Correspondence Education".

1. What kind of schools does the evening and correspondence education system include? 2. Do the courses of study at regular, evening and correspondence institutes differ from each other? 3. How many correspondence institutes and departments are there in the USSR? 4. What is the advantage of the correspondence and evening education systems? 5. What benefits are the correspondence students provided with?

Practice 2. Пользуясь информацией текста 2A и таблицы Practice 2 (раздела "Text Study") и активной лексикой, расскажите о системе вечернего и заочного высшего образования в СССР.

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы	Прилагательные
род занятий, специальность	**manager**	**to attend** **to leave** **to choose**	**effective** **possible** **various**
место занятий, работы	**correspondence institute** **higher school** **collective farm** **factory** **enterprise** **job**		
льготы, предоставляемые студентам	**pay** **holiday** **day off**		

Продолжение

Область применения	Существительные и сочетания с существительными	Глаголы	Прилагательные
слова, используемые в научных и технических текстах разной тематики	**experience** **advantage** **career**	**to continue** **to improve** **to enable** **to provide** **to differ**	

Text 2B

PRE-TEXT SECTION

Practice 1. Прочитайте следующие слова и словосочетания. Они помогут вам понять содержание текста.

tuition обучение, degree звание, ученая степень, paper письменная работа, to cover a wide range of охватывать большой ряд, manufacturing techniques методы производства, by post по почте

Practice 2. Прочитайте следующие предложения, выражающие основные положения текста.

— The Open University offers a wide range of courses at many different levels.
— The OU was established to give educational opportunities to those people who want to continue their education at home.
— In its teaching the OU employs a combination of television, radio, correspondence tests, broadcasts and personal tuition.
— The University is open to everybody.

Practice 3. Прочитайте текст и расположите основные положения текста (Practice 2) в порядке их следования. Раскройте (дополните) их информацией из текста.

Open University

The Open University was established in 1969 to enable people to study for a best degree at home. It started its first course in 1971 with 19,580 students. Now it is Britain's largest teaching institution, with more than 100,000 men and women taking its various courses at any given time. About 6,000 students of all ages get degrees

every year. Its degrees, diplomas and other qualifications are equal to those of any other university.

Apart from the well-known degree courses — from which more than 80,000 people have already graduated — there are a lot of other courses, some lasting only a few weeks, others ten or twelve months.

Courses cover a wide range of subjects — from everyday topics through traditional university disciplines — history, chemistry, electronics and so on — to the latest manufacturing techniques.

There are nearly 200 courses and in all of them (except for higher degrees) there is one principle: they are open to everybody. You need no formal academic qualifications to enter them. You must be 18 or over, and resident of the United Kingdom. And of course, you must have the desire to learn.

The OU operates by sending its educational materials to students in their own homes or places of work. It uses not only textbooks which can be bought at bookshops or by post from the Open University's centre at the new town of Milton Keynes, but also video and audio cassettes and a variety of other equipment. Students of the OU receive their lessons and lectures in their homes by means of special TV and radio programmes. They also work with their tutors all over the country. Students write papers on the courses and discuss them with their tutors at meetings or by correspondence.

The OU's success is of great interest abroad and a number of countries have bought teaching materials produced at the University.

AFTER-TEXT DISCUSSION

Practice 1. Вы прочитали об одном из университетов Англии. Иногда его называют "University on the Air". Как вы думаете, почему?

Practice 2. На основе информации текстов "For Those Who Work" и "Open University" сравните систему заочного образования в нашей стране и в Англии.

Text 3A

READING AND COMPREHENSION

Прочитайте текст и определите:

1. о каком высшем учебном заведении идет речь в тексте;
2. в каких абзацах описан процесс обучения;

3. есть ли в тексте информация о практической стороне обучения студентов; в каких именно абзацах;
4. в каком абзаце сформулировано основное преимущество данной формы обучения.

A Higher School for Autoworkers

There is a higher technical school in Moscow attached to the Likhachev Automobile Works. The school trains specialists for ZIL, its 15 branches in different cities, for the Lenin Komsomol Car Works and for the 1st State Ball-Bearing Factory. There is a daytime and an evening departments at the school. It has three faculties.

The first year at the school doesn't differ from the first year at a usual higher school. In their second to fourth years, students alternate their theoretical studies with practical work at the autowork, spending a week at each. They just study during the first semester in their fifth year. Then they get an engineering job and work in the daytime and study in the evenings.

In the course of their studies students learn three to four skilled worker jobs. Take the metal-processing department, for example, where its students try their hand at a variety of jobs, such as a production organizer, technological designer, and equipment mechanic.

The school devotes 4 to 7 percent less time to theory than a typical higher school. The volume of special subjects is 16 percent higher because the entire curriculum is compact.

The graduates have an optimal combination of theoretical knowledge and practical skill.

The school has some problems, but its main advantage is that the students can use the Works' materials and production facilities on a very wide scale. The teachers are the autoworks' experts who know the production needs and train specialists for the field of mechanical engineering.

WHILE-READING SECTION

Language Study

Practice 1. Прочитайте следующие «интернациональные» слова и догадайтесь об их значении. Найдите предложения с данными словами в тексте 3А и проверьте правильность найденных вами значений.

theoretical [θɪəˈretɪkl], practical [ˈpræktɪkl], semester [sɪˈmestə], organizer [ˈɔːgənaɪzə], designer [dɪˈzaɪnə], mechanic [mɪˈkænɪk], compact [kəmˈpækt], optimal [ˈɒptɪml], combination [ˌkɒmbɪˈneɪʃn], expert [ˈekspɜːt]

Practice 2. Уточните с помощью словаря значения следующих слов и словосочетаний и скажите, к какой области применения (см. Active Vocabulary к текстам 1A и 2A) их можно отнести.

a) branch
field
mechanical engineering

b) department
works
production facilities

c) curriculum
knowledge
course of studies

Practice 3. Переведите приведенные ниже словосочетания, образованные по уже известным вам моделям. При необходимости воспользуйтесь словарем. Найдите эти сочетания в тексте и укажите формальные показатели, определяющие начало и конец группы существительного.

equipment mechanic, works' materials, production facilities, autoworks' experts, production organiser, production needs, metal processing

Practice 4. Переведите приведенные ниже словосочетания, образованные по модели: Adj + N (какой?) (где Adj — прилагательное). Найдите эти сочетания в тексте и укажите формальные показатели, определяющие начало и конец группы существительного.

technical school, usual school, practical work, theoretical studies, technological designer, typical school, optimal combination, theoretical knowledge

Practice 5. Найдите в тексте английские эквиваленты для следующих русских слов и словосочетаний.

готовить специалистов, обычная высшая школа, чередовать учебу и работу, поступить на вечернее отделение, практическое умение, механик по оборудованию

Practice 6.

В описательных текстах часто используется модель there is/are + N + prep. N (где prep.— предлог места). В предложениях, построенных по такой модели, указывается на наличие/отсутствие чего-либо в определенном месте или в данное время. Например:

There are three institutes *in this city. В этом городе* три института.

There were not many institutes *in Russia* before the Revolution. До революции *в России* было немного институтов.

a) Найдите в тексте 3A предложения, построенные по данной модели, и переведите их.

b) Определите, какие из высказываний, включающих данную модель, соответствуют содержанию текста 3A.

1. There are 15 branches of the ZIL in different cities of the USSR. 2. There are two departments at the higher technical school. 3. There is no difference between the courses of studies at the school attached to the ZIL and a usual higher school. 4. There is an optimal combination of theoretical studies and practical work at the school. 5. There are no problems for the school of this kind.

Practice 7.

Модель N + have/has + N по смыслу соответствует модели there is/are + N + prep. N. Например, предложения: a) There are two faculties at this institute. b) This institute has two faculties — имеют одинаковый смысл: *В этом институте (имеется) два факультета.*

Имея в виду вышесказанное, заполните пропуски в следующих предложениях.

1. The higher technical school has a daytime and an evening departments. There is ... school. 2. The school has three faculties. There are ... school. 3. This system of education had some advantages. ... some advantages in this system of education. 4. We have many laboratories at the Institute. There ... at the Institute. 5. Our country has many branches of industry. There are ... our country. 6. We'll have a great number of specialists and engineers in this field in our country. There ... in this field in our country.

Practice 8. Составьте предложения с оборотом there is/there are, пользуясь следующими словами.

1. Moscow, in, scientific, were, there, many, workers, year, last. 2. 31 polytechnics, are, in, there, the United Kingdom. 3. Scotland, are, in, universities, 8, there. 4. England, are, in, and, 35, universities, there, Wales. 5. Northern Ireland, 2, there, universities, are. 6. System, education, the, is, United States, there, no, national, of, in. 7. 19, in, there, universities, are, Canada. 8. Are, private, there, 4, Canada, in, universities.

Practice 9. Переведите на русский язык предложения, составленные вами в предыдущем упражнении.

Text Study

Practice 1. Завершите предложения, подобрав соответствующие окончания в правом столбце.

1. A higher technical school is attached to...	...alternate studies with practical work.
2. There are...	...the works' materials and its production facilities.
3. There is...	...get an engineering job.
4. The students of the day-time department...	...a daytime and an evening departments at the school.
5. In the fifth year they...	...the Likhachev Automobile Works.
6. The students of the school use...	...3 faculties at the school.

Practice 2. Пользуясь информацией текста, заполните следующую таблицу. Для этого используйте следующие слова и словосочетания.

to differ from the first year at a usual higher school, to alternate studies with work, to study, to work in the day-time and study in the evening

Год обучения	Содержание обучения
The first year... In the second to fourth years... During the first semester in the 5th year... In the second semester of the 5th year...	

AFTER-TEXT SECTION

Text Discussion

Practice 1. Расскажите о ВТУЗе при ЗИЛе по следующему плану, используя приведенные ниже словосочетания, активную лексику к тексту 3А, а также заполненную вами таблицу Practice 2 раздела "Text Study".

1. Назначение института. (to train specialists for...) 2. Его структура. (There are ... faculties/departments...) 3. Процесс обучения. (in the first year, from the second to fourth years, in the fifth year) 4. Качество подготовки специалистов. (the graduates ... an optimal combination of...)

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы
область, отрасль деятельности	**branch** **field** **mechanical engineering** **metal processing**	
место занятий, работы	**department** **works** **faculty** **production facilities**	
деятельность в области производства	**production organiser** **technological designer** **equipment mechanic** **expert**	
выражение количества	**a variety of** **percent** **scale**	
область обучения	**course of studies** **curriculum**	**to learn** **to study**
слова, используемые в текстах разной тематики	**knowledge** **skill**	**to alternate** **to use** **to attach**

Text 3B

PRE-TEXT SECTION

Practice 1. Прочитайте следующие слова и словосочетания. Они помогут вам полнее понять содержание текста.

thick изобилующий, thin ненасыщенный, equally в равной степени, to get used to привыкнуть, to give somebody an insight into дать возможность лучше узнать, познакомиться, to choose wisely разумно выбрать

Practice 2. Прочитайте текст и выполните следующие за ним упражнения.

Sandwich Courses

There are specialized courses in polytechnics, institutes and some universities. These courses are usually a year longer than normal full-time academic courses, and enable students to alternate full-time studies with one or more periods of practical work and training away from college.

There are two types of these courses — thick and thin.

The students of the thick sandwich courses spend two years at college, one year in industry and then a final year in college.

A typical thin sandwich course provides greater variety of practice. Each of the first three years the students alternate equally between college and industry, the final year spent in college.

Sandwich courses help students to get used to working with others. They stimulate them to work better when they see the practical results of their studies. They give them better understanding of practical problems and an insight into industry, commerce and the professions. Practical orientation of their studies help the students choose their future job wisely.

AFTER-TEXT DISCUSSION

Practice 1. a) Вы прочли текст об одной из форм обучения в Англии. С какой формой обучения в нашей стране можно ее сравнить?

b) В чем сущность и каков срок обучения на данных курсах? Каков срок обучения на обычных курсах? Подтвердите ваш ответ ссылкой на текст.

c) Как вы поняли словосочетания thick sandwich course; thin sandwich course? Как вы думаете, что легло в основу этих названий?

Practice 2. Суммируйте информацию текста, заполнив следующую таблицу. Используйте при этом следующие выражения.

to study at college, to have training (practice) in industry, to alternate studies with practical work

Год обучения / Тип курсов	1-й год	2-й год	3-й год	4-й год
thin sandwich courses				
thick sandwich courses				

Practice 3. Сравните обучение на курсах с обучением во ВТУЗе.

SELF-TRAINING PRACTICE: SUPPLEMENTARY TEXTS

Text 1

Pre-Text Section

Practice 1. Прочитайте текст и выполните следующие за ним упражнения.

Every Third Person Studies

Continuous improvement in educational standards is an integral feature of the Soviet way of life. Three fourths of the population were illiterate in pre-revolutionary Russia. The peoples of the Far North, Central Asia and other outlying provinces were almost one hundred percent illiterate. In 1959 the USSR had achieved universal literacy.

Old Russia was at the bottom of the list of European countries in regard to the number of college students and diplomaed specialists. Today, the Soviet Union is one of the world's leading countries in this respect. Regarding the number of children of workers and peasants, the number of women and people of national minorities having a higher education, it has no equals. A total of only 10,000 specialists with higher education were employed in the economy of pre-revolutionary Russia. Today there are 14 million such specialists.

The USSR has successfully coped with the social task of ensuring in practice the actual equality of men and women in all spheres of social life. The educational level of men and women is now practically the same. In certain fields women surpassed men in educational standards.

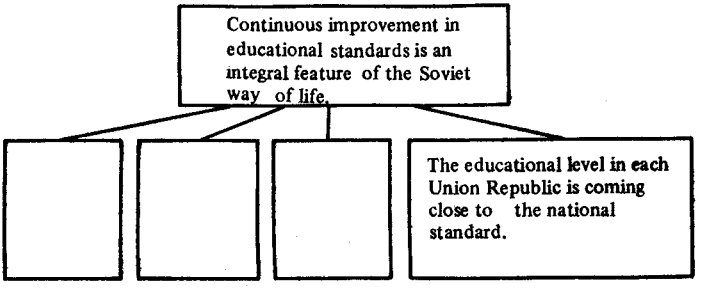
The Soviet Union has achieved a great advance in the educational level in each Union Republic, which is coming close to the national standard. For example, Estonia, the smallest of the 15 Union Republics, whose population is slightly more than 1.5 million employs some 90,000 specialists with higher education diplomas in its national economy.

---

improvement in ... standards повышение уровня
illiterate неграмотный
literacy грамотность
in regard to в отношении
national minorities национальные меньшинства
to have no equals не иметь равных
to cope with справляться с
to achieve an advance in добиться успеха в

After-Text Section

Practice 1. Суммируйте информацию текста, дополнив следующую схему.



Practice 2. Ознакомьтесь со следующими таблицами и скажите, какие положения текста они иллюстрируют.

Таблица 1

The number of women with higher and secondary special education employed in the national economy (mln)

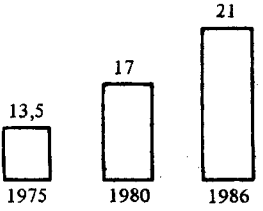


Таблица 2

	1960 = 1	1970	1980	1985
number of students		1.9.	2.2.	2.2.
number of specialists with higher education graduated		1.8.	2.4.	2.5.
number of specialists employed in national economy		1.5.	2.3.	2.5.

Таблица 3

The number of students in basic chain of educational system	*1940-41*	*1970-71*	*1985-86*
day-time general secondary schools	*34784*	*45448*	*41351*
vocational schools	*717*	*2592*	*4174*
secondary special educational establishments	*974,8*	*4388*	*4498*
higher educational institutions	*812*	*4581*	*5147*

Таблица 4

number of women-researchers

scientific workers — 40 %
candidates of science — 28 % } of the total number
doctors of science — 14 %

Text 2

Pre-Text Section

Practice 1. Прочитайте текст и выполните следующие за ним упражнения.

School Examinations in England

Pupils of secondary school in England (that is, pupils between the ages of 12 and 18) have two main exams: G.C.E. (General Certificate of Education) and C.S.E. (Certificate of Secondary Education).

They take the first exam when they are 15/16. It is called "O" (ordinary)-level. There is an exam which you can

take instead of "O"-level. It is called the C.S.E. It is not as difficult as "O"-level.

Most pupils take "O"-level in seven or eight different subjects. For many professional jobs, such as a clerk or assistant librarian, you must have five "O"-levels and usually these must include English and Math.

Pupils who want to go on to a college or university usually take seven or eight "O"-levels.

When they are 15 they may leave school. But if they stay in school after taking "O"-level, they go into the sixth form and start working on the second main exam: "A" (advanced)-level G.C.E.

Most people take "A"-level when they are 17/18. It is a difficult exam, so people don't usually take it in more than three subjects — and some people take only one or two subjects. Three "A"-levels are enough to get them in to most universities. For others, such as Oxford and Cambridge, you have to take special exams as well.

Of all school leavers, 15 % have one or more "A"-level, 34 % one or more "O"-level and 31 % one or more C.S.E.

General Certificate of Education (G.C.E.) аттестат об окончании полной средней школы

Certificate of Secondary Education (C.S.E.) свидетельство о среднем образовании (низшего уровня)

"O"(ordinary)-level обычный, средний уровень

"A"(advanced)-level продвинутый уровень

After-Text Section

Practice 1. Просмотрите таблицу и, ориентируясь на информацию текста, внесите необходимые корректировки.

Тип экзамена	Возраст сдающего	Количество сдающих (%)
General Certificate of Education at Ordinary level (G. C. E., "O"-level)	17/18	34 %
Certificate of Secondary Education (C.S.E.)	15/16	15 %
General Certificate of Education at Advanced level (G. C. E., "A"-level)	15/16	31 %

Practice 2. Суммируйте информацию текста, заполнив следующую таблицу.

Тип экзамена	Уровень экзамена	Возраст сдающего	Количество экзаменов	Открывающиеся возможности поступления на..., в...
General Certificate of Education	"O"-level			
				to enter most universities (except Oxford and Cambridge)
		15/16		

Text 3

Pre-Text Section

Practice 1. Рассмотрите схему на с. 35 и расскажите на английском языке, какие перспективы открываются перед английскими школьниками в возрасте 14—15 лет.

After-Text Section

Practice 1. Нарисуйте подобную схему, отражающую систему образования в нашей стране, и прокомментируйте ее.

Text 4

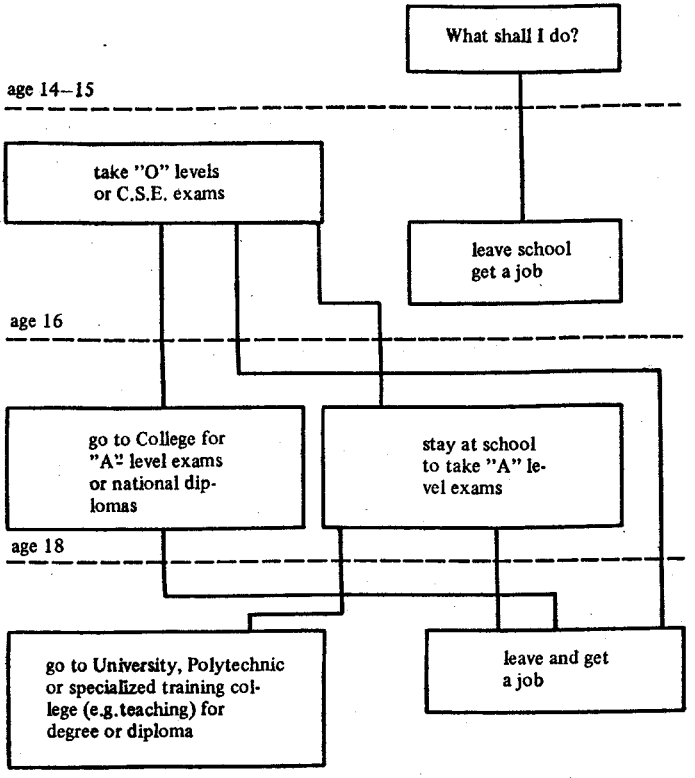
Pre-Text Section

Practice 1. Прочитайте текст и определите, на какие три группы и по какому принципу подразделяются университеты в Великобритании.

Universities

There is no single, universally accepted definition of what a university should be like. British universities are different.

In 1960 there were only 23 British universities. Today there are 46, of which 35 are in England, 8 in Scotland,



2 in Northern Ireland and 1 in Wales. They can be roughly divided into three groups.

Oxford and Cambridge: Scholars were studying in these ancient universities in the early thirteenth century. Since that time Oxford and Cambridge have continued to grow, but until the nineteenth century they were the only universities in England, and they offered no place to girls.

Four universities were founded in Scotland before Scotland and England were united: St. Andrews (1411), Glasgow (1450), Aberdeen (1494) and Edinburgh (1583).

The Redbrick Universities: In this group are listed all universities founded between 1850 and 1930 including London university. They were called "redbrick", because that was the favourite building material of the time, but they are rarely referred to as "Redbrick" today.

The New Universities: These were all founded after the Second World War. Some of them quickly became popular because of their modern approach to university courses.

The typical academic programme for university students in Great Britain is composed of a varying number of courses or subjects within a field of specialisation.

The academic activities for each subject fall into three types: lectures, at which attendance is not always compulsory, tutorials and examinations. These three categories — lectures, tutorials and examinations — provide the means by which students prepare themselves in specialised fields of knowledge.

However, universities have never had a monopoly on higher learning. In Britain, most full-time higher education takes place outside the universities.

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scholar ученый, ученик
redbrick красный кирпич
attendance посещение
compulsory обязательный

Text 5

Pre-Text Section

Practice 1. Прочитайте текст и озаглавьте его.

A college is a technical or professional school (often affiliated with a university).

Colleges offer a variety of courses leading to the award of their own certificates or diplomas. Some of them have traditional links with a university and award the degree of that university. A college education is in most cases less academic and more practical than a university education, and usually vocational. Colleges prepare young people for entry to specific job, or offer a specialist qualification. Courses last from one to three years and may be full-time or part-time.

After high school, many students go to college. They can choose a small college or a large one, in their own town or in another. They generally have to pay for a college education. But there are some scholarships for good students, and many college students work part-time because they need money for their education.

Colleges form an important part of higher education system in England and Wales.

---

to affiliate with присоединять (как филиал)
in most cases в большинстве случаев
scholarship стипендия

After-Text Section

Practice 1. Суммируйте информацию текста, расположив предложения в порядке их следования в тексте.

	№ предл.
— They prepare students for entry to specific job.	
— They form an important part of the higher educational system in England and Wales.	7
— A college is a technical or professional school.	1
— A college education differs from a university education: it is less academic and more practical.	
— Colleges offer a variety of courses.	
— Colleges are often affiliated with universities.	
— They award their own certificates or diplomas.	

Text 6

Pre-Text Section

Practice 1. Прочитайте текст и озаглавьте его.

A degree is an academic qualification awarded at most universities and colleges upon completion of a higher educational course (a first degree) or a piece of research (higher degrees). If students pass their final exam at the end of a three-year course, they get their first degree. Students with a first degree become Bachelors of Arts or Science, and can put B. A. or B. Sc. after their names. If they want to go a step further and become Master of Arts or Science, they have to write an original paper, or thesis, on some subject based on a short period of research, usually soon after graduation. If students wish to become academics and perhaps teach in a university, then they will work for a higher degree, a Doctor of Philosophy — a Ph. D. For this they will have to carry out some important research work.

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completion завершение
thesis выпускная работа
academic ученый

After-Text Section

Practice 1. На основании полученной из текста информации заполните следующую таблицу.

First degree		on completion of a three-year course
Higher degrees		
	Doctor of Philosophy	

Text 7

Pre-Text Section

Practice 1. Прочитайте текст и скажите, по каким из перечисленных ниже аспектов проводится сравнение американской и европейской систем образования. Подтвердите свой ответ ссылкой на текст.

1. роль системы образования в жизни страны;
2. уровень подготовленности выпускников;
3. цели и задачи обучения;
4. структура и организация системы образования;
5. учебные программы.

American and European Systems Compared

Education in America is largely the business of the individual State, not of the Federal Government. Each of fifty states has its own system of education. There is no Minister of Education such as exists in many other countries, no national system of education. In addition to public schools, academies, colleges and universities, there is a great number of private institutions of education. The Federal Government of the United States doesn't interfere in any way with public education within the States.

Americans tend to study a larger number of subjects than Europeans, in schools, and particularly at the university. Seven subjects are required for a first degree (Bachelor's degree) in many colleges. In the USA wide, and sometimes superficial, knowledge is often valued more than specialization.

The aim of American education is to create a good citizen, rather than a scholar. That is why great emphasis is placed on social duties and obligations, on communicating with other people, and obtaining varied inf rmation, which will be of practical use in life.

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public/private institutions государственные/частные учреждения
to tend стремиться
superficial knowledge поверхностные, неглубокие знания
to value ценить
citizen гражданин
great emphasis is placed on большое внимание уделяется
social duties and obligations общественные обязанности

Text 8

Pre-Text Section

Practice 1. Прочитайте текст и расположите следующие пункты плана в порядке следования информации в тексте.

1. культурная жизнь в высших учебных заведениях;
2. правила поступления в университеты и колледжи;
3. отличие американской системы образования от европейской;
4. совместное обучение в университетах и колледжах;
5. количество высших учебных заведений в стране;
6. количество поступающих в высшие учебные заведения.

Higher Education in the United States

There are more than two thousand institutions of higher education in the United States with the number of students ranging from fewer than a hundred to 40,000.

Young people who want to enter higher education must meet some requirements. They must have attended a high school for four years. No student is admitted to a college or university without having completed a four-year course in high school. This means that a student who wants to study at the university or college must begin by doing good work in high school. If his grades in high school are satisfactory, he is admitted to a university or college, where he may take a Bachelor's degree after a four-year course of study. About fifty three per cent of pupils who complete their high school course go on to a college or university.

The first two years in an American college or university differ somewhat from a similar period in a European

one. These years in American college are a continuation of secondary education. During this time certain courses in English, social science, natural science and so on must be completed before a student may begin an intensive study of this special field.

Nearly all of colleges and universities in the United States are coeducational. This means both men and women attend the same university. It is common for students to leave home to study, and only about 15 % of all university students live at home while they study. Students may live either on the university campus in one of the dormitories or in private homes in the city in which the University is located.

University life provides a wide variety of recreational activities. Although a great deal of time must necessarily be devoted to study, students find time for recreation. There are football, basketball, and baseball games, teas and dances, concerts, debates, club programs and plays, to mention only a few of the many activities. Most recreational activities are not expensive for the student.

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to meet requirements удовлетворять требованиям
to admit to принимать в
grades оценки
campus университетский городок
dormitory общежитие
recreation отдых

Text 9

Pre-Text Section

Practice 1. Прочитайте текст и скажите, чем отличается программа обучения на первых курсах в высших учебных заведениях в США и в нашей стране. Подтвердите ваш ответ ссылкой на текст.

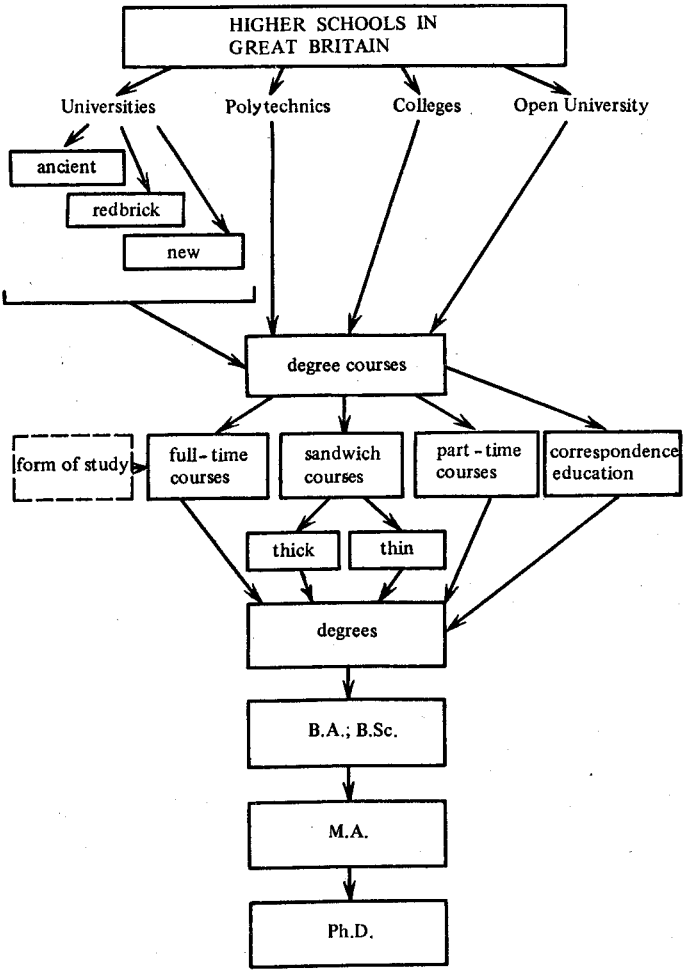
University Studies

First-year students, or freshmen, at universities and colleges are usually required to take certain subjects. Among these required courses are English history or government and physical education. In addition to the subjects which freshmen are obliged to take, they may choose from the following courses to complete their programs of study: history, mathematics, chemistry, physics, Spanish, French, German, Latin, geography, journalism, business administration, economics, and engineering. The courses which students select depend, of course, on the field of study in which he wants to major.

When he begins his second year in college, the student selects his courses so that he will meet the necessary requirements for graduation.

to select выбирать
to complete *зд.* составить
to major специализироваться в каком-л. предмете

ДЕНОТАТНАЯ СХЕМА



UNIT II

Higher Technical Education

Text 1A

READING AND COMPREHENSION

Прочитайте текст и определите:

1. какие высшие учебные заведения включает в себя понятие "polytechnical institute", а какие — "branch institute";
2. в каком абзаце идет речь о чертах, характерных для инженера нового типа;
3. в каких абзацах перечислены области техники, для которых готовят инженеров современные высшие учебные заведения.

Higher Technical Education

Higher technical education is offered by polytechnical and branch institutions of higher learning. Polytechnical institutes are large educational centres, training engineers in the most diverse fields of technology, providing them with a wide general scientific and general engineering education.

Branch institutes train engineers for individual branches of national economy, such as iron-and-steel, power engineering, mining, construction, mechanical engineering, forestry, transport, communications, the textile industry and many others.

Now that the country is through a period of qualitative changes in its economy, a period of mastering the latest achievements of the scientific and technical revolution, the higher school acquires a specific task to train engineers of a new type who would combine fundamental knowledge with a high professional level and practical training in the specific field of the national economy.

Engineers of a new type cannot be trained apart from modern production, science and technology.

The number of technical institutes, their specialization, the number of professions in which training is given and the forms in which the education is organized are continually adapted to the changing needs of production. In recent years there has been a greater emphasis on training engineers in applied mathematics, power engineering, electronics, designing of electric instruments and automatic devices, automatic control systems, and computer-processing of information.

At present Soviet technical institutes train engineers in more than 220 fields.

WHILE-READING SECTION

Language Study

Practice 1. Расположите слова списка (a) в алфавитном порядке. После этого переведите словосочетания списка (b), в которые входят эти слова.

a) higher, general, high, technical, scientific, branch, power, mechanical, fundamental, specific;

b) higher education, general education, branch institute, high education, scientific education, mechanical engineering, fundamental knowledge, specific field, power engineering

Practice 2.

N + is/are + V ed — действие направлено на подлежащее. Например:

...education is offered. ...образование предлагается. (кем-то)

...education is organized. ...образование организуется. (кем-то)

Прочитайте текст еще раз и выпишите из него все предложения, образованные по данной модели. О каких формах обучения и подготовки специалистов говорится в этих предложениях?

Practice 3. Составьте предложения с вышеприведенной моделью, пользуясь следующими словами.

1. The, were, universities, Australia, all, in, established, colonial, the, governments, by. 2. Were, they, the, on, Scottish, modelled, universities. 3. Provincial, established, the 19th, were, century, in, English, universities. 4. Education, organized, university, is, New Zealand, in, colleges, in six. 5. Cambridge, headed, in, is, a, dean, by, college, every. 6. Various, the, of, are, study, by, controlled, faculties, subjects. 7. Lecturers, professors, is, the, by, teaching, provided, and.

Practice 4. Переведите на русский язык предложения, составленные вами в предыдущем упражнении.

Practice 5.

V ing может обозначать сопутствующее действие; название области знаний; название процесса. В современном английском языке V ing может быть отглагольным существительным, причастием I или герундием.

Найдите в тексте предложения с приведенными ниже словосочетаниями и переведите их на русский язык.

1. ...institutes are centres, training... 2. ...institutes are centres, providing... 3. ...in designing of... 4. ...of mastering the... 5. ...of training the... 6. ...they read lectures, training... 7. ...of processing of...

Practice 6. Выпишите из текста все отрасли национальной экономики, дайте соответствующие русские сочетания. В каких из словосочетаний имеется корень, общий с корнем родного языка? Какова разница в произношении? Проверьте себя по словарю.

Practice 7. a) Прочитайте следующие числительные.

Model: 125 → 100 and 25 → one hundred[ø] and twenty five
605,420 → six hundred[ø] and five thousand[ø] four hundred[ø] and twenty

432,612; 1,056,073; 13,604,270; 100,100; 385; 64; 1,002; 422; 121,000; 6,334,958; 3,767,546

b) Прочитайте следующие сочетания с числительными. Обратите внимание на разницу образования порядковых и количественных числительных.

2,000 students; 6,935 books; 101 engineers; 12,000 pupils; 16 percent; 200 branches; 4,005 tables; 300,000 cars; 785,344 grams; 90 percent; on the 12th day; the XXVII th Congress of the CPSU; the 2nd week; the 5th group; on the 3rd of May; the 21st of June

Practice 8. Найдите в тексте предложения, содержащие цифровые данные, прочитайте их вслух и переведите на русский язык.

Practice 9. Обратите внимание на чтение хронологических дат в английском языке.

1987 → 19|87 → nineteen|eighty seven
1900 → 19|00 → nineteen|ou ou или
nineteen hundred

Найдите в предыдущих текстах хронологические даты и прочитайте их вслух.

Practice 10. Переведите на английский язык информацию, данную в газете «Вечерняя Москва» в 1987 году.

Вопрос: Сколько студентов обучаются сейчас в столичных вузах? Сколько нынешней осенью стали первокурсниками?

Ответ: Только что стали известны данные о приеме и количестве обучающихся в вузах Москвы в 1987 году. Сейчас в высших учебных заведениях города учатся 566 984 студента, в том числе 230 865 на дневном отделении, 113 288 человек стали в этом году первокурсниками, из которых 51 145 приняты на дневные отделения институтов. Справка получена в Министерстве высшего и среднего специального образования СССР.

Text Study

Practice 1. Выпишите из текста сочетания, отражающие черты инженера: а) глубокие знания; б) высокий профессиональный уровень; в) практические навыки.

Practice 2. Выпишите из текста все глаголы, с которыми может сочетаться слово а) education, переведите полученные сочетания (например: to offer education, to provide education); б) слово specialist; в) слово knowledge.

Practice 3. Пользуясь материалом предыдущих упражнений, заполните следующую таблицу.

Типы высших технических заведений	Черты, прививаемые будущим инженерам в институтах	Отрасль экономики, с которой связаны институты
I	II	III

Practice 4. Пользуясь таблицей Practice 3, перескажите текст. При пересказе воспользуйтесь моделями: there is/there are (I и III колонки), N + is/are + V ed (II колонка).

Practice 5. Прочитайте текст и найдите ответы на следующие вопросы.

1. What institutions of higher learning are there in the USSR? 2. Name the main institutions of higher technical education. 3. How many fields do Soviet technical institutes train engineers in? 4. What can you say about polytechnical institutes? 5. What is the purpose of branch institutes? 6. How do the changing needs of production affect (influence) the system of higher technical education? 7. Specialists in which branches does modern production require?

Practice 6. Пользуясь информацией текста, заполните следующую таблицу.

Type of technical higher learning institution	Its purpose
1.	
2.	

AFTER-TEXT SECTION

Text Discussion

Practice 1. Завершите предложения, подобрав соответствующие окончания в правой колонке.

1. The leading role of higher learning...	...the changing needs of production.
2. Higher education is provided at...	...247 technical institutes.
3. Higher technical education is offered by...	...wide general scientific and general engineering education.
4. In 1975 there were...	...is continually increasing.
5. They train engineers in...	...such as electronics, computer processing of information, automatic control systems and others.
6. Polytechnical institutes...	...more than 220 fields.
7. They provide...	...universities, institutes, academies, etc.

8. The system of technical education is adapted to...
9. A greater emphasis is made on training specialists for modern branches of science and engineering...

...train engineers in the most diverse fields of technology.

...polytechnical and branch institutions of higher learning.

Practice 2. Расскажите о системе высшего технического образования СССР по следующему плану, используя приведенные ниже конструкции и словосочетания. Используйте Active Vocabulary (см. ниже).

1. Количество технических вузов в СССР. (There are ... in the USSR.) 2. Типы технических вузов. (There are ... and ... .) 3. Их назначение. (...train specialists in... ...train specialists for...) 4. Главная задача высшего технического образования. (The basic task of ... is to... .)

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы и глагольные сочетания
область науки и техники	**iron-and-steel industry** **power engineering** **mining engineering** **construction engineering** **mechanical engineering** **textile industry** **transport** **communications** **applied mathematics** **electronics** **computer-processing industry**	
характеристика уровня образования, получаемого современными инженерами	**high professional level** **fundamental knowledge** **practical training** **general scientific education** **general engineering education**	
		to train engineers **to organize education** **to offer education**

Text 1B

PRE-TEXT SECTION

Practice 1. Зная значение выделенных слов, а) догадайтесь о значении следующих словосочетаний.

trade ремесло, профессия: trade school, method of teaching trade; *to compute* вычислять: computing centre; *to create* создавать, творить: creative abilities

b) назовите следующие отрасли машиностроения.

aircraft самолет: aircraft building; *automobile* автомобиль: automobile building; *instrument* прибор: instrument making; *locomotive* локомотив: locomotive construction

Practice 2. Прочитайте следующие слова и словосочетания. Они помогут вам полнее понять содержание текста.

cradle колыбель, current system современная система, civil engineering гражданское строительство, to originate брать начало, возникать, in accordance with в соответствии с

Practice 3. Прочитайте текст и выполните следующее за ним упражнение.

Moscow Higher Technical School

The founders of a trade school in 1830 in Moscow could not have imagined that it would become the cradle of many outstanding engineering ideas in Russia. Its education, even in the middle of the last century, provided practical skills combined with a high theoretical standard.

According to the programme of the school, the theoretical study at the institute was accompanied by practical training in industrial enterprises and research institutions. This was the so called "Russian method of teaching trade", and it formed the basis of the current system of training in many civil engineering specialities.

That close cooperation of the School with industrial enterprises and research institutions has become a tradition. It is of great importance for the development of the national economy.

Moscow Bauman Higher Technical School is one of the country's leading institutes, the alma mater of many of today's industries: aircraft and automobile building, instrument making, and locomotive construction. It is where the theory of mechanisms and machines originated.

The students of the School are active members of the Students' Scientific Technical Society (SSTS). The SSTS includes various scientific groups, design departments, computing centres and specialized laboratories. The task of the SSTS is to develop students' creative abilities, to organize their activity in accordance with individual interests, and to assist in the practical application of the results of their research.

In 1989 the School was reorganized into Moscow State Technical University named after Bauman.

AFTER-TEXT DISCUSSION

Practice 1. Суммируйте информацию, закончив следующие предложения.

The Moscow Higher Technical School	is one of... was founded in... is a cradle of... is the alma mater of... consists of... trains...

Text 2A

READING AND COMPREHENSION

1. **Прочитайте текст и определите его основную тематику.**
2. **Найдите в тексте предложения, содержащие информацию о подготовке инженеров-производственников.**
3. **Прочитайте второй абзац и озаглавьте его.**

The Birmingham University. Mechanical Engineering Department

The courses given in the Department are designed primarily to provide a broad education in the fundamental mechanical engineering sciences and in economics and business studies. The advanced courses in the Mechanical Engineering Department lead to careers (in technical management) in the fields of design, research, development and production in industry; the government service; the national research laboratories and institutions of higher learning; and to those in some branches of teaching.

One group of courses serves the Industrial Engineering stream and the other serves the Engineering Science stream. The former is intended for students whose interests lie mainly in the design and production side of mechanical engineering, the latter is meant for those who are analytically minded and who wish to study in depth the theoretical techniques used by engineers. After following a common first year and before entering the second year, students are divided into two streams on the basis of their own choice. The courses of study include mechanical, production and electronic and electrical engineering, metallurgy, mathematics and economics. They are supported by laboratory and drawing office exercises. The former includes electronic instrumentation, stress analysis, analogue and digital computation, metrology, etc. The latter culminates in design projects in the final year which are manufactured by second-year students during their second vacation course in industry. In both cases students are engaged in practical work with engineering firms during the summer vacation.

Information:

Birmingham is one of the largest industrial cities of Great Britain.

Steam engines, gas engines, motor cars, railway carriages, bicycles, agricultural implements and other articles are manufactured in its factories.

The University of Birmingham was founded in 19th century. It has more than 7,000 students.

The main faculties of the University are:

Faculty of Science and Engineering,
Faculty of Arts,
Faculty of Medicine,
Faculty of Commerce and Social Studies and
Faculty of Law.

The Faculty of Science and Engineering consists of about 30 different departments. Mechanical Engineering is one of them.

WHILE-READING SECTION

Language Study

Practice 1. а) Прочитайте следующие слова, имеющие общий корень со словами русского языка и догадайтесь об их значениях. Значение выделенных слов («ложных друзей переводчика») уточните по словарю.

mechanical [mɪ'kænɪkl], *department* [dɪ'pɑ:tmənt], national ['næʃənl], laboratory, career [kə'rɪə], analytical [ˌænə'lɪtɪkl], theoretical [θɪə'retɪkl], metallurgy [me'tælədʒɪ], electronic, electrical, instrumentation [ˌɪnstrʊmen'teɪʃn], metrology [me'trɒlədʒɪ], diagram ['daɪəgræm], line, culminate ['kʌlmɪneɪt], specification [ˌspesɪfɪ'keɪʃn], *manufacture* [ˌmænjʊ'fæktʃə], industry, gas, faculty ['fæklti], medicine ['medsɪn], commerce ['kɒmɜ:s]

b) Найдите предложения с данными словами в тексте 2A и проверьте правильность найденных вами значений.

Practice 2. Найдите в нижеследующем отрывке интернациональные слова, догадайтесь об их значении. Вспомните известные вам значения «ложных друзей переводчика». Переведите текст, не пользуясь словарем, так как все слова должны быть вам известны.

The technician often works out good solutions to the problems but doesn't know why they work.

The scientist and engineer analyze those empirical solutions and can develop general principles that can be applied when solving similar problems.

An engineering solution to a problem involves making an analysis of the problem that can be applied when a similar problem occurs in the future.

Practice 3. a) Заполните следующую таблицу.

Прилагательные	Наречия
technical	technically
analytical	
practical	
mechanical	
fundamental	
electrical	
theoretical	

b) Найдите в тексте наречия, образованные от прилагательных с помощью суффикса -ly.

Practice 4. a) Переведите приведенные ниже словосочетания, образованные по уже известной вам модели Adj + N (какой?).

broad education, technical management, mechanical engineering, theoretical technique, electrical engineering, electronic engineering, electronic instrumentation, digital computation, practical work, industrial city, agricultural implement

b) Найдите эти сочетания в тексте и укажите формальные показатели, определяющие начало и конец группы существительного.

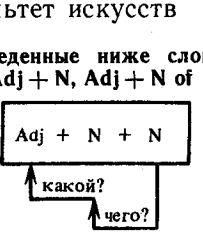
Practice 5. Переведите приведенные ниже словосочетания, образованные по уже известным вам моделям N + N (чего?), N + N (какой?). При необходимости воспользуйтесь словарем.

business studies, stress analysis, analogue computation, design project, second-year student, vacation course, engineering firm, summer vacation, steam engine, gas engine, motor car, railway carriage

Practice 6. Найдите в тексте группы существительного, построенные по модели N of N (чего?), и переведите их на русский язык.

Model: Faculty of Arts факультет искусств

Practice 7. а) Преобразуйте приведенные ниже словосочетания, образованные по моделям N of Adj + N, Adj + N of N, в цепочки слов, образованных по модели



Model: The Department of Mechanical Engineering — the Mechanical Engineering Department

national laboratories of research, institutions of higher learning, the stream of Industrial Engineering

b) Найдите полученные цепочки слов в тексте и переведите их на русский язык.

Practice 8.

В английском языке большое распространение имеет образование новых слов из существующих без изменения написания слов («конверсия»). Наиболее распространенным является образование глаголов от соответствующих существительных. Может иметь место и обратный процесс — образование существительных от глаголов.

а) Заполните следующую таблицу.

Глагол		Существительное	
англ.	русск.	англ.	русск.
to design	конструировать	design	конструкция
to mark	...	mark	отметка
to research	исследовать	research	...
to support	...	support	поддержка
to lead	вести, приводить	lead	...
to view	...	view	вид
to talk	...	talk	разговор

b) Найдите в тексте слова, образованные по конверсии, и определите, к какой части речи они принадлежат.

Practice 9. Выпишите в таблицу из 2-го абзаца текста слова и словосочетания, обозначающие общие и специфические предметы изучения для студентов промышленного направления и научного направления машиностроительного факультета Бирмингемского университета. Дайте их перевод.

<table>
<tr><td colspan="2">Industrial Engineering Stream</td><td colspan="2">Engineering Science Stream</td></tr>
<tr><td colspan="4">Общие предметы</td></tr>
<tr><td colspan="2">англ.</td><td colspan="2">русск.</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="4">Специфические предметы</td></tr>
<tr><td>англ.</td><td>русск.</td><td>англ.</td><td>русск.</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

Practice 10.

В английском языке очень часто для избежания повторения одного и того же слова в предложении употребляются слова-заместители, такие как one (ones), that (those). Слова-заместители занимают в предложении позицию замещаемого слова.

This complex of plants is the biggest **complex** (**one**) in the world. →

→ This complex of plants is the biggest **one** in the world.
Этот комплекс заводов — самый большой в мире.

Now we employ new methods of work, not old **methods** (**ones**). →

→ Now we employ new methods of work, not old **ones**.
Сейчас мы используем новые методы работы, а не старые.

that

This engine is more powerful than **the engine** of the old type. →

→ This engine is more powerful than **that** of the old type.

Этот двигатель более мощный, чем двигатель старого типа.

those

These experiments are more difficult than **the experiments** in our laboratory. →

→ These experiments are more difficult than **those** in our laboratory.

Эти эксперименты более трудные, чем эксперименты в нашей лаборатории.

a) Укажите, в каких предложениях слово one употребляется как слово-заместитель, а в каких — как числительное или неопределенное местоимение. Переведите предложения на русский язык.

1. This complex on the Kama river is the biggest one in the world. 2. The first cars were very strange, their engines had only one cylinder. 3. This method is highly efficient, but that one is even better. 4. Transport always was and still remains one of the largest branches in the general system of the world economy. 5. One must choose a profession which one likes. 6. One of the main trends in Soviet automobile building is the wide-scale utilization of diesel engines on lorries. 7. A heavy body falls harder than a light one.

b) Найдите в тексте предложения со словом one, определите, какой частью речи оно является, и переведите предложения.

Practice 11. a) Переведите предложения на русский язык. Укажите, в каких предложениях слово that употребляется как слово-заместитель, а в каких — как указательное местоимение или союз.

1. Trucks are getting larger and so are the tyres that move them. 2. The theory of Prof. Petrov is more complicated than that of Prof. Smirnov. 3. It is known that air has pressure. 4. There are many shops in that plant. 5. This fuel equipment is more modern than that one. 6. The speed of a passenger-car is higher than that of a bus. 7. The paper reports that the Belorus cultivator-tractors go to all corners of the USSR and also to 75 other countries. 8. There are many interesting stories in this book; read the one on the system of education in Canada.

b) Найдите в тексте предложения со словом those, определите его функцию. Переведите предложения на русский язык.

Practice 12. В тексте встречаются еще слова-заместители — это the former (первый из упомянутых) и the latter (последний из упомянутых). Найдите во 2-м абзаце текста предложения, содержащие эти слова-заместители, и определите, какие исходные слова и словосочетания они замещают.

Practice 13. Прочитайте следующие предложения и замените, где это возможно, существительные словами-заместителями that, those, one. Переведите полученные предложения на русский язык.

1. One group of courses serves the Industrial Engineering stream and the other group serves the Engineering Science stream. 2. Students of the Industrial Engineering stream are interested in the design and production engineering and students of the Engineering Science stream study the theoretical techniques. 3. The courses of study are supported by laboratory exercises and drawing office exercises. 4. During the summer vacation students are engaged in practical work with engineering firms.

Practice 14. В тексте имеется ряд предложений, в которых используется пассивный залог английского глагола. Найдите их по формальным признакам глагола в этой форме и переведите на русский язык.

Practice 15. Заполните таблицу недостающими формами глаголов, использованных в тексте. Проверьте себя по таблице нестандартных глаголов.

I	II	III
...	...	given
...	designed	...
lead	...	...
...	supported	...
...	...	meant
provide	...	...
...	intended	...
...	...	included
be	...	...
consist	...	...

Practice 16. В некоторых предложениях текста третья форма глагола (причастие прошедшего времени) встречается в сочетании с существительным в моделях V ed + N и N + V ed, где V ed является либо левосторонним, либо правосторонним определением к N.

a) Переведите отрывки, следуя образцу.

given — -мый, -щийся
taken — -вшийся, -нный, -тый

1. the courses given... 2. the advanced courses... 3. the theoretical techniques used by...

b) Найдите в первых двух абзацах предложения с приведенными выше отрывками и переведите их.

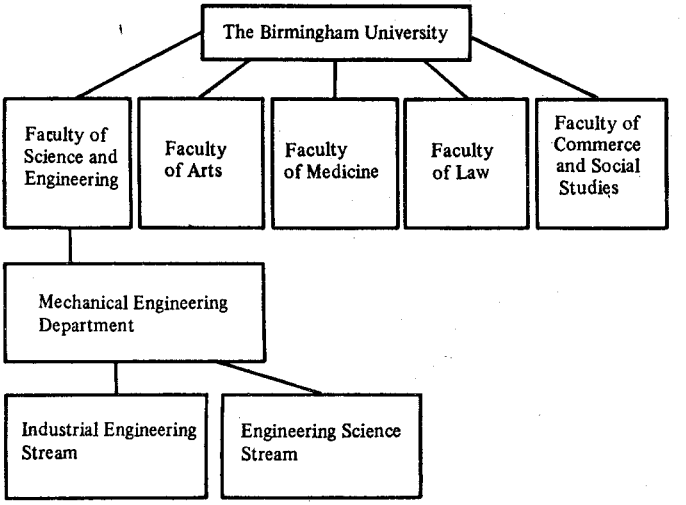
Text Study

Practice 1. Завершите предложения, выбрав соответствующие окончания в правом столбце.

1. The Mechanical Engineering department is...	...by different groups of courses.
2. The courses given in the department include:...	...the Industrial Engineering stream and the Engineering Science stream.
3. After the first year...	...practical work with engineering firms.
4. They are...	...laboratory and drawing office exercises.
5. Both streams are served...	...within the Faculty of Science and Engineering.
6. The Engineering Science stream course is intended for students...	...students are divided into two streams.
7. Students who are interested in design and production...	...study the Industrial Engineering stream course.
8. The courses of study are supported by...	...mechanical engineering sciences, economics and business studies.
9. During summer vacations students are engaged in...	...who wish to study the theoretical techniques.

Practice 2. На схеме показана структура Бирмингемского университета. Пользуясь информацией текста, а также схемой, расскажите об университете, употребив следующие слова, словосочетания и конструкции.

to be situated, to be founded, to have, there is/are, to include, to be divided into



Practice 3. Пользуясь информацией текста, заполните следующую таблицу.

Вид практических занятий	Процессы или результаты деятельности
1. 2.	

AFTER-TEXT SECTION

Text Discussion

Practice 1. Пользуясь информацией текста и таблицей из Practice 3, расскажите об учебном процессе на машиностроительном факультете Бирмингемского университета по следующему плану.

1. Место отделения в общей структуре университета.
2. Подразделение студентов на два потока (когда и по какому принципу).
3. Предметы, составляющие курс обучения.
4. Практические занятия.
5. Практические работы (где и когда).

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы
организация системы образования	**institution** **department** **stream** **course** **vacation course**	**to divide** **to include** **to intend** **to be engaged in**
предметы изучения	**engineering science** **business studies** **economics** **stress analysis** **analogue and digital computation** **mechanical** **production** **electrical** } **engineering** **electronical** **technical drawing** **design project**	
процесс приобретения знаний		**to lead to** **to support** **to represent** **to advance**

Text 2B

PRE-TEXT SECTION

Practice 1. Прочитайте следующие предложения и догадайтесь о значении выделенных слов и словосочетаний.

1. The Polytechnic is *made up* of six faculties. 2. All faculties *undertake research.* 3. Every student is required *to undertake a project* in the final year. 4. The Faculty of Engineering *is represented* by four departments. 5. The Polytechnic Students' Union *represents* students on various Polytechnical Committees.

Practice 2. Прочитайте следующие слова и словосочетания. Они помогут вам полнее понять содержание текста.

to integrate соединять, составлять целое, to relate academic work to industrial practice соотносить практические знания с практическими умениями, to shoulder responsibility взять на себя ответственность, principle

правило, закон, to benefit from извлекать пользу из, production engineer инженер по организации производства

Practice 3. Прочитайте текст и выполните следующие за ним упражнения.

The Polytechnic, Wolverhampton

The Polytechnic, Wolverhampton, is a large institution in the West Midlands and provides Higher Education for thousands of students from the United Kingdom and beyond. There are only thirty polytechnics altogether in England and Wales and Wolverhampton was one of the first to be designated. The Polytechnic was originally created in 1969 by uniting the College of Art with the College of Technology. In September 1977 the Dudley College of Education, the Wolverhampton Teachers' College for Day Students and the Wolverhampton Technical Teachers' College merged to form a Faculty of Education within the Polytechnic.

The Polytechnic thus is made up of six faculties: Art and Design, Engineering, Humanities, Science, Social Science and Education. Five of these faculties are located on the main campus in the centre of Wolverhampton; the sixth, the faculty of Education, is located at Dudley.

A wide range of degree, postgraduate, diploma and professional courses are offered at all six faculties. All faculties undertake research and all are served by the Polytechnical library. Nearly 4,000 students are on courses for three or four years, ranging from engineering and computer studies to social work courses. These courses are full-time, part-time and sandwich.

The teaching on the courses is partly by lectures but much of time is spent in smaller group work, in seminars and tutorials.

In addition to the higher degrees of MPhil (Master of Philosophy), PhD (Doctor of Philosophy) and MSc (Master of Science) the courses lead to a wide range of first degrees and diplomas.

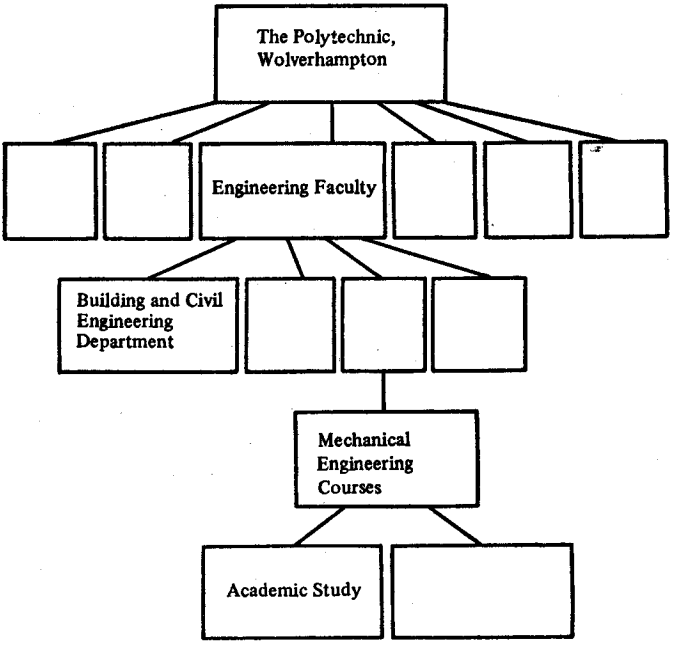
A high proportion of students live away from home; over 1,300 being accommodated in Polytechnic residential units. The main campus has hostel places for 600 students.

The Polytechnic Students' Union represents students on various Polytechnic Committees. It operates a number of national services for local students (such as accommodation, medical, financial, legal and other problems).

The Students' Union organizes and supports a wide range of social, recreational and cultural activities. A large number of clubs and societies are organized by it, which arrange entertainment. There are film, music, drama, poetry, blues and folk societies; rugby, judo, cross-country running, badminton and horse riding clubs. In addition, there are academic, political and other societies at the Polytechnic.

AFTER-TEXT DISCUSSION

Practice 1. Расскажите о структуре The Polytechnic, заполнив следующую схему.



Practice 2. Сравните The Polytechnic с политехническим институтом. Что общего? В чем различие?

Text 3A

READING AND COMPREHENSION

Прочитайте текст и определите:

1. каким образом подтверждается в тексте вклад Томского политехнического института в развитие советской науки и техники;

2. в каких абзацах идет речь о единстве трех направлений в работе института — образования, науки, промышленности;
3. в каком направлении ведут исследования три исследовательских центра института;
4. какие формы обучения ведутся кафедрами, открытыми непосредственно на промышленных предприятиях.

Siberian Diploma

The Tomsk Polytechnical Institute is the oldest school of engineering in Siberia and in the Soviet Far East. It was founded in 1896. One time, the celebrated scientists V. Obruchev and N. Chizhevsky were its faculty members, and it boasts of such people as Nobel Prize winner scientist N. Semenov, helicopter designer N. Kamov, discoverer of iron ore deposits in Norilsk N. Urvantsev, designer of Ostankino TV tower N. Nikitin, and many other graduates who made history in science and engineering.

Sixty Tomsk graduates became academicians and corresponding members of the USSR Academy of Sciences, and over 300 Heroes of the Soviet Union, Heroes of Socialist Labour, Lenin and State Prize winners, and merited workers in science and engineering.

Today, about 17,000 students attend eleven institute departments. The institute also has two evening and three correspondence departments.

Among the 1,200 faculty members, 70 are professors and doctors of science, and nearly 900, associate professors and candidates of science.

The Tomsk Polytechnical Institute library has about two million volumes in education, science, politics and fiction, and services as many as 28,000 readers every year.

The Institute is an example of integration of education, science and industry. There are training, research and industrial complexes at the institute, which are based on three supports: some institute department, research unit and industrial enterprise with which the institute cooperates and for which it does specific research. Over 9,000 students study at research labs and design bureaus, and in scientific societies and groups organized at the departments.

The institute incorporates three research institutes engaged in the study of nuclear physics, electron introscopy and high voltage. Its experimental facilities include a research nuclear reactor, a Sirius synchrotron, a cyclotron, cryogenic equipment.

Another form of integration at the institute involves branches of the institute chairs opened directly at industrial enterprises. Once a week, studies are moved from classrooms to the shop floor, and the instructor is joined by factory engineers. All laboratory work is performed directly at industrial facilities, and this cooperation has proven mutually advantageous.

WHILE-READING SECTION

Language Study

Practice 1. Определите, каким русским словам соответствуют следующие английские интернациональные слова, прочитайте их вслух с опорой на транскрипцию. Объясните по-русски, каким понятиям соответствуют выделенные английские интернациональные слова.

designer, professor, candidate of science, doctor of science, academician [əˌkædəˈmɪʃn], nuclear ['nju:klɪə] physics, electron *introscopy* [ɪˈlektrɒn ɪnˈtrɒskəpɪ], voltage ['vɒʊltɪdʒ], reactor, *synchrotron* ['sɪŋkrəʊtrɒn], *cyclotron* ['saɪklətrɒn], cryogenic [ˌkraɪəˈdʒi:nɪk], *integration* [ˌɪntɪˈgreɪʃn], to be based on, to cooperate, to organize

Practice 2. Объясните, как образованы данные сочетания и какие правила их перевода возможны; к какому правилу относится каждое из них. Объедините их в две группы.

helicopter designer, iron ore, prize winner, faculty member, institute department, research unit, design bureau, ship floor, factory engineer, laboratory work

Practice 3. Расположите следующие глаголы в алфавитном порядке, после этого переведите их, используя словарь. Объедините глаголы в две группы: 1) те, которые используются в тексте для описания учебной деятельности в институте; 2) те, которые описывают научно-исследовательскую базу института.

to found, to become, to attend, to be engaged in, to include, to involve, to move, to join, to perform, to prove

Practice 4. a) Выпишите из 1-го абзаца текста названия профессий, с которыми связаны фамилии названных в тексте деятелей науки и техники. Что это за профессии? (переведите).

Model: N. Kamov — helicopter designer — конструктор вертолетов

b) Выпишите из текста словосочетания, обозначающие изобретения или открытия этих людей. Переведите эти сочетания.

Practice 5. Выпишите из текста:

a) английские словосочетания, обозначающие составные части учебного, научно-исследовательского и промышленного комплекса. Пример на русском языке:

Комплекс опирается в работе на: 1) кафедру института; 2) научно-исследовательские подразделения; 3) промышленное предприятие;

b) английские словосочетания, обозначающие участки, на которых студенты проводят исследовательскую и конструкторскую работу, и переведите эти сочетания;

c) словосочетания, обозначающие научные направления, в которых работает институт, и экспериментальные установки, которые используются в исследованиях.

Practice 6. Помните, что перевод глагольной формы V ed зависит от ее окружения.

1) Подлежащее + сказуемое...+ N + **V ed** + prep. переводится на русский язык причастием на *-нный, -тый.*

Another form involves ... chairs *opened* ... at... Другая форма ... включает в себя ... кафедры, *открываемые/открытые* на...

Переведите выделенные формы.

1. Over 9,000 students study in scientific groups *organized* at... 2. The institute incorporates ... research institutes *engaged* in...

2) N + is/are + **V ed** — русским глаголом, оканчивающимся на *-ся.*

...studies are *moved*... ...занятия переносятся...

Переведите выделенные формы.

1. All laboratory work *is performed* at industrial facilities... 2. The instructor *is joined* by factory engineers.

3) Подлежащее + **V ed** + существительное — глаголом в прошедшем времени.

They *performed* the work. Они выполнили работу.

Найдите в тексте предложения, в которых глагол стоит в прошедшем времени, и переведите глагол на русский язык. Обратите внимание на особую форму прошедшего времени у неправильных глаголов.

Practice 7. Заполните таблицу недостающими формами глаголов, использованных в тексте. Проверьте себя по таблице нестандартных глаголов.

I	II	III
found	...	...
...	was, were	...
make	...	...
...	...	become
have	...	...
...	did	...
...	...	studied
join	...	...

Practice 8.

Категория времени (The Category of Tense)

Настоящее время (Present Tense)

I (you, we, they)	work		here.
He (she)	work + s [s] live, play + s [z] go + **es** [z] teach + es [ɪz]	(после глухих согласных) (после звонких согласных и гласных) (после **-o**) (после **-s, -se, -oss, -sh, -x, -ch**)	here.

Вопросо-ответная модель

Вопрос				Ответ	
				Краткий	Полный
Do	I (you, we, they)	work	here?	No, I don't Yes, I do	work here.
Does	he (she)			No, he doesn't Yes, he does	

Найдите в тексте предложения со сказуемым в настоящем времени и объясните, по каким признакам вы их обнаружили.

Practice 9. a) Запомните формы образования прошедшего времени английского глагола. Особое внимание обратите на сопровождающие их формальные признаки.

Прошедшее время (Past Tense)

			Формальные показатели
	правильные глаголы		
I, he, she, we, you, they	work + **ed** [t] (после глухих согласных) live + **d** [d] (после звонких согласных) play + **ed** [d] (после гласных) experiment + **ed** [ɪd] (после **-t, -d**)	here	yesterday the day before yesterday last night (week, year, etc.) 6 minutes (hours, days, weeks, years, months, etc.) ago in 1940...
	неправильные глаголы *		
	went came taught		

* Неправильные глаголы — з а п о м н и т е!

Вопросо-ответная модель

Вопрос					Ответ	
					Краткий	Полный
Did	I (he, she, we, you, they)	work	here	yesterday?	No, I didn't Yes, I did.	work here.

b) Найдите в тексте слова и словосочетания (формальные признаки), обусловливающие употребление предложений со сказуемым в прошедшем времени.

Practice 10. a) Запомните формы образования будущего времени, обращая особое внимание на сопутствующие им формальные показатели.

Будущее время (Future Tense)

			Формальные показатели
I, we he, she, you, they	shall will + work	here	tomorrow the day after tomorrow soon next morning (evening, week, year, etc.) in a day (week, month, year, etc.) in 1999 in the future

Вопросо-ответная модель

Вопрос					Ответ	
					Краткий	Полный
Shall Will	I, we he, she, you, they	work	here	tomorrow?	No, I shan't Yes, I shall No, he won't Yes, he will	work here.

b) Переведите время действия в последнем абзаце текста из плана настоящего в план будущего, изменив форму сказуемого в предложениях.

Practice 11. Закончите предложения, выбрав соответствующий показатель времени.

1. Electric cars will help to provide traffic safety... 2. The laboratory supplied the new calculations for designing the engine... 3. The plant produces a great number of machines... 4. She will become an engineer... 5. They finished school... 6. We worked at this plant... 7. My friend works at the research institute... 8. Several scientists work at this problem... 9. The Soviet automobile industry produces many cars and lorries...

---

in the past, in the future, last year, next year, now, last month, in 5 years, every year

Practice 12. Раскройте скобки, поставив глагол в нужной форме.

1. Auto-making research and development (to begin) after the October Socialist Revolution. The young Soviet State (to require) automobiles and tractors for its industry and agriculture. 2. Prof. Smirnov (to give) a lecture on physics next week. He (to supply) the fundamental calculations for designing engines. 3. The Soviet Government (to establish) the Automobile Research Institute in 1920. But the scientists (to start) auto-making research in 1918. 4. We (to have) many plants and factories in our country. 5. The number of our institutes, research centres and laboratories (to increase) from year to year. 6. We (not to take) that examination yesterday. We (to have) it in 2 weeks. 7. My father (not to work) in the field of mechanical engineering, he (to design) boats. 8. E. A. Chudakov (to develop) the automobile theory? — Yes, he did. Besides, he (to provide) the basic formulas of auto-designing. 9. Nick (to know) mathematics well? — Yes, he does. He (to like) it and (to do) research in this field. 10. You (to work) in the chemistry laboratory a week ago? — No, we didn't. We (to work) there only the day after tomorrow. 11. This programme (to include) many problems. We (to study) different aspects of bridge construction, testing and operation.

Practice 13. Заполните таблицу, используя следующие глаголы, связанные с исследованием, конструированием и выпуском продукции.

to test, to supply, to design, to produce

1.	The engineer		the engine	last week tomorrow every day
2.	The engineer		new equipment	last year next year
3.	The scientist		new formulas to the lab	yesterday in a month
4.	The plant		new machines	every day last month

Practice 14.

Степени сравнения прилагательных и наречий

Сравнительная степень

Steel	is	stronger far stronger slightly stronger **more** expensive much **more** expensive a much **more** expensive material a much **more** expensive material to produce	**than**	cast-iron.

Cast-iron	is	weaker **less** expensive much **less** expensive a much **less** expensive material a much **less** expensive material to produce	**than**	steel.

Превосходная степень

This kind of steel	is	**the** strongest **the most** expensive **the least** expensive	of all.

Notes: 1. Односложные и часть двусложных прилагательных и наречий образуют сравнительную степень при помощи суффиксов **-er, -est.**

2. Многосложные и большинство двусложных прилагательных и производных наречий, оканчивающихся на **-ly,** образуют степени сравнения с помощью **more** *больше,* **less** *меньше,* **most** *наиболее,* **least** *наименее.*

Укажите, в каких словах -er — суффикс степени сравнения прилагательных.

teacher, summer, driver, other, darker, easier, never, writer, weather, bigger, deliver, faster, under

Practice 15. Заполните таблицу по образцу. Вспомните значение приведенных здесь прилагательных из всех текстов Units I, II.

a) small	smaller	the smallest
old broad high large great wide easy new full thick thin		
b) difficult	more difficult	the most difficult
specific modern personal practical effective traditional theoretical typical		

Practice 16. Запомните таблицу, обращая внимание на существительные, образованные от прилагательных через степени сравнения. Дайте перевод существительных.

Прилагательные			Существительные
deep	deeper	deepest	a depth
long	longer	longest	a length
wide	wider	widest	a width
high	higher	highest	a height
strong	stronger	strongest	a strength
warm	warmer	warmest	a warmth
true	truer	truest	a truth

Practice 17. Язык измерений: основные метрические единицы. Изучите диаграммы линейных измерений и запомните примеры.

(a) length

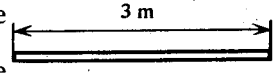
We can describe the length of this bar in four ways:

The bar is three metres long.

The bar is three metres in length.

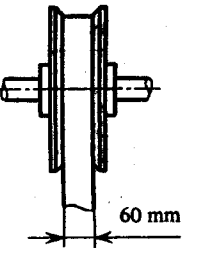
The bar has a length of three metres.

The length of the bar is three metres.



(b) width or breadth

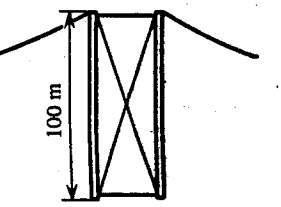
We can describe the width or breadth of this driving belt in four ways:



The belt is sixty millimetres wide/broad.
The belt is sixty millimetres in width/breadth.
The belt has a width/breadth of sixty millimetres.
The width/breadth of the belt is sixty millimetres.

(c) height

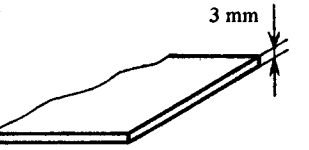
We can describe the height of this support tower in four ways:



The tower is a hundred metres high.
The tower is a hundred metres in height.
The tower has a height of a hundred metres.
The height of the tower is a hundred metres.

(d) thickness

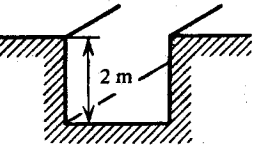
We can describe the thickness of this steel sheet in three ways:



The sheet is three millimetres thick.
The sheet has a thickness of three millimetres.
The thickness of the sheet is three millimetres.

(e) depth. Depth is usually measured vertically downwards from a surface. This surface is often ground level or the surface of a liquid.

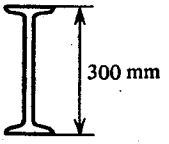
We can describe the depth of this trench in four ways:



The trench is two metres deep.
The trench is two metres in depth.
The trench has a depth of two metres.
The depth of the trench is two metres.

Other examples of depth:

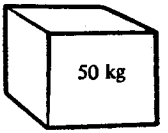
(i) The depth of the beam is three hundred millimetres.



(ii) The depth of the screw is one point seven five millimetres.

(f) mass

We can describe the mass of this block in three ways:



The block has a mass of fifty kilogrammes.

The block is of mass fifty kilogrammes.

The mass of the block is fifty kilogrammes.

Practice 18. Опишите объекты измерения на с. 72 как можно большим набором предложений.

Practice 19. а) Прочитайте диалог и выполните задания, приведенные после него.

At the Drawing Lesson

T. Good morning, everybody. Today you ought to draw this part. I'm sure you know its name, don't you?

S. I think it's a key. (a valve, a cutting tool)

T. That's right. What are you going to do first?

S. First I am going to measure it.

T. Good! What are you going to measure?

S. I am going to measure its length, width and height.

T. All right. Do it. Now, tell me its length.

S. Its length is 90 mm.

T. And what is its width?

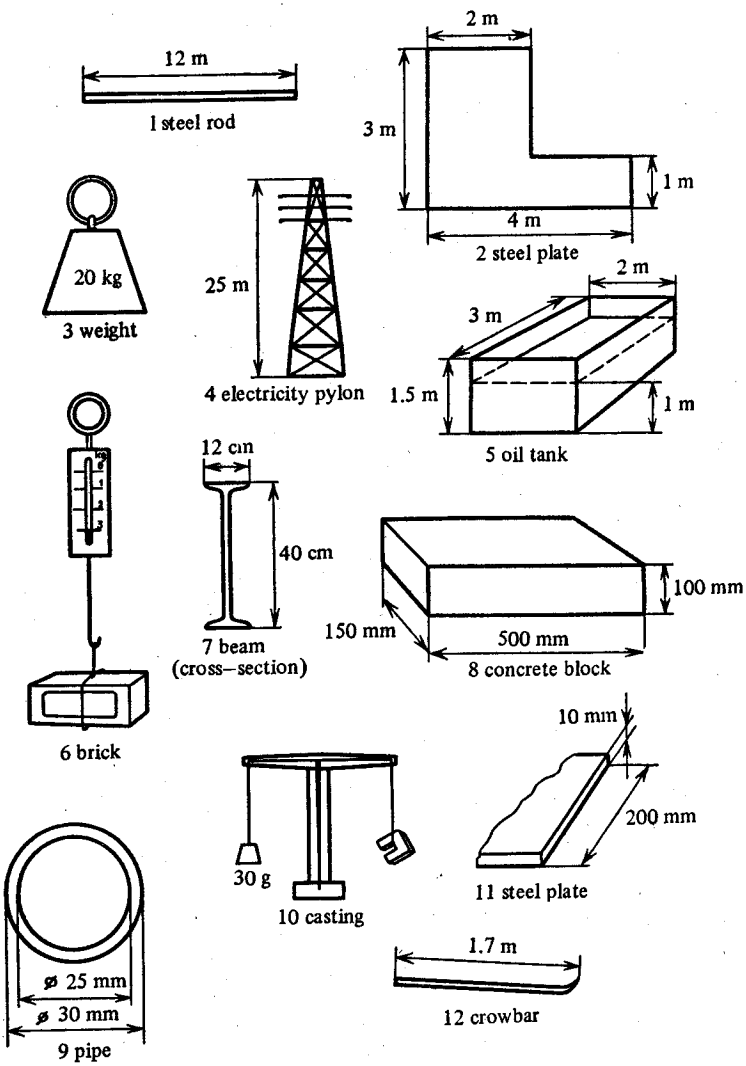
S. Its width is 10 mm.

T. Will it take you long to calculate its cross section?

S. Just a minute. The cross section of this key is 80 sq. mm.

T. Fine. You are right. The cross section of this key is 80 sq. mm. Perhaps you know what metal it is made of?

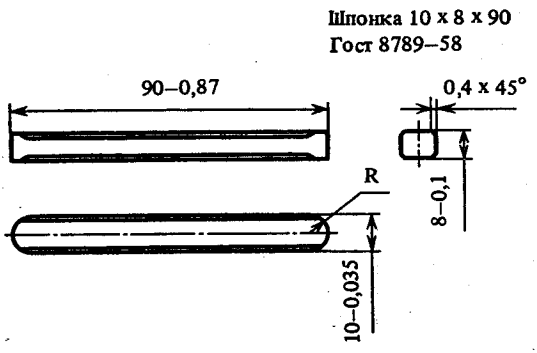
S. Let me see. I suppose it is made of steel.



b) Расскажите:

а) какие измерения и расчеты вы сделаете, прежде чем приступите к чертежу;

б) что можно будет увидеть на вашем чертеже.



Practice 20. Сравните по следующему образцу.

Model: Steel is expensive.
Silver is more expensive.
Gold is the most expensive.

1. три вещества с точки зрения их значения в промышленности: water, coal, gas (important). 2. три металла с точки зрения их твердости: steel, copper, aluminium (hard). 3. три марки автомобилей с точки зрения веса: "MAZ", "Zaporozhets", "Moskvitch" (light). 4. три вида транспорта с точки зрения скорости: a car, a train, a plane (fast).

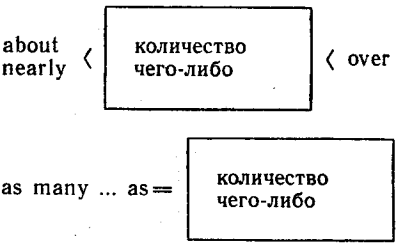
Practice 21. Запомните таблицу степеней сравнения от разных основ прилагательных и наречий.

Положительная	Сравнительная	Превосходная
good хороший	better	(the) best
bad плохой	worse	(the) worst
little маленький	less	(the) least
many much много	more	(the) most
far далекий	farther	(the) farthest
far дальний	further	(the) furthest

Practice 22.

Наречия, указывающие на меру чего-либо

a) Найдите их значения в словаре.



b) Что больше?

nearly 20 или over 20?
about 20 или as many as 20?

c) Переведите на русский язык следующие сочетания из текста.

1. ...as many as 28,000 readers... 2. ...about 17,000 students... 3. ...over 9,000 students... 4. ...nearly 900 associate professors...

Practice 23. Найдите в тексте числительные, прочитайте их вслух.

Practice 24. Соедините следующие пары предложений с помощью союзов which и who. Помните, что придаточное определительное должно стоять после определяемого слова. Who обязательно используется с одушевленным предметом, which — чаще всего с неодушевленным предметом.

1. Many celebrated scientists were faculty members. They made history in science and engineering. 2. There are training, research and industrial complexes. They are based on three supports. 3. The complex includes the industrial department. The institute cooperates with the industrial department.

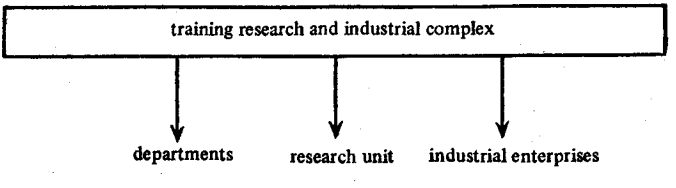
AFTER-TEXT SECTION

Text Discussion

Practice 1. Заполните следующую таблицу данными из текста. После этого подготовьте краткое сообщение о Томском политехническом институте, используя оборот there is/are и данные таблицы.

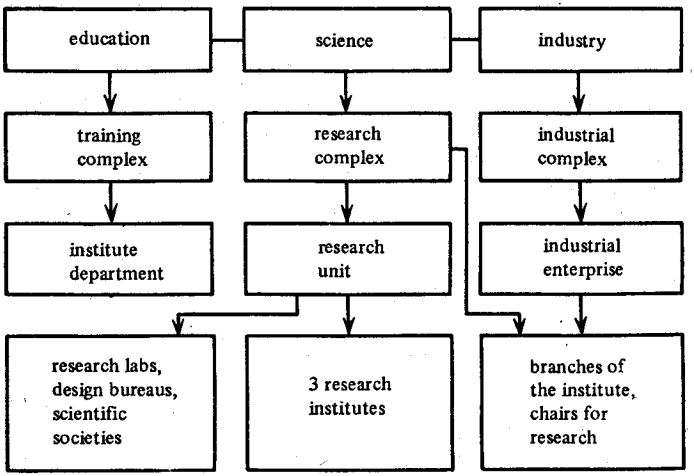
	Institute	Library	Research Institutes of the Institute
The number of students	...		
The number of departments	...		
The number of evening departments	...		
The number of professors, associate professors	...		
The number of book volumes		...	
The number of readers every day		...	
The number of research institutes			...
Fields of investigation			...
Experimental facilities			...
Forms of integration	1) ... 2) ...		

Practice 2. Опишите учебно-исследовательский комплекс института, используя следующую схему и предлагаемую последовательность пересказа.



1. ...is founded... 2. It became... 3. It includes... 4. They cooperate... 5. They perform...

Practice 3. Изучите нижеприведенную схему и расскажите об интеграции обучения, науки и промышленности в Томском политехническом институте, используя конструкции there is/are, ...have/has..., be+V ed.



Practice 4. Прочитайте приведенную ниже справку о Московском автомеханическом институте. Кратко передайте содержание прочитанного на английском языке.

Московский автомеханический институт (МАМИ) был создан в 1939 г. В то время в институте было только два факультета: автотракторный и автомеханический, на которых обучалось всего 400 студентов дневного и вечернего отделений по специальностям: автомобили и тракторы; механическая обработка металлов. (Срок обучения по специальности автомобили и тракторы составлял 3 года.)

В январе 1941 г. в институте уже насчитывалось 25 кафедр, а контингент студентов составил 955 человек.

В настоящее время МАМИ — один из основных институтов автомобильной промышленности. На его четырех факультетах (автотракторном, факультете автотракторных двигателей, факультете технологии и автоматизации машиностроения, факультете автоматизации и машин литейного и штамповочного производства) готовят специалистов для машиностроительных и автомобильных заводов СССР. Институт имеет 3 вечерних филиала: в Дмитрове, Ликино и на АЗЛК. Ученые института, работающие в тесном сотрудничестве с промышленными предприятиями, занимаются научными исследованиями, к которым широко привлекаются студенты. 3 отраслевые лаборатории института оказывают

большую помощь в решении сложных задач, стоящих перед учеными и производственниками.

Прочитайте объявление из «Вечерней Москвы» и на его основании расскажите о Всесоюзном заочном политехническом институте по плану:

1. местонахождение института;
2. отделения и филиалы;
3. факультеты и специальности.

Всесоюзный заочный политехнический институт

на факультеты:
по специальностям:

энергетический — электрические станции; электроснабжение промышленных предприятий, городов и сельского хозяйства; тепловые электрические станции, промышленная теплоэнергетика; электропривод и автоматизация промышленных установок; электрические машины; электрические аппараты; атомные электростанции и установки;

строительный — промышленное и гражданское строительство; производство строительных изделий и конструкций; теплогазоснабжение и вентиляция; сельскохозяйственное строительство;

машиностроительный — технология машиностроения; металлорежущие станки и инструменты;

химико-технологический — химическая технология переработки нефти и газа; технология основного органического и нефтехимического синтеза; машины и аппараты химических производств; технология неорганических веществ и химических удобрений; химическая технология пластических масс;

металлургический — металлургия черных металлов; металлургия цветных металлов; литейное производство черных и цветных металлов; металловедение, оборудование и технология термической обработки металлов; обработка металлов давлением; механическое оборудование заводов черной металлургии;

автоматики и радиоэлектроники — автоматика и телемеханика; электронные приборы; информационно-измерительная техника; радиотехника;

автомеханический — автомобили и автомобильное хозяйство; автомобили и тракторы; двигатели внутреннего сгорания; строительные дорожные машины и обо-

рудование; подъемно-транспортные машины и оборудование;

горно-нефтяной — машины и оборудование нефтяных и газовых промыслов; проектирование и эксплуатация газонефтепроводов; газохранилищ и нефтебаз; геологическая съемка, поиски и разведка месторождений полезных ископаемых; гидрогеология и инженерная геология; технология и комплексная механизация; подземные разработки месторождений полезных ископаемых; технология и комплексная механизация открытой разработки месторождений полезных ископаемых; обогащение полезных ископаемых; электрификация и автоматизация горных работ; маркшейдерское дело; горные машины и комплексы;

инженерно-экономический — экономика и организация горной промышленности; экономика и организация металлургической промышленности; экономика и организация машиностроительной промышленности; экономика и организация химической промышленности; экономика и организация строительства; экономика и организация энергетики.

Имеется ВЕЧЕРНЕЕ отделение.

Институт имеет филиалы и УКП (в Подольске, Коломне, Ногинске).

Адрес института: 129805, Москва, ул. Павла Корчагина, 22.

Проезд: ст. метро «ВДНХ», трамв. 11 до ост. «Улица Павла Корчагина», ст. метро «Проспект Мира», авт. 98, 714.

Телефон 283-77-58.

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы	Наречия	Слова-организаторы
квалификация инженера, ученого, ученые степени	**graduate** **scientist** **celebrated scientist** **designer** **discoverer**	**to found** **to become** **to attend** **to cooperate** **to study** **to organize**	**mutually** **advantage-ously** **directly**	**such ... as** **also** **nearly** **about** **as many as** **over**

Продолжение

Область применения	Существительные и сочетания с существительными	Глаголы	Наречия	Слова-организаторы
	academician **professor** **doctor of science** **associate professor** **candidate of science**	**to be engaged in** **to include** **to involve** **to move** **to join** **to perform** **to prove**		
результаты деятельности инженеров, ученых и область их исследований	**TV** **TV tower** **helicopter** **iron ore deposits** **nuclear physics** **high voltage**			
оборудование, используемое в научных исследованиях	**nuclear reactor** **synchrotron** **cyclotron** **cryogenic equipment**			

Text 3B

PRE-TEXT SECTION

Practice 1. Прочитайте следующие предложения и догадайтесь о значении выделенных слов и словосочетаний:

1. *Post-graduate studies* are studies which a student takes after he has a first degree. They are at a more advanced level than undergraduate studies and involve research. 2. A first degree is awarded at the end of a three year course of study at a university or a college. *Higher degrees* are awarded after further study: *MSc* (Master of Science) — after a year's post-graduate course of study, *PhD* (Doctor of Philosophy) — usually after three years of research. 3. Education at the Cranfield Institute of Technology is *at the post-graduate level*, leading to higher degrees. 4. The Institute *has power to award* its

own degree. 5. The School of Automotive Studies is a member of the Facutly of Engineering Design and Development.

Practice 2. Прочитайте следующие слова и словосочетания. Они помогут вам полнее понять содержание текста.

instruction обучение, fundamental основной, concept понятие, идея, refresher or specialization courses курсы усовершенствования, engine двигатель, topic тема, safety безопасность, behaviour поведение

Practice 3. Просмотрите текст и скажите, идет ли в нем речь только об обучении людей, уже имеющих высшее образование.

Practice 4. О каких двух направлениях в обучении на транспортном отделении инженерно-конструкторского факультета идет речь в тексте?

Cranfield Institute of Technology

Cranfield is a national centre of post-graduate studies and research in technology and management.

In December 1969 a Royal Charter created the Cranfield Institute of Technology with power to award its own degrees. The educational activity of the Institute is at the post-graduate level, with full-time courses of instruction and research leading to higher degrees.

The School of Automotive Studies is a member of the Faculty of Engineering Design and Development, which is one of the five faculties of the Institute. The aim of the School is to give the student a thorough understanding of fundamental techniques and advanced concepts to equip him for his future career and to enable him to exploit fully the benefits of advanced technology.

Teaching activities comprise full-time courses leading to higher degrees and short courses which are designed as refresher or specialization courses for practicing engineers in industry.

Full-time study consists of an MSc course, MSc by Research and PhD by Research.

Courses offered are:

a) Automobile Engineering, with options in vehicle structure, engines and transmissions, vehicle dynamics, and manufacturing and management;
b) Rail Transport, with emphasis in either mechanical or electrical engineering.

The students are required to complete a research project and to achieve a considerable level of analytical ability.

The topics for the research projects are normally associated with research being carried out in the School by a team of engineers and psychologists conducting investigations into aspects of vehicle safety and driver behaviour.

AFTER-TEXT DISCUSSION

Practice 1. Суммируйте полученную вами информацию, закончив следующие предложения (не пользуясь текстом).

1. The School of Automotive Studies is a member of... 2. The Faculty of Engineering Design and Development is one of the faculties of... 3. The Cranfield Institute of Technology is a national centre of... 4. The School is designed to... 5. The School provides courses in... 6. Full-time courses lead to... 7. Short courses are... 8. The students are required to... 9. Their research projects are associated with aspects of...

Practice 2. Проверьте правильность своих ответов по тексту.

Practice 3. Некоторые параметры внесены в следующую таблицу ошибочно. Исправьте таблицу, дайте в ней перевод всех данных на русский язык.

Специализация автотранспортного отделения	Изучаемые дисциплины	Получаемые степени
Automobile Engineering	manufacturing, electrical engineering, vehicle structures, management	BSc BA MSc
Rail Transport	transmission, vehicle dynamics, mechanical engineering	

Practice 4. Подготовьте сообщение об автотранспортном отделении Кранфилдского технологического института по следующему плану:

1. creation of the Cranfield Institute of Technology;
2. the aim of the School of Automotive Studies;
3. its structure;
4. courses;
5. topics for the research projects.

Text 1

Pre-Text Section

Practice 1. Прочитайте текст и скажите, какие из приведенных ниже тем рассматриваются в нем:

1. связь высших учебных заведений с научно-исследовательскими центрами;
2. виды научной работы студентов;
3. роль научной работы студентов в подготовке высококвалифицированных специалистов;
4. связь науки с производством.

The Higher School and the Ways to Science

Student participation in research is one of the most effective methods for training highly-qualified specialists capable of taking part in the rapidly developing scientific and technological revolution.

Students are encouraged to participate widely in research while still at college. The programme of studies is designed in such a way as to draw students ever deeper into scientific research.

Research enables the students to improve their knowledge and put to practical use the things they learn at lectures, seminars and laboratories. Furthermore, it enables them to realize the practical value of their knowledge, to master the basic experimental techniques, to learn how to handle the modern equipment and analyse the results of the experiment.

Such students graduate as highly-skilled specialists. And this actually is one of the most important tasks facing college.

There are student research societies at every university and institute. Contests, competitions and exhibitions, based on student research have become an established tradition. Every year a country-wide student contest is held for the best research project, the winners being awarded special medals and diplomas.

Students are engaged in research under guidance of professors, instructors, engineers and post-graduates. As a rule, students write their term papers and graduation theses on the problems of their research work. They

operate experimental and industrial installations, conduct theoretical investigations, read scientific literature on their speciality.

Many term papers and graduation theses include elements of research done at some higher school department on contract with industrial enterprises. Term papers, research work, graduation theses of practical importance to industry — such are the stages of turning students into highly-skilled thinking engineers ready for independent work even before they get their diplomas.

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to participate in участвовать в чем-л.
to realize the value of определить ценность
to handle equipment/to operate installations управлять оборудованием и установками (работать на...)
term papers курсовые работы
graduation theses дипломные работы
independent work самостоятельная работа

After-Text Section

Practice 1. Прослушайте следующее утверждение и на основе полученной из текста информации продолжите его аргументацию.

Student participation in research is one of the most effective methods for training highly-qualified specialists. Research enables the students:

1) to improve their knowledge,
2)
3)
4)
5)
6)

Practice 2. Вам необходимо сделать сообщение на тему "Stages of Turning Students into Highly-skilled Thinking Engineers". Какую информацию из текста вы включите в свое сообщение?

Text 2

Pre-Text Section

Practice 1. Прослушайте заглавие текста и переведите его. Расскажите, как вы представляете себе сотрудничество в области образования.

Practice 2. Прослушайте текст с тем, чтобы определить, правильны ли ваши предположения.

USSR Assistance to Foreign Countries in Training National Specialists

The USSR makes a great contribution to creating and developing higher and secondary special education in socialist and developing countries. In fact, there is not one branch of the economy for which specialists were not trained at the higher and secondary special educational institutions set up with the USSR economic, scientific and technical help. With Soviet assistance, 21 higher and 18 secondary educational institutions have been built in more than 20 foreign countries. These educational institutions are outfitted with modern equipment, technical educational facilities, the necessary training appliances and aids.

Besides outfitting the educational institutions with equipment, every year the Soviet Union sends abroad a great number of Soviet highly-skilled teachers, instructors, researchers and other specialists to train people locally. At present over two thousand Soviet teachers work in more than 40 countries. They help foreign countries' national colleges create most up-to-date courses and organize student training at the level of the latest achievements of science and technology.

Today it is impossible to imagine the training of the national specialists in Vietnam and India without the Hanoi polytechnical institute and the Bombay technological institute. Graduates of the Kabul polytechnical institute can be met today at any large Afghan factory and plant, in geological expeditions and at building sites. The polytechnical institute in Conakry (Guinea) has become well known outside the country. Students from Mali, Nigeria, Equatorial Guinea, Burundi and other countries are trained there.

All these institutes are well known in their own countries and outside them as centres for training skilled national personnel.

Soviet higher schools have concluded long-term cooperation agreements with a number of countries, which make it possible to train national personnel according to the demands of each country's economy, science, engineering and culture.

The USSR assistance to foreign countries in training national personnel successfully progresses and gives positive results. It promotes the economic strengthening

of the socialist countries and creates favourable conditions for the successful development of the new developing countries.

to make a contribution to вносить вклад во что-л.
to create создавать
branch отрасль
to outfit оснащать
technical educational facilities технические средства обучения
training appliances and aids учебные пособия
to conclude long-term agreements заключать долгосрочные соглашения

After-Text Section

Practice 1. Составьте план текста. Раскройте каждый пункт плана двумя-тремя предложениями из текста.

Text 3

Pre-Text Section

Practice 1. Прочитайте текст и скажите, о какой форме сотрудничества в области образования идет речь.

Practice 2. Озаглавьте текст.

The role of the Soviet higher schools in training national personnel for the developing countries is not confined to training them locally. More than 100,000 students from 149 UN member-countries are being educated at Soviet schools of higher education, research institutions and specialized secondary schools.

More than 50 schools and research institutions in the Soviet Union train foreign students. Among them is Moscow State University, the country's largest, universities in practically all the Union Republics, the Patrice Lumumba Peoples' Friendship University founded in 1960. Students who know no Russian learn it and other basic subjects in one year at preparatory departments in 50 higher educational institutions.

Foreigners are trained in more than 250 occupations. Students from the socialist countries with well-developed system of higher education mainly study social sciences, the Russian language and literature. Students from the developing countries, badly in need of highly trained national personnel, study technological, agricultural, pedagogical and medical sciences. Many of them train to become engineers in the construction of industrial

projects, housing, roads, tunnels, bridges, and in engineering, chemical technology, etc.

During the past nearly 40 years more than 350,000 experts for the socialist and developing countries have been trained in the Soviet Union. As many as 18,000 foreigners have received Candidate of Science degrees in the Soviet Union.

Foreign graduates of Soviet higher and specialized secondary educational institutions work in almost all spheres of the economy and culture back home. In some countries the graduates of Soviet higher educational institutions hold the posts of ministers and deputy ministers, directors of major companies and enterprises. Many of the graduates return to the Soviet Union to continue their education as post-graduate students or participants in international seminars.

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a preparatory department подготовительное отделение
badly in need of испытывающие острую необходимость в чем-л.
construction строительство
a deputy minister заместитель министра
a post-graduate student аспирант

After-Text Section

Practice 1. Прокомментируйте цифровые данные текста.

Text 4

Pre-Text Section

Practice 1. Вы хотите поступить в один из следующих вузов: в Московский энергетический или Каунасский политехнический. Какие сведения об этих институтах помогли бы вам определить ваш выбор, перечислите их.

Practice 2. Прочитайте тексты "The Moscow Power Institute" и "The Kaunas Polytechnical Institute".

The Moscow Power Institute

There are more than 20,000 students and almost 500 post-graduate students in nine faculties of the Moscow Power Institute. Every year it adds thousands of new graduates to the ranks of research workers, engineers and designers capable of developing modern machinery, from micro-circuits for electronic computers to power units for giant hydro-electric power stations.

The institute has 78 departments and 150 educational and research laboratories, including unique ones such

as an experimental thermal power station and a laboratory for physical modelling of power systems. The institute also boasts a computer centre, an educational close-circuit TV centre and a students' design office. Its laboratories are able to accommodate nearly 3,000 students at one time. There are over 1,600 staff engaged in teaching, including 140 professors and doctors of science and 700 assistant professors and candidates of science.

The Kaunas Polytechnical Institute

The Kaunas Polytechnical Institute in Lithuania is relatively new: it was organized in 1950. During the past years that institute has become a large centre of higher technical education that has trained about 30,000 specialists. At the present time it comprises 12 faculties which train engineers in 42 fields of technology, many of them having been introduced in recent years, including automatic control systems and applied mathematics. Both education and research are conducted by highly qualified professors and teachers and also by more than 500 researchers in the institute's 42 departments and 20 research laboratories.

---

machinery машины, машинное оборудование
micro-circuit микросхема
power unit силовая установка
to boast гордиться
in recent years недавно, за последние годы

After-Text Section

Practice 1. Вы ознакомились с содержанием текстов. В каких предложениях вы нашли необходимую вам информацию?

Practice 2. а) Сравните эти вузы, заполнив следующую таблицу.

Название вуза	Количество				Дополнительные сведения
	факультетов	отделений	лабораторий	студентов	

b) Какой бы институт вы выбрали? Почему? Мотивируйте свой ответ ссылкой на тексты.

Text 5

Pre-Text Section

Practice 1. Прочитайте текст и расположите следующие пункты плана в порядке следования информации в тексте:

1. университетский городок;
2. краткие сведения о системе высшего образования КССР;
3. университет сегодня;
4. история создания университета;
5. университет во время войны.

Kazakh University — a Centre of Training National Personnel

Only 22 Kazakhs received a higher education throughout the entire prerevolutionary history. Today Kazakhstan has 80 specialists with higher education per every 1000 people employed. It has 55 higher schools, including two universities — in Alma-Ata and in Karaganda. The University in Alma-Ata alone has trained some 50,000 specialists.

The University in Alma-Ata was founded in 1934. It was at the time when workers from all over the country were building the Turkestan-Siberian Railway. Miners from Donbas were sinking mines in Karaganda, and Moscovites and workers from Makeyevka were building the copper-smelting giant in Balkhash. Oil workers from Baku were training their young counterparts from Emba, and 17,000 Kazakhs were studying at the country's higher and specialized secondary schools. It was then that the government decided to open a university in Alma-Ata. Five professors and ten assistant professors from the oldest Russian universities went to Alma-Ata. A preparatory department for young Kazakhs was organized, and early in 1934, 25 teachers started giving lessons to 54 students at two faculties — biology and maths and physics.

Sergei Kirov, one of the then most prominent CPSU leaders, did a lot for the University which was later named after him.

When the World War II started, many teachers had to leave the University. They were partly replaced by researchers who were evacuated to Kazakhstan from nazi-occupied territory. The University departments carried out research in problems dealing with defence. The students raised a large sum of money for building a tank unit. Not all the front-line soldiers returned to the University. A memorial plaque with their names has been placed in one of the foyers.

The University today has 13,000 students and 950 teachers. The teachers include 28 Academicians and corresponding members of the Kazakh SSR Academy of Sciences, 126 professors and doctors of science and more than 600 assistant professors and candidates of science.

Students of 36 Soviet nationalities study at 11 daytime and 6 evening and correspondence faculties. Young people from Bulgaria, Cuba, Vietnam, Mongolia, Afghanistan and Laos also study there. The University has 101 departments and 43 research laboratories.

The University campus in the foothills of Alatau is no part and parcel of the Alma-Ata architectural image. The 18-storied main building and about a dozen others buildings have all the necessary facilities for teaching, including a cinema, TV and equipment for simultaneous translation. The students live in 14 5-storied hostels. The campus has a student club, café, cinema, various service workshops, barbers and hairdressers, shops and a large sports centre.

The students get their first taste of research at the scientific student society which has 107 clubs and seminars. The student design bureau has its own experimental plant. There is also a branch of the Inventors and Rationalizers Society.

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miner шахтер
a copper-smelting giant медеплавильный завод-гигант
oil worker нефтяник
counterpart *эд.* коллега
defence оборона
foothill подножие
part and parcel неотъемлемая часть
simultaneous translation синхронный перевод

After-Text Section

Practice 1. Сравните прошлое и настоящее Казахского университета, заполнив следующую таблицу.

Период	Количество				
	факультетов	отделений	лабораторий	студентов	профессорско-преподавательский состав
1934					
настоящее время					

Practice 2. Расскажите о Казахском университете. Воспользуйтесь при этом составленными вами планом и таблицей.

Text 6

Pre-Text Section

Practice 1. Прочитайте текст и скажите, о подготовке каких инженеров идет речь в тексте.

Practice 2. Озаглавьте текст.

Leeds University has a century-old tradition of teaching and research in mechanical engineering and its degrees are recognized the world over.

The Mechanical Engineering department has about 270 undergraduates and so academic staff. The teaching staff are practising engineers as well as academics. They are involved in consultation and research and maintain close links with industry.

The Department offers both three year courses leading to the degree of Bachelor of Engineering (B. Eng.) and four year courses leading to the degree of Master of Engineering (M. Eng.).

The first two years of the courses are common to both three- and four-year schemes and cover basic material for practising engineers. The course covers solid mechanics, thermofluids, materials, design, production and computing. There are also courses in mathematics and electronics and in introduction to the role of the engineer in society. The final years of both schemes offer thirty options from which students choose five or seven subjects. These options include vehicle dynamics, aerodynamics,

energy, analysis of manufacturing processes, biomechanical engineering, noise and vibration control, social and industrial psychology.

The courses consist of formal lectures, reinforced by tutorials, laboratory classes and projects, and practical design and computing work. Project work takes the form of assignment which a qualified engineer might be given. The project in the fourth year of the M. Eng. course involves co-operation with industrial engineers.

After-Text Section

Practice 1. a) Опираясь на информацию текста, расскажите о курсах обучения на факультете. b) Перечислите основные и факультативные дисциплины, изучаемые на факультете.

Text 7

Pre-Text Section

Practice 1. Прочитайте текст и выполните следующие за ним упражнения.

What is Polytechnic?

Polytechnics are fairly new. They were established by the government in 1966 in order to concentrate in major colleges the large amount of work of university standard being done outside the university. Now there are 30 polytechnics in England and Wales, and 14 similar colleges in Scotland.

In many ways the polytechnics and universities are similar; for example, in much of the work they do. However, there are two important differences. Firstly, universities are autonomous bodies. Secondly, universities, being autonomous, award their own degrees. Most degrees in polytechnics are awarded by a national body called the Council for National Academic Awards. The Council ensures that the degrees awarded in polytechnics are comparable in standard to degrees awarded by universities.

Polytechnics are teaching institutes. They have more varied courses than any other higher educational institute. They provide courses for various levels from post GCE "A"-level to post-graduate level. Courses are also

of various patterns: full-time, part-time and sandwich. The student has therefore, a wide range of choice, such as a pure academic study, a study of an applied nature or a professional qualification.

About two-thirds of Polytechnic graduates get qualifications in subjects of an applied nature and take their first jobs in the field for which they have studied.

Polytechnics have close links with commerce and industry. Many of them are vocational, that is, prepare students for technical jobs. They produce technologists, technicians and craftsmen.

At a polytechnic, as at a university, students come from different backgrounds, have diverse interests and follow a variety of courses. Students' life at a polytechnic is interesting and varied, socially, as well as educationally.

Polytechnics play a main role in higher education.

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similar подобный, схожий
body орган, организация
to ensure обеспечивать, гарантировать
to be comparable соответствовать
subjects of applied nature прикладные науки
pure academic study чисто теоретическая наука
technologist технолог
technician техник
craftsman мастер

After-Text Section

Practice 1. a) Прочитайте следующую справку.

In 1966 a new form of higher education was established. Thirty of the technical colleges became "polytechnics" — more than half of them in cities with universities. They may devise their own courses and examinations for degrees awarded by the Council for National Academic Awards. Their courses (not all technical, and not all leading to degrees) are of many kinds, including part-time and "sandwich". Their popularity is growing rapidly.

b) Какая информация текста не нашла в ней своего отражения? В каких абзацах она содержится?

Practice 2. Сравните The Polytechnic с Университетом. Подтвердите свой ответ ссылкой на текст.

Text 8

Pre-Text Section

Practice 1. Прочитайте текст и расположите следующие пункты плана в порядке следования информации в тексте:

1. программа курса обучения;
2. система оценок;
3. продолжительность учебного года.

US Academia: Some Explanations

The American academic year usually runs from some time in September to the end of May. Most, although not all, schools run on a semester system. Achievement is measured by grades which are given on papers and tests during the course of the semester and a final examination at the end of the semester. The final grade is based on all of the work done for the course. At the university level, grades are usually given in the form of letters that correspond to numbers 1-4, with 4 indicating excellence. A grade point average (GPA) is determined at the end of a term to show overall achievement.

The degree programs contain several major courses and a certain number of credit hours is given for every course. A student must take a predetermined number of credit hours in order to graduate. One can drop or add a course in the beginning of the term but not in the middle of the semester. Withdrawing from a course midsemester will be noted on grade records. Students are encouraged to discuss any academic problems or questions they may have with their academic adviser.

In the classroom, Americans are encouraged to ask questions and to voice their opinions, even if they differ from those of the professor. Also, professors expect papers to be typed and not handwritten.

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a grade point average средний балл, получаемый студентом за проделанную работу в течение всего семестра

to correspond соответствовать

overall общий

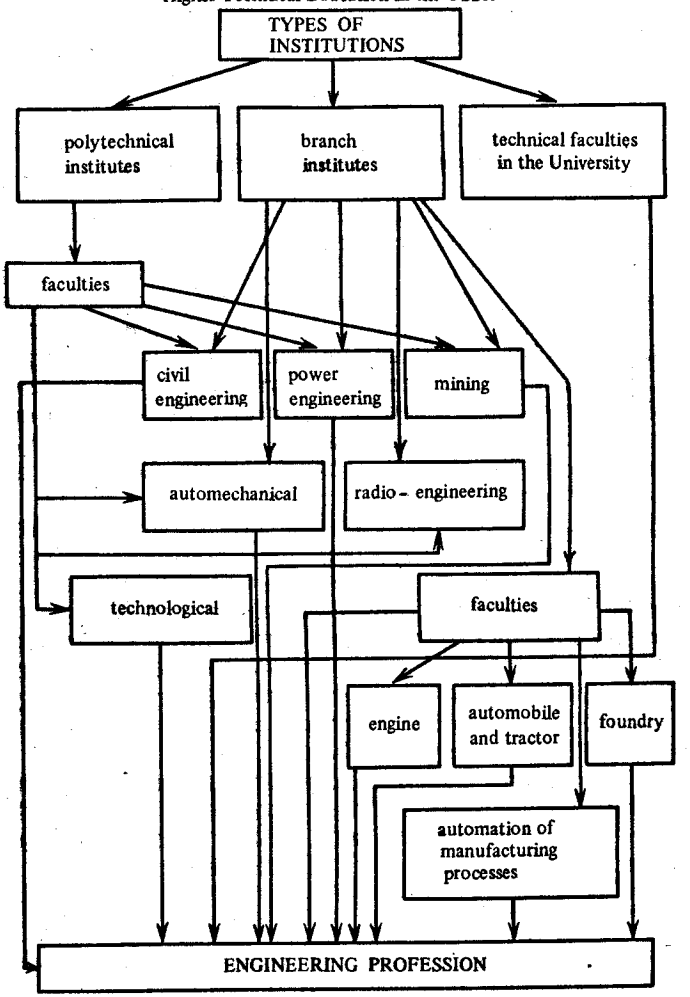
to vote opinions высказывать мнения

After-Text Section

Practice 1. Перечислите различия в системе обучения в США и в нашей стране. Подтвердите свой ответ ссылкой на текст.

ДЕНОТАТНАЯ СХЕМА

Higher Technical Education in the USSR



UNIT III

The Engineering Profession

Text 1A

READING AND COMPREHENSION

Прочитайте текст и определите:

1. в каком абзаце говорится о специфике машиностроения на современном этапе;
2. в каких абзацах говорится о роли инженера и его основных функциях;
3. в каких абзацах идет речь о деятельности инженера:
   — в лаборатории;
   — на производстве;
   — в конструкторском бюро.

Distinguishing Characteristics of Mechanical Engineers

The engineer typifies the twentieth century. He is making the vast contribution in design, engineering and promotion. In the organization and direction of large-scale enterprises we need his analytical frame of mind. We need his imagination.

He may be designing the product itself; inventing new products; testing the product, its components, and the materials in it; analyzing its performance and making a mathematical analysis.

He may be engaged in the development of the new product, making drawings and specifications.

He may be concerning himself with the development of a new production process, or the adaptation of a current process to a new product.

He may be utilizing his engineering know-how in determining the best processes and equipment for the mass production of high-quality products.

He may be the project engineer in charge of the design and installation of a highly automatic conveyer system for handling different kinds of parts between various assembly stations.

He may be working on designing and developing tools, dies, jigs, assembly fixtures, welding fixtures for the production of an automotive body.

In the 20th century the engineer has at his command many new sources of power. He works much to develop better materials especially new alloys for special purposes. He wants to make machinery automatic.

WHILE-READING SECTION

Language Study

Practice 1. a) Догадайтесь о значениях следующих интернациональных слов. Значения выделенных слов («ложных друзей переводчика») уточните по словарю.

contribution, organization, *direction*, analytical, to test, component, to analyze, analysis, specifications, adaptation, project, conveyer, *assembly*, station, command, special

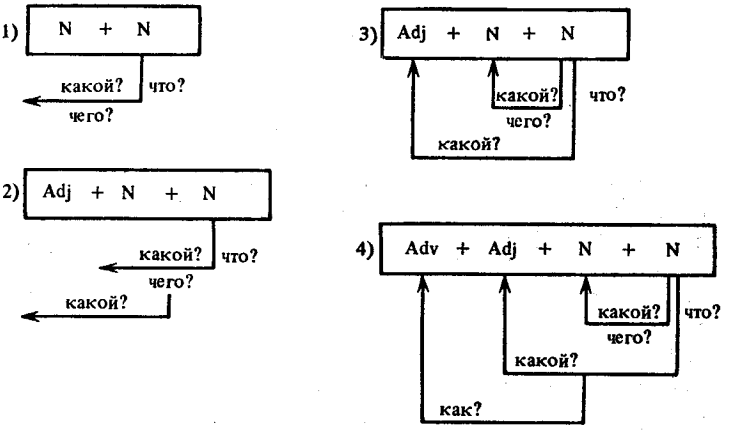
b) Найдите предложения с данными словами в тексте и проверьте по контексту правильность выбранных вами значений.

Practice 2. Выпишите из 3-го и предпоследнего абзацев английские слова и сочетания слов, служащие для обозначения понятий, связанных с деятельностью инженера в конструкторском бюро. Уяснив их смысл с помощью политехнического словаря, дополните таблицу по образцу.

Вид деятельности		Объект деятельности	
англ.	русск.	англ.	русск.
1. to develop	разрабатывать	new product	новая продукция
2.		drawings and specifications	
3. to design			новые инструменты, узлы, крепления

Practice 3. Выпишите из 2-го абзаца текста английские слова и сочетания слов, служащие для обозначения понятий, связанных с деятельностью инженера в лаборатории. Уяснив их смысл (при необходимости с помощью политехнического словаря), составьте таблицу, аналогичную таблице Practice 2.

Practice 4. Найдите в 4-м — 7-м абзацах текста цепочки слов, построенные по моделям:



где Adv — наречие на -ly.

Переведите цепочки на русский язык.

Practice 5. Найдите в 4-м — 8-м абзацах текста английские эквиваленты для следующих русских слов и словосочетаний.

существующий процесс, источники энергии, установка, узлы, сплавы, транспортировка, упорно работать, инженерное умение, ответственный за, в своем распоряжении

Practice 6.

Местоимения

Личные		Притяжательные	Возвратные и усилительные
Именительный падеж	Объектный падеж		
I	me	my	myself
you	you	your	yourself
he	him	his	himself
she	her	her	herself
it	it	its	itself
we	us	our	ourselves
you	you	your	yourselves
they	them	their	themselves

Найдите в тексте и назовите существительные, вместо которых употреблены личные местоимения he, it.

Practice 7. Найдите в тексте притяжательные местоимения his, its и укажите существительные, которые они определяют.

Practice 8.

Категория числа существительного

единственное число	множественное число	
a book + ø	book + s [s]	(после глухих согласных)
a pen + ø	pen+s } [z]	(после звонких согласных и гласных)
a boy + ø	boy + s } [z]	(после звонких согласных и гласных)
	box + **es** [ɪz]	(после свистящих и шипящих согласных)
a sheep + ø	sheep + ø	
a tooth	teeth	
a child + ø	child + ren	

Образуйте множественное число от существительных, употребленных в тексте 1А.

Model: a machine — machines

an engineer, a design, an enterprise, a product, a component, a material, a drawing, a specification, a process, a system, a part, a station, a tool, a die, a jig, a fixture, a body, a source, an alloy

Practice 9. Заполните таблицу образованными в Practice 8 формами существительных в соответствии со способом образования множественного числа.

engineers [z]	...
designs [z]	...
products [s]	...
enterprises [ız]	...

Practice 10. Образуйте форму множественного числа следующих существительных латинского и греческого происхождения по модели. Запомните эти формы.

Model 1:

единственное число	множественное число
-um **-on**	**-a**
datum данное maximum максимум minimum минимум spectrum спектр phenomenon явление stratum слой	data данные ... ...

Model 2:

единственное число	множественное число
-is	**-es**
analysis анализ axis ось basis основа thesis тезис synthesis синтез	analyses анализы ... ...

Practice 11. Запомните формы существительных, совпадающие в единственном и множественном числе:

единственное число	множественное число
an apparatus прибор, аппарат	apparatus
a means средство	means
a news новость	news
a series ряд	series

Practice 12.

Группа существительного (Noun Phrase — NP)

Имена существительные в английском языке сопровождаются определителями. Определители служат формальными признаками существительного и стоят перед ним. Если имеются другие слова, определяющие существительное, то определитель всегда стоит перед этими словами. *My* first scientific *work*. Определители помогают найти существительное при анализе английского предложения.

единственное число			множественное число		
	определитель			определитель	
It is	a the this that my your its her his	book.	They are	the these those our your their	books.

N o t e: В таблице представлены определители существительных, выраженные артиклями, указательными и притяжательными местоимениями.

Найдите в тексте и переведите на русский язык группы существительных в единственном числе, ориентируясь на их определители.

Practice 12. Найдите в тексте и переведите на русский язык группы существительных во множественном числе, ориентируясь на их определители.

Practice 13.

Обозначение количества

с исчисляемыми существительными			с неисчисляемыми существительными	
many a few few	cars	много немного мало	much a little little	air

Note: Слова правой колонки, обозначающие количество, могут употребляться и как наречия: He works much.

Найдите в последнем абзаце текста предложения с обозначением количества, переведите их на русский язык.

Practice 14. Сгруппируйте существительные текста, сочетающиеся со словами much, a little, little и many, a few, few.

Practice 15.

Категория вида глагола (The Category of Aspect)

Недлительный вид Non-Continuous Aspect	Длительный вид Continuous Aspect
1. Значение: Представляет действие как факт и служит для выражения отдельных или повторных действий в настоящем, прошедшем или будущем.	1. Значение: Представляет действие как процесс и служит для выражения продолженного, незаконченного действия, происходящего в какой-то момент в настоящем, прошедшем или будущем.
2. Форма: **V ø** **speak + ø**	2. Форма: **be + V ing** **be speak + ing**
We **speak** We often **speak** English at the lessons.	We **are speaking** We **are speaking** English now.
3. Формальные показатели: often, seldom, usually, frequently, sometimes.	3. Формальные показатели: now, still, at present, at that time, придаточные времени, точное указание времени.

Недлительный вид Non-Continuous Aspect	Длительный вид Continuous Aspect
He **usually** comes home late. She **seldom** writes to her parents. They **sometimes** made reports on physics.	He is coming home **now.** She is **still** writing a letter to her parents. They were making a report **at 5 o'clock yesterday.**

N o t e s: 1. В форме Continuous глагол **to be** несет все показатели лица, числа, времени, залога в предложении, согласуясь с подлежащим; образует вопросительную и отрицательную модель. Например:

He (to work) at this plant now.

I этап (вид) to **be**+work**ing**
II этап (время) is ↓
↓
He **is working** at this plant now.

2. Формальные показатели длительности совместно с показателями времени помогают правильно выбрать форму глагола.

Найдите в 1-м абзаце текста предложение с глаголом в длительном виде, переведите его на русский язык.

Practice 16. Прочитайте следующие русские предложения, подчеркните в них формы, соответствующие длительному виду в английском языке.

1. В наши дни объем научной информации растет очень быстро. 2. Сейчас появляются совсем новые отрасли техники, которые были неизвестны совсем недавно. 3. Не все еще отрасли техники развиваются сейчас с одинаковой скоростью: одни из них лидируют, другие отстают в своем развитии. 4. Ежегодно автозавод имени Лихачева производит большое количество грузовиков. 5. В нашей лаборатории в настоящее время ученые и инженеры разрабатывают прибор, который дает лучший результат при определении химического состава материалов. 6. Ярославский двигательный завод — один из крупнейших заводов Европы по производству автомобильных дизельных двигателей. В настоящее время этот завод экспортирует свою продукцию в более чем 46 стран.

Practice 17. Прочитайте следующие предложения, переспросите о происходящем действии, дайте отрицательный ответ.

Model: This engineer is working in the field of automaking now. Is this engineer working in the field of automaking now? No, he is not working in the field of automaking now.

1. I am making the diagram now. 2. He is preparing for his report at the conference now. 3. He was doing an interesting work last week. 4. She will be working at our laboratory next year. 5. We are studying new drawings and specifications at present. 6. They were working on a new type of body fixtures last month.

Practice 18. Сравните следующие предложения, переведите их на русский язык.

1. Our engineers work hard at this problem. Look at these two men — they are working at a new problem. 2. Our autoplants produce all the main body components. This plant is producing only tyres now. 3. A "Moskvitch" usually does 135 kilometres per hour. Look at this car. I think it is doing 140 kilometres per hour now. 4. They designed this instrument for laboratory research. When we visited their institute they were designing new equipment.

Practice 19. Прочитайте текст, переведите его и обратите внимание на многообразие функций глагола to be.

Mr White *is* a transport planner. Among other things his work *is* to develop future transport systems. This *is* a very difficult task, because there *is* too little scientific information on this subject. He *is* to find answers to questions such as:

— Why *are* some people fond of cars while others are inclined to walk?

— What *are* the reasons for some people using aeroplanes?

— *Are* people going to use bicycles instead of cars?

Questions like these *are* not easy to answer.

Practice 20. Переведите на русский язык.

The millionth electric motor is rolling off the conveyer line of the plant now. Representatives of more than 80 professions took part in its manufacture. Next year the plant will be producing 1000 electric motors every day.

Practice 21. Прореагируйте на данные высказывания, употребив длительный вид и still.

Model: — I know he was working on his report about new kinds of engines last week.
— He is still working on it.

1. I know she was teaching chemistry last year. 2. I know he was working at your laboratory last month. 3. I know you were working a lot last year. 4. I know this plant was trying to expand the production of new tools. 5. I know he was preparing for a difficult experiment last week. 6. I know this scientist was developing a new theory last year.

Practice 22. Используйте следующие предложения для описания современного состояния науки.

Model: *1st student:* Scientific information did not grow so rapidly in the last century.
2nd student: Scientific information is growing very rapidly now.

1. Knowledge did not expand so rapidly in the last century. 2. Not so many people took part in research in the last century. 3. Scientists did not work in big research teams in the last century. 4. Not so many new branches of science appeared in the last century. 5. Research centres did not grow so rapidly in the last century. 6. Scientific thinking did not develop so rapidly in the last century. 7. Scientists did not publish so many papers in the last century.

Practice 23. Покритикуйте следующие заявления, употребив not ... enough.

Model: *Teacher:* The situation is improving.
Student: Quite true, but it is not improving rapidly enough.

1. We are using this technique effectively. 2. Scientific contacts are expanding. 3. He is doing this work well. 4. Research methods are improving. 5. This process is going rapidly. 6. Scientists are exchanging new information. 7. Technology is developing. 8. Our knowledge is growing.

Practice 24. Раскройте скобки и поставьте глагол в нужную форму времени и вида. Используйте грамматическую модель.

1. I know she (to prepare) for a difficult experiment now. 2. What you (to do) when I came in? — I (to read)

an article on the British educational system. 3. I thought you (to do) this work yesterday.— No, I still (to work) at it. 4. Tomorrow at 6 o'clock I (to report) the results of this analysis. 5. Our laboratory will be provided with new equipment. You see, these two engineers (to mount) a new electronic system. 6. The ZIL Works (to manufacture) a new truck model now with an engine that is protected against cold. 7. The process of the technical reequipment of transport continuously (to go on).

Practice 25.

Большинство предложений текста построено по модели: may+be+V ing, где may *может* обозначает возможность совершить действие.

a) Переведите следующие отрезки предложений.

1. The engineer may be designing... 2. The engineer may be analysing... 3. The engineer may be inventing... 4. The engineer may be testing... 5. He may be concerning himself... 6. He may be utilizing... 7. He may be working...

b) Найдите в тексте предложения, в которых употреблены данные отрезки, и переведите их на русский язык.

Text Study

Practice 1. Завершите предложения, подобрав соответствующие окончания в правом столбце.

1. The engineer typifies...	...the products' performances.
2. He makes a great contribution...	...deals with the automation of production processes.
3. His main functions are...	...the 20th century.
4. The engineer also analyses...	...the designing office, in the lab and in the production field of engineering.
5. So he can work in...	...designing, developing and testing the products.
6. At present the engineer...	...the analytical frame of mind and imagination.
7. The work of the engineer requires...	...to progress.

Practice 2. Пользуясь информацией текста, заполните таблицу, ответив на вопрос:

What does the engineer do?

at the plant	in the lab	in the designing office
1. 2. 3. 4.		

AFTER-TEXT SECTION

Text Discussion

Practice 1. Воспользовавшись заполненной вами таблицей Practice 2 выше и активной лексикой, расскажите о работе инженера:

1. в области конструирования;
2. в исследовательской области;
3. на производстве.

Practice 2. Ситуации для высказываний. (При рассказе воспользуйтесь активной лексикой, данной ниже.)

1. Вы инженер-конструктор. Расскажите, где вы работаете и чем занимаетесь.
2. Вы работаете в исследовательской лаборатории по испытанию новых узлов (материалов). Скажите, в чем заключается ваша работа?
3. Ваш цех переходит на выпуск нового вида продукции. Скажите, в чем будет заключаться ваше участие (как инженера) в этом процессе?

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы и глагольные сочетания
деятельность инженера в различных областях		**to design** **to develop** **to invent** **to test** **to analyze** **to handle** **to make drawings**

Продолжение

Область применения	Существительные и сочетания с существительными	Глаголы и глагольные сочетания
место изготовления изделий	**enterprise** **conveyer system** **assembly station**	
машины, механизмы, узлы	**product** **tool** **die** **jig** **fixture** **automotive body** **machinery**	
характеристики изделий	**performance** **specifications**	
технологические процессы, операции		**to weld** **to assemble** **to produce**

Text 1B

PRE-TEXT SECTION

Practice 1. Прочитайте следующие слова. Они помогут вам полнее понять содержание текста.

to condense down *зд.* уменьшить до, objective цель, to recognize определять; признавать, to encourage поощрять, interchange (взаимо)обмен

Practice 2. Прочитайте текст и выполните следующие за ним задания.

Educating Tomorrow's Engineers

Engineering education developed very differently on the Continent and in the UK. In general on the Continent, engineering and the technical sciences were set up in technical universities, while in the UK engineering departments were set up in multi-discipline universities. As a consequence, engineering education developed on the Continent as a more professionally oriented subject,

while in the UK the emphasis has been on engineering science. Perhaps because of their size and their more professional engineering-oriented courses the Continental technical universities have developed a much closer relationship with industry. In Germany, the Herr Professor is also likely to be a Herr Director and there are many visiting industrial professors, who will spend a day a week in the University. In France much of the lecturing is provided by staff from the appropriate industries. There is nothing similar in UK engineering departments.

The question is what is to be done about engineering education in the UK? In the opinion of Britain's specialists, 70 to 80 engineering faculties in English universities and polytechnics should be condensed down into 20 or so major technical universities. They should become more industrially-oriented.

Lastly, the objective of engineering education and training should be recognized. So what should be the objective of undergraduate education? It is to educate and train people to think and search out knowledge for themselves, and to have the self-assurance to apply it to the job in hand. Many of the courses are now much too intensive and students have too little time or encouragement, to read and think for themselves. The solution is to recognize that it is impossible to cover all the subjects which an engineer may find useful in a lifetime, and realize that if he has been correctly educated he can read up on subjects which he may need as he progresses in his career.

However, industry must recognize that a graduate will need training in the specific area in which he is working, and must also be prepared to encourage him to attend continuing education courses and/or seminars and conferences as appropriate. It is clear that there is to be much more interchange of staff between industry and higher education.

The education and training of engineers must be a partnership between industry and higher education, which extends from undergraduate education and training through to post-graduate short and long courses and research.

AFTER-TEXT DISCUSSION

Practice 1. В 1-м абзаце текста проводится сравнение между системой высшего технического образования в Великобритании и на континенте. Есть ли различия между ними? Какие?
Выделите в этом абзаце:
— причину,
— следствие,
— пример.

Practice 2. Оставшаяся часть текста является ответом на вопрос: What is to be done about engineering education in the UK? Еще раз прочитайте эту часть текста и перечислите изменения, которые должны быть внесены в систему технического образования.

Practice 3. Одним из способов улучшения подготовки инженеров является сотрудничество высших учебных заведений с промышленностью. В чем оно должно проявиться? Подтвердите свой ответ ссылкой на текст.

Text 2A

READING AND COMPREHENSION

Прочитайте текст и определите:

1. о каких инженерных профессиях идет речь в 1-м абзаце;
2. о каких механизмах и машинах сообщается в 3-м абзаце;
3. в связи с чем упомянут XIX век в последнем абзаце.

The Engineering Profession

Engineering is one of the most ancient occupations in history. Without the skills included in the broad field of engineering, our present-day civilization never could have evolved. The first toolmakers who chipped arrows and spears from rock were the forerunners of modern mechanical engineers. The craftsmen who discovered metals in the earth and found ways to refine and use them were the ancestors of mining and metallurgical engineers. And the skilled technicians who devised irrigation systems and erected the marvellous buildings of the ancient world were the civil engineers of their time.

Engineering is often defined as making practical application of theoretical sciences such as physics and mathematics. Many of the early branches of engineering were based not on science but on empirical information that depended on observation and experience.

The great engineering works of ancient times were constructed and operated largely by means of slave labor. During the Middle Ages people began to seek devices and methods of work that were more efficient and humane. Wind, water, and animals were used to provide energy for some of these new devices. This led to the Industrial Revolution which began in the eighteenth century. First steam engines and then other kinds of machines took over more and more of the work that had previously been done by human beings or by animals. James Watt, one of the key figures in the early development of steam engines, devised the concept of horsepower to make his customers understand the amount of work his machines could perform.

Since the nineteenth century both scientific research and practical application of its results have escalated. The mechanical engineer now has the mathematical ability to calculate the mechanical advantage that results from the complex interaction of many different mechanisms. He or she also has new and stronger materials to work with and enormous new sources of power. The Industrial Revolution began by putting water and steam to work; since then machines using electricity, gasoline, and other energy sources have become so widespread that they now do a very large proportion of the work of the world.

WHILE-READING SECTION

Language Study

Practice 1. Используя, в случае необходимости, словарь, прочитайте еще раз 1-й абзац и определите, какое отношение к специальности mechanical engineer имеет toolmaker, к mining and metallurgical engineer — craftsman и к civil engineer — skilled technician.

Practice 2. Во 2-м абзаце вы встретились с термином empirical information, в 3-м абзаце — horsepower, в 4-м — mechanical advantage. Как переводится каждый из этих терминов? Выпишите их значения из словаря. В связи с чем упомянут каждый из этих терминов в соответствующем абзаце?

Practice 3. Выпишите из 2-го и 3-го абзацев названия всех механизмов и машин прошлого и соответствующие русские термины.

Practice 4. Выпишите из последнего абзаца виды источников энергии и соответствующие им русские эквиваленты.

Practice 5. a) Следующие слова имеют общий корень со словами русского языка. Постарайтесь определить их, не обращаясь к словарю.

engineering, civilization, modern, metal, construction, to refine, metallurgical, irrigation, practical, physics, empirical, application

Выпишите транскрипцию этих слов и определите закономерности в произношении английских и соответствующих русских слов.

b) Следующие слова — «ложные друзья переводчика». Выпишите те их значения из словаря, которые соответствуют контексту.

occupation, civil, human, observation

Practice 6. Выпишите все интернациональные слова из последнего абзаца текста, определите их значения, выделите «ложные друзья переводчика». Подготовьте этот абзац для чтения вслух.

Practice 7. Расположите следующие глаголы в алфавитном порядке. Найдите их значения по словарю. Вернитесь к тексту и выпишите сочетания, в которых встретились эти глаголы. Переведите на русский язык эти сочетания.

to discover, to refine, to devise, to erect, to depend, to provide, to perform, to lead, to escalate, to calculate

Practice 8.

а) Инфинитив, следующий за существительным, является определением к нему.

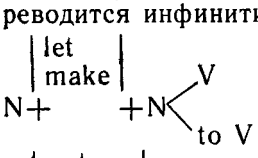
...N+to V ...ways to refine... ...способы (для) очистки...

...ways to use... ...способы (для) использования...

Переведите следующие отрывки и предложения, в которые они входят.

1. the ability to calculate... 2. materials to work with...

б) Инфинитив, стоящий после существительного, перед которым стоит сказуемое, выраженное глаголами to make, to let, to enable, to allow, to put, to cause (*заставлять*), входит в состав сложного дополнения и переводится инфинитивом.



They let him move. Они заставили его двигаться.

put
enable
allow
cause

The professor allowed his students to use calculators.

Переведите следующие отрывки и предложения, в которых они встречаются в тексте.

1. ...put water to work... 2. ...put steam to work... 3. ...make customers understand...

Вставьте вместо пропусков глаголы.

to enable давать возможность, to allow позволять, to make заставлять, to cause вызывать

Переведите предложения на русский язык.

N o t e: Обратите внимание на то, что после глагола **to make** в значении *заставлять* инфинитив употребляется без **to.**

1. The rise in temperature ... the mercury ... rise up the tube. 2. The motorway ... motorists ... travel from London to Birmingham much more quickly than before. 3. The use of tractors ... more food ... be produced more cheaply. 4. The presence of oxygen ... the mixture ... burn rapidly. 5. The increase in exports ... the country ... import more raw materials. 6. The risk of an explosion ... the workers ... leave the factory. 7. The sharp rise in temperature ... the engine ... overheat. 8. The presence of non-metallic constituents in iron ... it ... behave in various ways. 9. Rapid cooling ... unequal contractions ... occur in the metal. 10. The growth of industrial towns ... many people ... leave the countryside. 11. The differential gear ... the two rear wheels ... turn at different speeds.

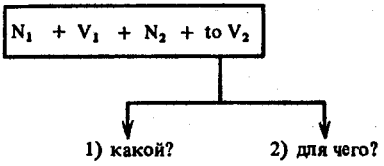
в) Инфинитив, стоящий после глагола-сказуемого, может быть обстоятельством цели. Например:

They were used to provide... Их использовали (для чего?), чтобы обеспечить...

Переведите следующие отрывки и предложения, в которые они входят.

1. ...wind was used to provide energy... 2. ...water was used to provide energy... 3. ...the concept "horsepower" was devised to make customers...

г) Если после глагола-сказуемого в активном залоге стоит существительное, а после него — инфинитив, то инфинитив может быть или обстоятельством цели, или определением к существительному.



He devised this concept to calculate the amount of work.

Он изобрел это понятие, 1) какое?
2) с какой целью? чтобы подсчитать количество работы.

He invented steam engine to perform work...

Он изобрел паровой двигатель 1) какой? производящий работу
2) с какой целью? для производства работы

Переведите следующие отрывки и предложения, в которых они встречаются.

1. They discovered ways to refine metals. 2. James Watt devised the concept of horsepower to make his customers to understand... 3. The engineer has the ability to calculate... 4. He has materials to work with...

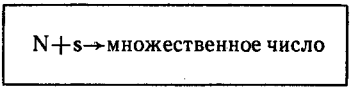
Practice 9. Определите, какое из каждой пары предложений соответствует содержанию текста.

a) 1. Many branches of engineering were based on empirical information. 2. Many branches of engineering are based on empirical information.

b) 1. Without the engineering, our present-day civilization could not have evolved. 2. Without the engineering, our present-day civilization could have evolved.

c) 1. The great engineering works of ancient times have been produced by means of slave labour. 2. The great engineering works of ancient times were produced by means of slave labour.

Practice 10.



engineer	engineers
student	students

These engineers *are* clever.

Но:

news mathematics — единственное число physics

This news *is* important.

Ряд существительных, оканчивающихся на -s, могут соответствовать как единственному, так и множественному числу.

works means — множественное и единственное число

The new works *is* built not far from the centre.
The steel works *are* closed for the holidays.

Образуйте предложения, принимая во внимание число существительных.

Physics	is used	by engineers...
News	were applied	by the scientist...
Works	are built	in Moscow.
Means of...	is given	every morning.
Engineers	is taught	
	are taught	

Practice 11.

Перевод глагола have зависит от контекста.

have + N — *иметь* (полнозначный глагол);

have + V ed — не переводится (вспомогательный глагол);

have + to V — *должен* (эквивалент модального глагола).

Определите функцию глагола to have.

1. In walking machine designs, the designers *have tried* to reproduce the trajectory of man's foot. They *have proposed* a number of patterns for effecting such trajectories. Some of them *have* simply *resorted* to a rectilinear pattern, while others *have selected* the optimum trajectory. For example, American scientist J. Shighey thinks that the best trajectory is an oval composed of two

semicircumferences and two straight lines. He *has developed* a series of mechanisms for walking devices, in particular, a pantograph mechanism.

2. Specialists in engineering materials *have taken* a new approach to the problem of the permanent nature of materials' properties. It is no less useful to *have materials* whose properties can be changed and controlled. That's why specialists *have to create* materials with variable porosity, elasticity and thermal conductivity.

Practice 12. Найдите глагол to have в последнем абзаце текста и определите его функцию.

Practice 13.

Категория временно́й отнесенности. Perfect/Non-Perfect

Non-Perfect	Perfect
1. Значение: Не уточняет характера действия и служит для выражения отдельных или повторяющихся действий в настоящем, прошедшем или будущем.	1. Значение: Выражает совершенное действие, законченное к какому-то моменту в настоящем, прошедшем, будущем.
2. Форма: ... **speak + ø**	2. Форма: **have ... en** **have spoken**
Sometimes we **speak** to this engineer.	We **have** just **spoken** to this engineer.
3. Формальные показатели: often, seldom, always, sometimes, frequently. I **often** meet him. In 1968 I finished school.	3. Формальные показатели: а) когда действие закончено, результат действия налицо — just, already, ever, never, yet, recently, lately, up to now, by 1970, since 5 o'clock, since we met last..., by the time you come... б) когда действие закончено, а время действия нет — today, this week, this winter, this month, this year. I have **never** met him. I have read many books **this month.** **By 1968** I had finished school.

В форме Perfect глагол to have несет все показатели лица, числа, времени в предложении, согласуясь с подлежащим; образует вопросительную и отрицательную модель.

В каких из следующих предложений при переводе следует употребить Perfect?

1. Человек использует машины во многих областях. 2. Некоторые из машин сохранились неизменными с древних времен. 3. Давно уже изобретен рычаг. 4. К середине прошлого столетия были выпущены первые паровозы. 5. Первые автомобили были очень громоздкими. 6. Машины, которые были разработаны в течение последних столетий, изменили нашу жизнь. 7. Давно уже появились двигатели разных типов.

Practice 14. Прочитайте следующие предложения. Переспросите о происходящем действии. Дайте отрицательный ответ на вопрос.

1. Comrade N. has worked at the factory for 12 years. 2. Our engineers have improved this new method of work. 3. We shall have graduated from the Auto-Mechanical Institute by 1995. 4. They had completed their work by 5 o'clock yesterday. 5. This plant has developed new types of vehicles such as electromobiles, cars with magnetic suspension and so on. 6. For years my friend has dreamed of becoming a technical engineer.

Practice 15. Переведите следующие предложения на русский язык.

1. The ZIL Works has already manufactured a new truck model with an engine that is protected against cold. 2. Every object of our industrialized world has practically flown from the machine. 3. The construction of the KAMAZ complex within such a short period has become possible only by using the latest achievements of science and technology. 4. Graduation theses of these students were based on material they had accumulated while working at the Student Design Bureau. 5. Since the latter half of the 60's VEF has produced a great many transistor radios. 6. Finally, when the planning engineer has ordered the material, the tool engineer has designed the tools and the design engineer has given the specification on the drawings, production is begun. 7. The chemical engineer will have completed the experiments by the 21st of June. 8. The total number of automobiles in all countries had exceeded 250,000,000 by 1972. 9. Michael Faraday gathered together and set in order all

the work of the scientists who had worked on electrical problems before him.

Practice 16. Заполните в таблице недостающие формы глаголов.

I	II	III
...	found	found
to learn	...	...
to be	was, were	...
to see	saw	...
...	founded	...
to know	...	known
...	took	taken
to have	...	...
...	gave	...
...	heard	heard
to begin	...	...
...	came	...
to supply	...	supplied
...	used	used
...	...	put
...	did	...
to become	...	...
to understand	...	...
to provide	...	...

Practice 17. Подберите формальные показатели к следующим предложениям.

a) 1. Auto-making has become a major Soviet industry producing all types of passenger cars, trucks and buses. 2. Prerevolutionary Russia had produced only 10 passenger cars. 3. The Estonian Academy of Sciences' Institute of Cybernetics has developed programming systems for an electronic computer. 4. Professor N. had planned a new experiment. 5. Have you been to this workshop?

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by 1910, ever, recently, by the end of last year, at present

b) 1. The construction of the complex on the Kama river has become one of the biggest construction sites in the world. 2. A special mini vehicle for cleaning pavements, court-yards and footpaths has not passed preliminary tests. 3. The 2-millionth Moskvitch rolled off the production line at the Moscow Lenin Komsomol Car Fac-

tory. 4. The enterprise had specialized in radio and telephone equipment. 5. We have not seen our planning engineer.

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by 1960, yet, already, since the morning, in 1972

Practice 18. Раскройте скобки и поставьте глагол в нужную форму.

1. The elegant, reliable and easy to use radios VEF (to win) world-wide fame. 2. He (to like) physics and mathematics when he (to be) at school. 3. The Soviet Union (to build) the world's most powerful presses with a force of 75,000 tons by 1974. 4. Let's try to answer questions which you (not to ask) yet. 5. Several famous scientists (to make) reports at the conference yesterday. 6. I already (to see) this device at the exhibition of scientific achievements. 7. When you (to discuss) this problem with our chief engineer? — We (to discuss) it a few days ago. 8. Radical changes (to take place) in this country since then.

Practice 19. Переведите предложения на английский язык.

1. К 1928 году Советское государство построило 841 автомобиль и к концу первой пятилетки (к 1932 году) — 23800, а к концу второй пятилетки (к 1937 году) — 199 800. 2. «Неделя науки» превратилась в эффективное средство привлечения студентов к исследованию. 3. Машины стали «механическими слугами» человека.

Text Study

Practice 1. Завершите предложения, подобрав соответствующие окончания в правом столбце.

1. Engineering is...	...many new sources of power such as electricity, gasoline, atomic power, etc.
2. It is based on...	...the Industrial Revolution began.
3. In ancient times engineering work was done...	...one of the oldest occupations in history.
4. In the Middle Ages the methods and devices of work...	...and much stronger materials to work with.

5. In the 18th century... ...by means of slave labor.
6. Steam gave man... ...became more efficient.
7. Since the 19th century both scientific research and its practical application... ...theoretical sciences such as physics and mathematics.
8. In the 20th century the mechanical engineer has... ...great sources of energy.
9. The engineer has new and... ...have greatly progressed.

Practice 2. Пользуясь информацией текста, заполните таблицу по данному образцу.

Engineering specialty	Its forerunner	Its function
mechanical engineer	tool-makers who chipped arrows and spears from rock	to make tools and machinery
mining engineer		
metallurgical engineer		
civil engineer		

AFTER-TEXT SECTION

Text Discussion

Practice 1. Ответьте на вопросы по теме "The Engineering Profession".

1. Who were the forerunners of modern mechanical, mining and metallurgical, and civil engineers? 2. How is engineering often defined? 3. What kind of information were many of the early branches of engineering based on? Give some examples. 4. Name two important factors in the explosion of scientific knowledge in modern times. 5. What made people in the Middle Ages in Europe begin to experiment with new devices and methods of work? 6. What was the historical result of experimentation with different kinds of energy? 7. Who was

James Watt? Why did he devise the concept of horsepower? 8. What advantages have scientific research and its applications given to the mechanical engineer? 9. What energy sources have come into common use since steam engines were developed at the beginning of the Industrial Revolution?

Practice 2. Расскажите об истории развития инженерной профессии. При составлении сообщения используйте вопросы Practice 1 как план. Употребите в своем сообщении нижеприведенную активную лексику.

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы	Прилагательные
специальности и ремесла в области техники	**toolmaker** **craftsman** **mining engineer** **metallurgical engineer** **civil engineer**		**efficient** **human**
машины и механизмы	**steam engine** **device** **arrow**	**to erect** **to escalate** **to refine**	
методы исследования, используемые при расчетах механизмов, и дисциплины, связанные с этим	**empirical information** **observation** **experience** **mechanical advantage** **horsepower** **physics** **mathematics**	**to discover** **to devise** **to perform** **to provide** **to calculate** **to depend upon**	

Text 2B

PRE-TEXT SECTION

Practice 1. Зная значение выделенных слов, переведите следующие слова и словосочетания.

to expand расширять: expansion of scientific knowledge; *to increase* увеличивать: the increase of scientific knowledge; *to grow* расти: the growth in the number of specialties; the growth in the number of engineering

fields; *competition* соревнование: to compete with somebody; *head* глава, руководитель: to head something; *to contribute* делать вклад: to combine the contributions made by all the different disciplines; *advanced* продвинутый, повышенного типа: advanced education; advanced degree

Practice 2. Прочитайте следующие слова и словосочетания. Они помогут вам полнее понять содержание текста.

to emerge появляться, sale аукцион, braking system тормозная система, to keep up with changes следить за изменениями

Practice 3. Прочитайте текст и выберите заглавие к нему.

Development of Engineering
Science and Engineering
Engineering Specialties

One result of the rapid expansion of scientific knowledge was an increase in the number of engineering specialties. By the end of the nineteenth century not only were mechanical, civil, and mining and metallurgical engineering established but the newer specialties of chemical and electrical engineering also emerged. This growth in the number of specialties is continuing with the establishment of such disciplines as aerospace, nuclear, petroleum, and electronic engineering. Many of these are subdivisions of earlier specialties — for example, electronic from electrical engineering or petroleum from chemical. Within the field of mechanical engineering the major subdivision is industrial engineering which is concerned with complete mechanical systems for industry rather than individual machines.

Engineers design and make machines, equipment and the like. Such work requires creative ability and a working knowledge of scientific principles. The engineer must also have an understanding of the various processes and materials available to him/her and could be working in any of the following areas: the organization of manufacture, research and development, design, construction, sales and education.

Because of the large number of engineering fields today there are often many different kinds of engineers working on large projects such as the development of nuclear power or new aircraft. In the design of a new aircraft mechanical engineers work not only on the plane's engines but on other mechanical aspects such

as the braking system. When the aircraft goes into production mechanical and industrial engineers are involved in designing the machines necessary to fabricate the different parts as well as the entire system for assembling them. In both phases of such a project mechanical engineers work with specialists in fields such as aerospace and electronic engineering. Each engineer is a member of a team often headed by a systems engineer able to combine the contributions made by all the different disciplines.

Another result of the increase of scientific knowledge is that engineering has become a profession. A profession is an occupation like law or medicine that requires specialized advanced education. Today it requires at least four or five years of university study leading to a Bachelor of Science degree. More and more often engineers, especially those engaged in research, get an advanced master's or doctor's degree. Even those engineers who do not study for advanced degrees must keep up with changes in their profession. A mechanical engineer who does not know about new materials cannot succesfully compete with one who does.

AFTER-TEXT DISCUSSION

Practice 1. Вы ознакомились с содержанием текста. Как вы поняли из контекста значение словосочетаний industrial engineers, systems engineer?

Practice 2. Суммируйте информацию текста, закончив следующие высказывания соответствующими окончаниями из правого столбца.

1. Engineering is based on...	...to the growth in the number of engineering fields.
2. The rapid increase of scientific knowledge leads...	...that engineering has become a profession.
3. Because of the large number of engineering fields the development of a complex mechanism requires...	...that each engineer keeps up with changes in his profession.
4. Another result of the increase of scientific knowledge is...	...a large number of different kinds of engineer.
5. Profession is an occupation...	...that requires specialized advanced education.
6. It also requires...	

Practice 3. Дополните составленный вами рассказ информацией из текста "The Engineering Profession" и сделайте сообщение на тему "Engineering and Engineering Profession".

Text 3A

READING AND COMPREHENSION

Прочитайте текст и определите:

1. связан ли он по тематике с предыдущими текстами данного цикла;
2. в каких абзацах текста содержится информация о работе инженера;
3. в каком абзаце текста расшифровывается понятие "the essential triangle";
4. раскрывает ли заглавие "The Essential Triangle" содержание текста; предложите свои варианты заглавия.

The Essential Triangle

Technological and industrial progress depends on the scientist, the engineer and the technologist — an essential triangle. Each makes major contribution to progress. The engineer depends upon the scientist for new knowledge and upon the technologist for specialized assistance in translating engineering plans into operating reality.

The pure scientist can make his contribution to progress through the investigation of the unknown.

The interests of the research engineer are in the area of applied science and research. Scientists work in a world of generalizations and abstractions. The technologist on the other hand, works in the real world of specific things and concrete objects. His problems are practical and they require practical solutions. He is more interested in how to do things. He must understand engineering tables and formulas and apply them in his work. The scientist, the research engineer, the technologist — all play an important role in the modern world.

The principal work of the engineer is design. He has to design products, machines and production systems. Like the research engineer, the engineer asks "why?". Like the technologist, he is also concerned with "how?".

The engineer must combine many of the characteristics of the scientist, research engineer and technologist. He must have a basic knowledge of the sciences, and

understanding of the abstract techniques of the research engineer and he should know much of the technology employed by technologists.

Perhaps the most important function of the engineer is to integrate the work of the essential triangle. His interest must be in combining the abstract-theoretical world and the technical-practical world.

WHILE-READING SECTION

Language Study

Practice 1. a) Переведите на русский язык следующие слова и сочетания, составленные из интернациональных слов. Значение выделенных слов — «ложных друзей переводчика» уточните по словарю.

technological progress, industrial progress, specialized assistance, reality, *abstraction*, concrete object, *specific*, *table*, formula, role, modern, *principal*, to combine, basic, abstract *techniques*, function, *to integrate*

b) Найдите предложения с данными словами и словосочетаниями в тексте и проверьте по контексту правильность выбранных вами значений.

Practice 2. a) Найдите в тексте существительные, образованные от приведенных ниже глаголов и уточните их значения:

to know, to contribute, to assist, to investigate, to generalize

b) Найдите в тексте глаголы, от которых образованы приведенные ниже существительные, и уточните их значения:

requirement, combination, integration

c) Переведите предложения с найденными вами существительными и глаголами на русский язык.

Practice 3. Найдите в 1-м — 4-м абзацах текста английские эквиваленты для следующих русских словосочетаний и слов.

прикладная наука и исследования, главная работа, практические решения, применять, производственные системы, подобно, играть важную роль, зависеть от, проектировать машины

Practice 4.

Модальные глаголы (Modal Verbs)

Модальные глаголы	Эквиваленты модальных глаголов	Значение	Примеры
can наст. вр. **can** а) *могу, может*		а) физическая возможность	I can lift this unit.
б) *умею, умеет*	**to be able (to)** *быть в состоянии, мочь*	б) умственная способность	I can operate this device. He was able to do this work himself.
прош. вр. **could**	**to be unable to** (в отрицательном предложении) *быть не в состоянии, не мочь*		This engineer will be unable to come.
may наст. вр. **may** а) *могу, может, можно*		а) разрешение, отсутствие запрета	You may take the book.
б) *может быть, вероятно*		б) вероятность	She may come.
	to be allowed (to) *иметь разрешение*		The students were allowed to test the new device.
прош. вр. **might**	**to be permitted (to)** *иметь разрешение*		Comrade N. will be permitted to go on with his experiment.

Продолжение

Модальные глаголы	Эквиваленты модальных глаголов	Значение	Примеры
must наст. вр. **must** *должен*		долженствование, обязанность	Every student must attend the lectures.
	to have (to) *быть вынужденным*	а) в силу обстоятельств	He had to do it again.
	to be (to) *быть обязанным*	б) в силу договоренности, плана	We are to meet at 6 p.m.
	to be supposed (to) *быть обязанным*	в) в силу договоренности	You were supposed to prepare it.
	to be obliged (to) *быть вынужденным*	г) в силу морального обязательства	I am obliged to help him.

Notes: 1. Модальные глаголы не имеют инфинитива, не изменяются по лицам, не имеют многих форм, свойственных английскому глаголу. После модальных глаголов инфинитив употребляется без частицы **to.**

2. Модальные глаголы образуют вопросительную и отрицательную формы без помощи вспомогательного глагола.

Can you do it? — No, I can't.

3. Эквиваленты модальных глаголов не только употребляются вместо соответствующих модальных глаголов, но они также восполняют недостающие временные формы модальных глаголов: в таблице эту функцию выполняют первые приведенные по списку эквиваленты.

Practice 5. Эквивалентами каких модальных глаголов являются следующие сочетания?

to be able to, to be obliged to, to have to, to be supposed to, to be to, to be permitted to, to be allowed to

Practice 6. Переведите на русский язык предложения, данные в качестве примеров в таблице.

Practice 7. Трансформируйте следующие предложения в прошедшее и будущее время, используя соответствующие формальные показатели времени.

Model: The engineer must know all the properties of this material.
The engineer had to know all the properties of this material.
The engineer will have to know all the properties of this material.

1. You must use this equipment. 2. The scientists can test their new apparatus in the laboratory. 3. This plant can provide our research institute with a new type of fuel equipment. 4. This scientist may investigate new means of production. 5. Our scientific research laboratory must launch a new programme this year. 6. New types of this plant can have the longer period of their durability. 7. Our Soviet cars can guarantee their reliability and safety. 8. He may use these reference books for his report. 9. Nobody can lift this heavy tyre.

Practice 8. Переведите на русский язык предложения из Practice 7.

Practice 9. a) Найдите в тексте предложения с указанными в таблице моделями и переведите их на русский язык.

b) Определите, какие из высказываний соответствуют содержанию текста.

1. The technologist is to solve practical problems. 2. The engineer is to integrate the work of the essential triangle. 3. The scientist has to design products, machines and production systems. 4. The technologist is to investigate the unknown. 5. The engineer must apply engineering tables and formulas in his work. 6. The pure scientist is to work in the area of applied science and research. 7. The engineer should apply his theoretical knowledge to practice.

Practice 10.

В приведенной ниже таблице модальные глаголы выражают то, что:

1) necessary/not necessary
   необходимо/не необходимо
2) possible/not possible
   возможно/невозможно
3) permitted/not permitted
   разрешено/не разрешено

Necessary	Not Necessary
must	needn't don't } need to doesn't } need to
Possible	Not Possible
can	mustn't can't

Permitted	Not Permitted
may can	may not can't/cannot mustn't

N o t e: Need может быть и модальным и полнозначным глаголом. В качестве модального глагола он обычно используется в отрицательной форме и за ним следует инфинитив без частицы **to**. Например:

We needn't provide new information this week.

В качестве полнозначного глагола **need** используется с частицей **to**. Например:

But I need to know more about this project.

Прочитайте следующие предложения, переспросите о происходящем действии, дайте отрицательный ответ на вопрос. Обратите внимание на то, что модальный эквивалент have to образует вопросительную и отрицательную форму с помощью вспомогательного глагола do.

Model: *1st St.* He had to meet this delegation of engineers from the Kiev plant.
2nd St. Did he have to meet the delegation of engineers from the Kiev plant?
3rd St. No, he didn't have to meet this delegation from the Kiev plant.

1. All the units of a new tractor can be produced at this plant. 2. Our laboratory has to launch a new programme this month. 3. This scientist was allowed to take part in the all-union conference on automobile designing. 4. This new minibus can hold 18 passengers. 5. Everybody must be present at the lecture of Prof. Ivanov. 6. Student Smirnov is to defend his diploma project next month. 7. This new plant is to build only body fixtures. 8. She may use this new device for testing her design.

Practice 11. Переведите предложения из Practice 10.

Practice 12.

В приведенной ниже схеме все модальные глаголы выражают долженствование, но в разной степени.

категоричность

must	mustn't
ought to	oughtn't to
should	shouldn't

совет

Проанализируйте предложения в предпоследнем абзаце текста и объясните необходимость введения глагола should в последнем предложении этого абзаца.

Text Study

Practice 1. Завершите предложения, подобрав соответствующие окончания в правом столбце.

1. The essential triangle consists of...	...design.
2. The scientist makes his contribution to progress through...	...how to do things.
3. The technologist is more interested in...	...to integrate the work of the essential triangle.
4. The principal work of the engineer is...	...the scientist, the technologist, the engineer.
5. The most important function of the engineer is...	...investigation of the unknown.

Practice 2. Пользуясь информацией текста, заполните таблицу по образцу.

Сфера деятельности	Деятель
new knowledge	scientist
work in the area of applied science and research	
translating engineering plans into operating reality	
production process	
designing products, machines, production systems	

AFTER-TEXT SECTION

Text Discussion

Practice 1. Расскажите о роли ученого, инженера и технолога в научно-техническом прогрессе, используя следующие словосочетания и активную лексику на с. 130.

the essential triangle, to consist of, to make contribution to progress, to investigate the unknown, to deal with the production process, to design new products, to integrate the work

Practice 2. Ситуации для высказывания. (При рассказе воспользуйтесь активной лексикой.)

1. У вас аналитический склад ума. Вас интересуют чисто научные проблемы. Скажите, можете ли вы заниматься научными исследованиями в институте? Каким образом?
2. Вы заканчиваете машиностроительный институт. Скажите, в какой области (исследований, проектирования, на производстве) вы собираетесь работать? Где? Чем конкретно вы будете заниматься?
3. Вы инженер-технолог, работающий на машиностроительном заводе. Назовите свои основные обязанности.

Active Vocabulary

Область применения	Существительные	Глаголы	Прилагательные
исследование и систематизация знаний	**object** **area** **knowledge** **investigation** **generalization** **abstraction** **solution** **assistance**	**to abstract** **to generalize**	**principal** **basic** **practical** **theoretical** **abstract** **essential** **major** **technical**
применение изделий, конструкций		**to apply** **to employ**	

Text 3B

PRE-TEXT SECTION

Practice 1. Зная значение выделенных слов, переведите следующие слова и словосочетания.

productive производительный: productivity; *to improve* улучшать, совершенствовать: improvements in productivity; *available* имеющийся в наличии: availability of engineers; *to process* обрабатывать: metal processing, processing problems

Practice 2. Прочитайте следующие слова и словосочетания. Они помогут вам лучше понять содержание текста.

in turn в свою очередь, way метод, способ, to be familiar with знать что-либо, быть в курсе чего-либо,

tool engineer технолог, common общий, approach подход, advanced engineering courses курсы повышения квалификации, complicated сложный

The Role of Science in Manufacture

Future improvements in productivity are largely dependent on the application of science to manufacturing. This depends in turn on the availability of large numbers of scientifically trained engineers. The higher schools can serve the needs of industry in two ways: by performing basic research and by training well-qualified engineers in the manufacturing field.

There is a growing need for engineers who are familiar with the fundamental problems in metal processing and manufacturing. In the near future many of the engineers will be recent university graduates. A few will come through courses of study in industry. Others, having a basic engineering knowledge will continue additional studies at colleges to prepare themselves for work in industry. Therefore, an engineer does not finish his education when he receives his diploma, particularly in the fields of interest to tool engineers who are to study new developments constantly.

There are numerous ways in which industry and education can cooperate on problems of common interest. Scientists and research engineers are engaged in work that is intended to provide a scientific approach to many purely industrial problems. These scientists and engineers can make a real contribution to engineering education or academic research. They can, for example, teach advanced engineering courses and they can actively participate in basic and applied research.

Similarly, large and complicated projects of new technologies could well be handled by institute researchers working on practical applications. This would often provide the most efficient approach to the solution of processing problems.

AFTER-TEXT DISCUSSION

Practice 1. Прочитайте следующие утверждения и расположите их в порядке следования информации в тексте.

1. An engineer does not finish his education when he receives his diploma.

2. There is a close cooperation between industry and education.
3. The higher school can serve the needs of industry.

Practice 2. На чем основано каждое из этих утверждений? Подтвердите свой ответ ссылкой на текст.

SELF-TRAINING PRACTICE: SUPPLEMENTARY TEXTS

Text 1

Pre-Text Section

Practice 1. a) Прочитайте текст и найдите в нем информацию, подтверждающую следующие утверждения.

1. The machine-tool is the mother of all machines. 2. The engineer is a guiding force behind the machine-tool. 3. The development of a complex mechanism involves the combined work of a large number of different kinds of engineers.

b) Озаглавьте текст.

The Soviet technique from the very first months of the victory of Soviet Power was directed towards tasks that were connected with the building up of Socialism.

How to make the work of people easier and more productive, how to improve machine-building, which technology and materials to apply — all these and other questions should be the constant objects of every Soviet engineer's attention and care.

The machine-tool is the original source of every object of our industrialized world. Automobiles, airplanes, diesel locomotives, washing machines, electric stoves and radio sets are made by machine-tools. But without the engineer the machine-tool couldn't function.

One engineer seldom deals with every phase of development of a complex mechanism, e. g. a steam turbine. Various specialists take part in its development: a mechanical engineer skilled in the application of thermodynamics, a chemical engineer utilizing all the by-products of the fuel used, an electrical engineer converting the mechanical energy into a conventional form of power, an engineer skilled in the calculation of stresses when designing the turbine blades, a production engineer planning the smooth flow of material into the finished

product, as well as the research engineer who conceived the idea in the first place.

After all the components of the turbine have been developed into a complicated mechanism and detailed drawings have been made of all component parts, materials are ordered and routing of the materials is planned. Finally, when the planning engineer has ordered the material, the tool engineer has designed the tools and the design engineer has given specifications on the drawings, production begins.

The finished components are assembled, inspected and moved from the factory to the consumer through a department directed by a sales engineer.

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original source первоисточник
to utilize the by-products of the fuel использовать побочные продукты сгорания топлива
to convert ... into a conventional form of превращать ... в обычную форму
stresses напряжения
turbine blades лопасти турбины
to conceive the idea выдвинуть идею
drawings чертежи
to order заказывать
tool engineer инженер-технолог
consumer потребитель
sales engineer инженер по сбыту

After-Text Section

Practice 1. Расположите разновидности инженеров в порядке их функционирования в производстве.

design engineer, sales engineer, tool engineer, research engineer, planning engineer

Practice 2. Расскажите о функции каждого инженера, заполнив следующую таблицу.

The function of	a mechanical	engineer	is	to apply thermodynamics in the development of a complex mechanism.
	a chemical an electrical a production a research a planning a tool a design a sales			

Text 2

Pre-Text Section

Practice 1. Прочитайте текст и скажите, какая проблема затронута в нем. В каком предложении эта проблема наиболее точно сформулирована?

Practice 2. Озаглавьте текст.

The public has become much more aware, especially in the last decade, of the social and environmental consequences of engineering projects. For much of the nineteenth and twentieth centuries, the public attitude could be summed up in the phrase "Science is good", and the part of science that was most visible was the engineering work that made scientific knowledge useful. Countless cars and other mechanical devices are part of our engineered environment.

Today, however, people are more conscious of the hidden hazards in products and processes. The automobile is a typical example. No one disputes its convenience but many are also aware of the air pollution it causes and the amount of energy it consumes. Engineers are working to solve these problems by designing devices that reduce pollution and improve fuel efficiency.

The engineer, then, does not work in a scientific vacuum but must take into account the social consequences of his or her work.

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social and environmental consequences последствия для общества и окружающей среды
to be aware of/to be conscious of сознавать, знать
attitude to отношение к
visible видимый, явный
device устройство
hidden hazards скрытые угрозы
convenience удобство
air pollution загрязнение воздуха
to take into account принимать во внимание

After-Text Section

Practice 1. а) Прочитайте следующие утверждения и скажите, на чем они основаны.

1. The attitude of the general public toward engineering projects has changed recently. 2. The automobile is a typical example of public's divided attitude toward engineering projects. 3. The engineer does not work in a scientific vacuum.

b) Подтвердите свой ответ ссылкой на текст.

Text 3

Pre-Text Section

Practice 1. В тексте рассказывается о великом математике и изобретателе Героне. Какие сведения о нем вы предполагаете почерпнуть из текста? Перечислите их.

Practice 2. Прочитайте текст с целью нахождения в нем предполагаемой информации.

Hero of Alexandria

1 About sixty years after the death of Archimedes, Hero of Alexandria was born. Nobody knows the exact date of his birth, but according to the best authorities, he lived about 150 B. C. In addition to being a great mathematician, he invented the siphon, the gear-wheel, the pump, the water clock and the steam engine.

2 His book on mechanics translated into Arabic, was carefully studied by mechanics and engineers of the sixteenth century. In this remarkable book Hero lists and describes five simple ways by which an unusually heavy weight may be lifted and moved with minimum effort. These five principles form the basis of all the machinery in the world today and, though described in detail by Hero, their practical application to machinery did not come about for more than a thousand years. They are: the lever, the wheel and axle, the pulley, the wedge, the screw.

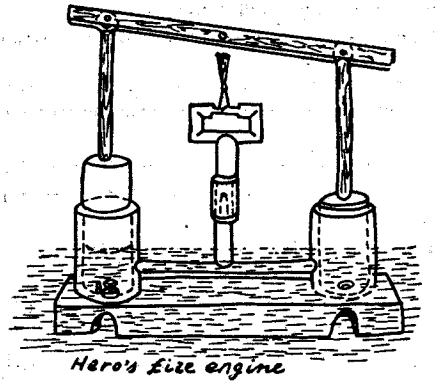
3 While it is true that the invention of the screw is attributed to Archimedes and the wedge and the lever were known long before Hero's time, he was the man, who showed for the first time that all machinery is based on these five important principles, and how to apply these principles to machinery — such as it was in these early times.

4 Neither he nor anyone else of his time realized the importance of these inventions. Hero's book on pneumatics, which was translated into Italian in 1549 and later into English, described more than seventy totally useless inventions, most of which embody important basic principles.

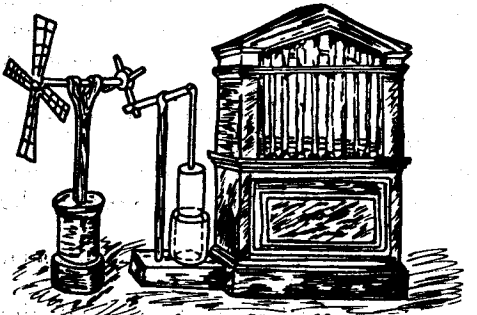
5 Their main function was to entertain.

6 The siphon, that is essential to modern plumbing and sanitation, Hero saw as a sort of toy. Nineteen

centuries later Robert Fulton would employ the power of steam for locomotion, but Hero used it to make a hissing sound of a rattlesnake. He discovered the pump, so vital to our civilization, but he used it only as a toy. Hero applied it for the automatic pumping of an organ where the air was supplied by wheel turning in the wind. The importance of pumps in industry was not realized until the middle of the sixteenth century, sixteen hundred years after the death of the inventor. Among his other inventions we find a slot machine placed in the temple for different purposes and some other inventions of this kind. It is doubtful whether any other inventors in history applied so many world-shaking ideas to what would appear to us as entertainments. But all this was in keeping with Greek reverence for philosophy and scientific theory and indifference to practical application.



Hero's fire engine



Hero's alter organ blown by the energy of a windmill

7 The illustrations in these pages show a number of Hero's remarkable inventions. If you overlook their entertaining applications you will find in them the basic elements of all the machinery and many of the important inventions that were to follow centuries later.

gearwheel зубчатое колесо
pump насос
lever рычаг
axle ось
pulley шкив
wedge клин
screw винт
neither... nor... ни... ни...
plumbing водопроводная система
sanitation санитария
a hissing sound of a rattlesnake шипение гремучей змеи
a slot machine автомат для опускания монет
It is doubtful whether... Вряд ли...
to be in keeping with Greek reverence for... быть в соответствии с благоговейным отношением греков к...

After-Text Section

Practice 1. Вы ознакомились с содержанием текста. В каких абзацах вы нашли предполагаемую вами информацию?

Practice 2. Какую еще информацию вы получили? Укажите номера абзацев, в которых она содержится.

Practice 3. Суммируйте полученную вами информацию о Героне, расположив следующие утверждения в порядке следования их в тексте.

— Hero's attitude to his inventions is explained by Greek reverence for scientific theory and indifference to practical application.
— All his inventions were used to entertain only.
— Hero lived about 150 B. C.
— Among his inventions are the siphon, the gearwheel, the pump, the water clock, and the steam engine.
— Hero of Alexandria was a great mathematician and inventor.
— Practical application of these five principles to machinery came about more than a thousand years later.
— Hero also showed for the first time that all machinery is based on these principles.
— Hero's book on pneumatics described more than seventy of his totally useless inventions.
— The five principles, described by Hero, are the lever, the wheel and axle, the pulley, the wedge, the screw.
— In his book on mechanics, Hero listed and described the five basic principles of mechanics.
— Neither Hero nor his contemporaries realized the importance of his inventions.

Text 4

Pre-Text Section

Practice 1. Прочитайте текст и составьте перечень работ Фарадея, упомянутых в тексте.

Faraday Puts Electricity to Work

Michael Faraday, who was born in 1791 and died in 1867, gathered together and set in order all the work of the scientists who had worked on electrical problems before him.

In 1823, he discovered how to make an electrical motor. In 1831, he built the first generator, then called dynamo. The modern car has both a starting motor and a generator. The starting motor draws electric current from the car battery to start engine. The generator is driven by the engine to recharge the battery and to furnish electric power for all the electrical conveniences in the car.

In 1833, Faraday discovered the laws of electrolysis.

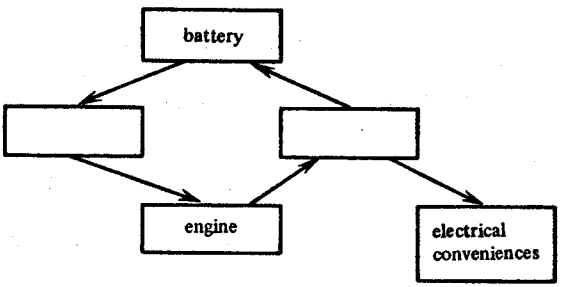
As a result of Faraday's work, Morse was able to invent the electro-magnetic telegraph, Bell, the telephone, and Edison, the electric light.

---

to recharge подзаряжать
to furnish снабжать

After-Text Section

Practice 1. На основе информации текста заполните следующую схему.



Text 5

Pre-Text Section

Practice 1. Прочитайте текст и проследите, как Белл пришел к изобретению телефона.

The Telephone

Alexander Graham Bell never planned to be an inventor. He wanted to be a musician or a teacher of deaf people. The subjects that he studied in school included music, art, literature, Latin and Greek. They did not include German, which most scientific and technical writers used in their books, or science or math.

Alexander's mother was a painter and a musician. His father was a well-known teacher. He developed a system that he called "Visible Speech", which he used to teach deaf people to speak. When Alexander was a young boy he and his two brothers helped their father give demonstrations of the system for doctors and teachers.

In 1863, when Alexander was only sixteen, he became a teacher in a boy's school in Scotland. He liked teaching there, but he still wanted to become a teacher of deaf people. He read all the books about sound that he could find, and started to work on some of his own experiments. Reading scientific books wasn't easy for him, but he worked very hard, and he learned a lot about the laws of sound.

He became interested in telegraph, and he tried to find a way to send musical sounds through electric wires. These experiments were not very successful.

Then Alexander was offered a job at the School for the Deaf in Boston, Massachusetts. He was so successful that he was able to open his own school when he was only twenty-five.

About this time Alexander became interested in finding way to send the human voice through an electric wire. He found an assistant, Tom Watson, who worked in an electrical shop and knew a lot about building electric machines. Tom and Alexander worked together to build a machine that people could use to talk to one another over long distances.

After 2 years, the two young men were becoming discouraged. Then, one day, when they were working on

a new transmitter, Alexander spilled some acid on himself. Tom Watson, who was alone in another room, heard a voice. The voice was coming through a wire to a receiver on the table! The voice was Alexander Graham Bell's! It was saying "Come here, Mr. Watson! I want you!"

The spilled acid was forgotten when Tom and Alexander realized that their talking machine worked.

The first permanent telephone line was built in Germany in 1877. And in 1878, the first telephone exchange was established in New Jersey. By 1915 a coast-to-coast telephone line was opened in the United States — 5440 kilometres from New York to San Francisco. Alexander Graham Bell was invited to open the new line, and he asked his old friend, Tom Watson, to help.

On the important day, January 25, 1915 Mr. Watson was in San Francisco and Mr. Bell was in New York City. Everyone expected to hear a serious, scientific speech.

The words that Mr. Bell chose to say were: "Come here, Mr. Watson! I want you!"

---

visible speech видимая речь
deaf people глухие люди
sound звук
wire провод
human voice человеческий голос
shop мастерская
transmitter передатчик
to spill some acid пролить кислоту
receiver динамик
telephone exchange центральная телефонная станция
to expect ожидать, предполагать

After-Text Section

Practice 1. Суммируйте информацию текста, составив предложения, соответствующие содержанию текста.

1. Alexander Graham Bell wanted to be
   — an inventor.
   — a teacher of deaf people.
2. In school he studied
   — science, math and German.
   — music, art, literature, Latin and Greek.
3. Bell's father was
   — a scientist.
   — a well-known teacher.
4. He was well-known
   — for his system for teaching deaf people to speak.
   — for his book on teaching.

5. Alexander became a teacher when he was
   — twenty-five.
   — only sixteen.
6. Bell was interested
   — in laws of sound.
   — in mechanics.
7. He wanted to find a way
   — to send the human voice through an electric wire.
   — to communicate without wire.
8. His assistant, Tom Watson, was
   — a specialist on electric machines.
   — a mechanic.
9. After 2 years of work they built
   — an electric telegraph.
   — a talking machine (telephone).
10. In 1878 the first permanent telephone line was built
   — in the United States.
   — in Germany.
11. In 1915 Bell was invited to open
   — the first telephone exchange in New Jersey.
   — the new coast-to-coast telephone line in the United States.

Text 6

Pre-Text Section

Practice 1. Прочитайте текст и определите, о каких изобретателях идет речь и каков их вклад в развитие автомобилестроения.

The Pioneers

Karl Benz (1844-1929), the son of a railway engine-driver who died when Karl was two, studied engineering at the Karlsruhe Polytechnic. After various jobs he set up business, with successive partners in a very small way making two-stroke gas engines of his own design in 1880. Although he is entitled to be called the "inventor of the petrol car" he was reluctant to depart from his original design of belt driven horseless carriage which sold well in 1890s. Other designers were called in, and after 1902 Benz had little influence on the development of the motor car.

Frederick William Lanchester (1868-1946), son of an architect, made Britain's first four-wheeled petrol car of wholly native design, in 1895 with the help of his

brother George. A small company was formed and production was begun late in 1899. Lanchester's designs were always unique and ahead of their time; he was responsible for many innovations which became accepted some years later. Those include a vibrationless, fully balanced engine, splined shafts, full-pressure lubrication, lightweight pistons, disk brakes, a preselector semi-automatic gearbox, worm drive, the torsional vibration damper, the harmonic balancer and more. "Doctor Fred" was also a pioneer authority and writer on aerodynamics, and for many years Consultant Engineer to the Daimler Co.

Henry Ford is usually credited with "inventing" mass-production, yet the idea originated many years earlier in the Connecticut clock trade and was developed in the American's small-arms industry. Henry Leland in America, De Dion Bouton in France and Lanchester in England all based their car production on fully interchangeable machined components, with the minimum of hand-fitting, some years before Ford.

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two-stroke gas engine двухтактный двигатель, работающий на газе
to be entitled иметь право
petrol car автомобиль с бензиновым двигателем
to be reluctant to depart не желать отказаться от...
to be ahead of time опережать время
to be responsible for many innovations быть автором многих нововведений
to accept принимать
to originate возникать
fully interchangeable components полностью взаимозаменяемые двигатели
hand-fitting установка деталей вручную

After-Text Section

Practice 1. Опираясь на информацию текста, мотивируйте следующие утверждения.

Statement from the text	Why?
1. Karl Benz is entitled to be called the "inventor of the petrol car". 2. After 1902 Karl Benz has little influence on the development of the motor car. 3. Frederick William Lanchester is called a pioneer of automobile engineering. 4. Henry Leland, De Dion Bouton and Lanchester may be called pioneers of mass production.	

Text 7

Pre-Text Section

Practice 1. Прочитайте текст и составьте перечень работ Джеймса Уатта.

James Watt

James Watt was born in Greenock, Scotland, and was taught at home, later he went to Greenock Grammar School.

His technical expertise seems to have been obtained from working in his father's workshop and from early in life he showed academic promise. His early formal training was as an instrument maker in London and Glasgow.

Watt combined the expertise of a scientist with that of a practical engineer, for later he was not only to improve the heat engine but also to devise new mechanisms.

Watt was interested in making experimental models of steam engines and this marks a historical milestone in engineering development, for they were the first experimental apparatus purposely constructed for engineering research. Watt's early interest in steam arose from experience in repairing a model steam engine in 1764, and in 1765 he invented the separate steam condenser. In 1769 he took out a patent on the condenser in which steam came into direct contact with cold water; that was a milestone by which steam engineering reached its practical and usable form.

In 1784 he took out a patent for a reaction turbine at a time when continental engineers were only considering similar approaches. An improved centrifugal governor was to follow in 1788 and a design for a pressure gauge in 1790. The engine pressure indicator is also attributed to him.

In the development of the steam engine James Watt represents the perfecting of a sequence of stages beginning with the Newcomen engine and ending with the parallel motion and sun/planet gearing. The latter is said to have been invented by W. Murdock but patented by Watt.

In the scientific field Watt's finest memorial, apart from steam engines, is his establishment of the unit of power — the rate of doing work. He coined the term

horsepower (hp); one horse being defined as equivalent to 33,000 ft lb/min.

Watt was interested in the strength of materials and designed a screw press for chemically copying written material. A leading brand of reprographic equipment today is remarkably similar. Watt received many honors in recognition of his important works. He was a Fellow of the Royal Society of London and Edinburgh, and was a member of the Academy of Sciences in France.

James Watt died in 1819 in Heathfield, after a life of incomparable technical value. Later, a statue to Watt was placed in Westminster Abbey.

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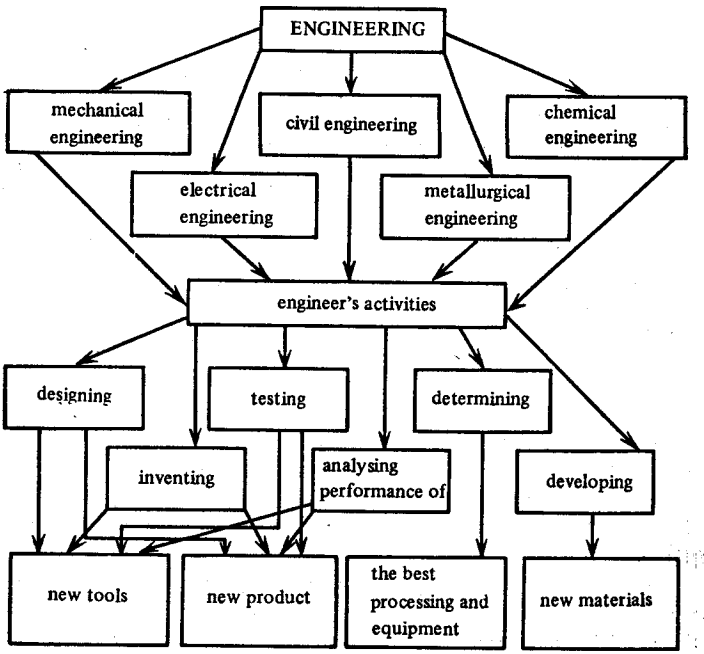
expertise мастерство
instrument прибор
milestone веха
to repair ремонтировать
governor регулятор
pressure gauge манометр (прибор для измерения давления)
sequence последовательность
parallel motion and sun/planet gearing параллелограммный механизм и планетарная передача
the latter последний (из двух названных)
to coin the term ввести термин
ft lb/min футо-фунтов в минуту
strength of materials сопротивление материалов
screw press винтовой пресс

ДЕНОТАТНАЯ СХЕМА



UNIT IV

Machine-Building

Text 1A

READING AND COMPREHENSION

1. **В 1-м абзаце текста подчеркивается, что современные машины подвергаются огромным напряжениям и выполняют сложные движения. В то же время автомобильный двигатель назван «простой» машиной. Какое отношение между первым и вторым положениями этого абзаца?**
2. **Основная часть текста посвящена классификации основных отраслей техники, специалистов, работающих в каждой из этих областей, и перечислению основных изделий промышленности. Назовите абзацы и предложения текста, которые относятся непосредственно к машиностроению.**

Engineering

Today machines have to withstand such tremendous stresses and to be able of such complex motions that complicated and specialized calculations taking hundreds of factors into account are needed in the design of even quite a simple machine like a motor-car engine.

So, as engineering progresses, engineers must become ever more scientific and specialized. Today the branches of engineering are so wide that it is impossible to give

a satisfactory classification. But we may try to divide it into uses. The main divisions of engineering may be listed as follows:

1. Mechanical engineering.

Steam engines; internal combustion engines; turbines (steam, gas, water); pumps; compressors; machine-tools; mechanisms.

2. Electrical engineering.
   a) Power: generators; motors; transformers; transmission (power lines and so on).
   b) Electronics: radio, radar, television.
3. Civil engineering.

Dams; tunnels; roads; and so on.

4. Structural engineering.

The structural details of all large buildings and bridges.

5. Chemical engineering.

Any of these branches of engineering may require the special services of the following specialists: the metallurgist; the strength of materials expert; the thermodynamics of heat expert; the mechanics or machines experts; the various production engineering experts such as the engineering designer or the tool designer; the mathematician specializing in engineering problems and many more.

The engineer must also deal with the economists to assure himself that he is producing what is wanted, and economically.

WHILE-READING SECTION

Language Study

Practice 1. a) Переведите следующие словосочетания на русский язык, постарайтесь догадаться о значении интернациональных слов и только после этого проверьте правильность перевода этих слов по словарю.

b) Найдите эти слова в тексте и уточните их значение по контексту.

metallurgist, expert, mechanics, structural engineering, chemical engineering, mathematician, generator, civil engineering, heat expert, tool designer, economist, electrical engineering, engineering designer, strength of materials expert, turbine, tunnel, radio, engine, steam engine, internal combustion engine

Practice 2. Найдите в 1-м абзаце текста словосочетания, образованные по модели have+to; как переводится глагол have? Образуйте предложения по этой модели, используя данную таблицу. Переведите их на русский язык.

The engineer	has to	deal with economists.
The mathematician		know mechanisms.
The mechanic		withstand pressure of steam.
A steam engine		deal with thermodynamics.
The heat expert		solve engineering problems.

Practice 3. Проанализируйте все предложения текста, содержащие модальные глаголы и их эквиваленты. Какое значение придает всему предложению каждый из этих глаголов?

Practice 4. Выпишите из текста предложения с модальными значениями в таблицу и переведите их на русский язык.

Долженствование, обязанность	Возможность, способность	Разрешение, вероятность

Practice 5. а) Запомните нижеприведенную таблицу неопределенных местоимений.

+	+	—	?	—	
some,		any,		no,	every

Местоимения	-thing	-body -one	-where	Употребление
+				
some	something	somebody	somewhere	в утвердительных предложениях
некоторый	что-нибудь	кто-то	где-то	
какой-то	что-то	someone	куда-то	
какой-нибудь		кто-нибудь	где-нибудь	
несколько			куда-нибудь	
+ — ?				
any?	anything?	anybody?	anywhere?	в вопросительных предложениях
какой-нибудь?	что-то?	что-то?	где-то?	
любой?	что-нибудь?	что-нибудь?	куда-то?	
			где-нибудь?	
			куда-нибудь?	

Продолжение

Местоимения	-thing	-body -one	-where	Употребление
— по никакой ни один	nothing ничто ничего	nobody no one никто	nowhere нигде никуда	в отрицательных предложениях
every каждый всякий	everything все	everyone everybody все каждый	everywhere везде повсюду	во всех трех видах предложений

b) Найдите в тексте предложение с неопределенным местоимением и переведите его на русский язык.

Practice 6. Переведите следующие предложения на русский язык.

1. Everything is ready for the experiment. 2. The students looked for this book everywhere, but couldn't find it anywhere. 3. Do you know anything about the history of the Soviet machine-building industry? 4. There is some reference-book on your table. 5. Everybody knows Professor Petrov. 6. The old plant had no modern facilities. 7. Everybody can do this. 8. Is there anybody there? 9. None of them could solve the problem. 10. I left my text-book somewhere. 11. We read nothing about this type of automobile. 12. If you discover any faults (дефекты) in the detail, tell the engineer about them.

Practice 7. Ответом на какие вопросы являются нижеприведенные предложения?

Model 1: There are *some* interesting inventions at this research centre.
Are there *any* interesting inventions at this research centre?

1. This plant employs some highly efficient equipment. 2. There are no specialized plants in this town. 3. This scientific research institute has some specific features in its work. 4. Our chemical laboratory makes no researches in the field of mechanical engineering. 5. They carry out some interesting experiments.

Model 2: *Somebody* saw this engineer.
Did *anybody* see this engineer?

1. I read something about this apparatus last month. 2. You will find no one at the office tomorrow. 3. There is somebody in the laboratory. 4. The students wanted to go nowhere.

Practice 8. Раскройте скобки и переведите на английский язык слова, данные в них.

Remember: Правильно: **some of you, none of us, each of them, any of you.**

1. Does (кто-нибудь) of you know this engineer? 2. (Никто) of our students receives this newspaper. 3. (Любой) of us can help you with your work. 4. Is (все) ready for the test work? 5. I'll try to read (что-нибудь) on this problem. 6. You are allowed to choose (любую) of these books. 7. She knows (ничего) about this experiment. 8. Do you see (кого-нибудь) of your friends in the hall? 9. (Каждый) of us is ready to take this difficult examination.

Practice 9. Переведите предложения из активного в пассивный залог.

1. They will start production of the new type of engine soon. 2. That country doesn't produce any heavy industrial machinery. 3. Jilles de Dion built the first mechanically propelled vehicle. 4. They reconstructed this plant entirely. 5. Our laboratory employs the most modern technology. 6. Tsarist Russia produced only a few automobiles before World War I. 7. In 1916 Russia made efforts to build some motor works. 8. The Soviet Union built a whole group of workshops on the Kama river in the town of Naberezhny Chelny. 9. In 1975 our country produced over 785,000 trucks.

Practice 10. Найдите в тексте предложения в пассивном залоге и переведите их на русский язык, обращая внимание на особенности перевода пассива.

Practice 11.

Специальные вопросы

Who?		What?	Where?	When?
You	study	many subjects	at the Institute	every year.

Специальный вопрос образуется через общий вопрос в соответствии со строгим порядком слов в английском предложении.

where?
You study many subjects at the Institute every year. →

← where?
→ Do you study many subjects at the Institute every year? →
→ Where do you study many subjects every year?

when?
You study many subjects at the Institute every year. →

← when?
→ Do you study many subjects at the Institute every year? →
→ When do you study many subjects at the Institute?

Вопрос к подлежащему образуется не через общий вопрос, а непосредственно от утвердительного предложения.

who?
You study many subjects at the Institute every year. →
→ Who studies many subjects at the Institute every year?

Поставьте специальные вопросы к выделенным словам предложения.

1. *A new experimental minibus* was made *at the Likhachev Automobile Works.* (2) 2. *The total number of automobiles in all countries* exceeded 250,000,000 *in 1972.* (3) 3. There are *many research institutes in our country.* (2) 4. *The plant* will produce *new types of engines in 5 years.* (3)

Practice 12. Поставьте по одному специальному вопросу к каждому абзацу текста.

Practice 13. a) Обратите внимание на употребление слов such и so (такой).

It is **such** an interesting fact. Это такой интересный факт. (such перед существительным)	This fact is **so** interesting. Этот факт такой интересный. (so перед прилагательным)

b) Найдите в первых двух абзацах текста предложения со словами such и so и переведите их на русский язык.

Practice 14.

$N_1 + V + N_2 +$ to V

для того чтобы что-то сделать

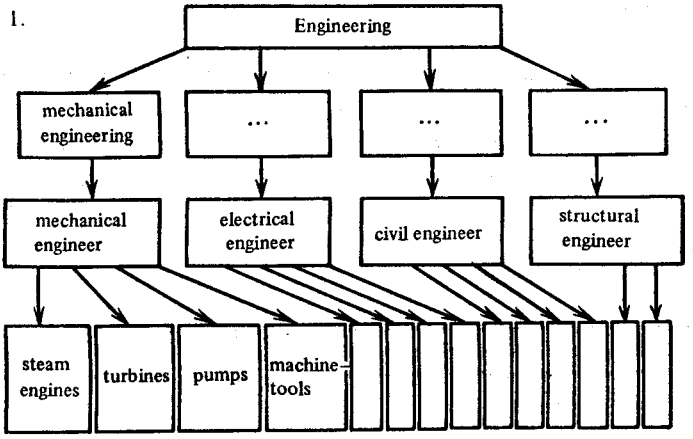
Найдите в последующем абзаце текста слова, образующие данную модель. Переведите предложение на русский язык. Переведите следующие отрезки предложений, образованных по этой же модели.

1. Any branch of engineering requires the special services of the metallurgist to select the proper material for... 2. A mechanical engineer should know thermodynamics to calculate heat processes in... 3. A production engineer takes part in the manufacturing process to plan the... 4. A tool designer cooperates with an engineering designer to select machinery for...

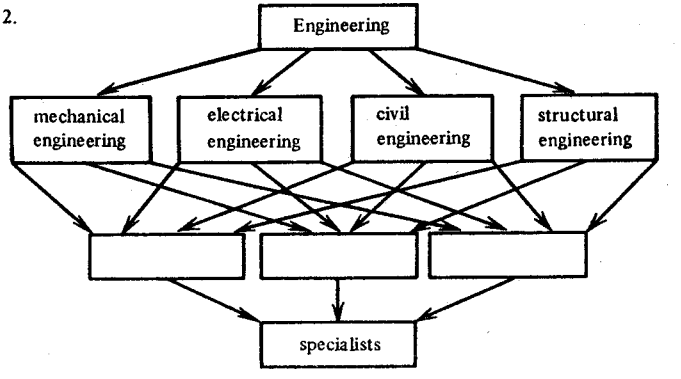
Text Study

Practice 1. Подберите из текста словосочетания для заполнения следующих диаграмм, которые отражают отношение между отраслью производства, производителем и изделием.

1.



2.



Text Discussion

Practice 1. Завершите предложения, подобрав соответствующие окончания в правом столбце.

1. At present there are...	...more scientific and specialized.
2. It is very difficult...	...the special services of specialists from various branches.
3. The main divisions of engineering are...	...numerous branches of engineering.
4. So, engineers must become...	...complicated and specialized calculations are needed.
5. In designing even a simple machine...	...to give a satisfactory classification of these branches.
6. Thus, any branch of engineering may require...	...mechanical engineering, electrical engineering, civil engineering, structural engineering and chemical engineering.

Practice 2. Заполните таблицу по образцу.

Branch of engineering	Specialist	Object of work
1. civil engineering	civil engineer	dams, tunnels, roads ...
2. mechanical engineering		
3. electrical engineering a) b)		a) b)
4. structural engineering		
5. chemical engineering		

Practice 3. Воспользовавшись заполненной таблицей из Practice 2, расскажите об основных отраслях техники, специалистах, работающих в этих отраслях, содержании их работы.

Practice 4. Ситуации для высказываний. (При подготовке используйте Active Vocabulary.)

1. Вы закончили школу и собираетесь стать инженером-строителем. Скажите, в каком вузе вы можете получить эту специальность; в чем ее специфика?
2. Вы — студент факультета «Двигатели» автомеханического института. Скажите, к какой отрасли промышленности относится автостроение; что вы знаете о своей будущей специальности.
3. Вы занимаетесь разработкой нового типа турбины для теплоэлектростанций. Скажите, помощь каких специалистов вам потребуется?

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Прилагательные, причастия
области техники	**mechanical engineering** **electrical engineering** **civil engineering** **structural engineering** **chemical engineering**	
специалисты различных отраслей техники характеристики специалистов	**metallurgist** **strength of materials expert** **mechanics** **heat expert** **production engineering expert** **engineering designer** **tool designer** **mathematician** **economist**	**specialized** **scientific**
продукты производства	**steam engine** **internal combustion engine** **turbine** **pump** **machine-tool** **generator** **motor** **radio** **tunnel** **bridge** **dam**	

Text 1B

PRE-TEXT SECTION

Practice 1. Какое событие, связанное с утверждением машиностроения как отдельной отрасли техники, упомянуто в 1-м абзаце текста?

Practice 2. Просмотрите 2-й абзац текста и определите связь между этим текстом и текстом 1A, опираясь на знание коннектора In fact.

Practice 3. В 3-м абзаце текста дается классификация отраслей и подразделений Американского общества инженеров-механиков. Какие из этих отраслей были отмечены в тексте 1A?

Mechanical Engineering

Mechanical engineering has been recognized as a separate branch of engineering since the formation of the Institution of Mechanical Engineers of Great Britain in 1847. The development of the textile machinery, steam engines, machine-tools, pumping machinery, turbines and locomotives of that time made such a diversity interest for civilian engineers that these and allied subjects were called mechanical engineering.

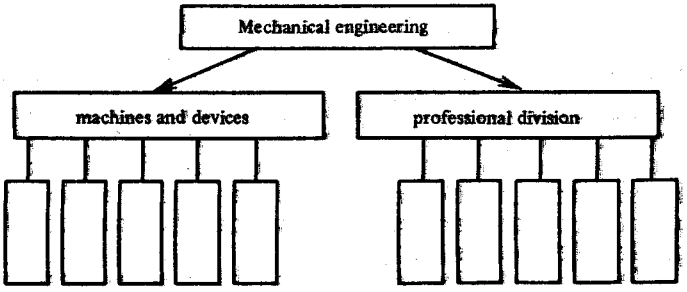
Mechanical engineering deals with the design, construction and operation of machines and devices of all kinds, and with research and sciences upon which these depend. Among these machines are prime movers such as engines and turbines using air, gas, steam and water as operating media; pumping machines and other hydraulic apparatus; steam boilers, heating, ventilating, air conditioning and refrigerating equipment, transportation structures used in aviation; automotive engineering, railroads and ships, machine-tools, special machines for industry and for construction of buildings, railroads and harbors. In fact, mechanical engineering enters into the work of all engineers whose machines are to be developed for the processes of specialists of the other branches of engineering. To understand better the extent of the activities and interests of mechanical engineers, the following lists of the professional divisions and technical committees of the American Society of Mechanical Engineers (ASME) are given:

Professional divisions; applied mechanics, aviation, fuel, graphic arts (printing), heat transfer, hydraulics, industrial instruments and regulators, management,

materials handling, metals engineering, oil and gas power, process industries, production engineering, railroad, rubber and plastics, textiles, wood industries.

AFTER-TEXT DISCUSSION

Practice 1. Заполните схему, использовав информацию текста.



Practice 2. Расскажите: а) об изделиях машиностроения; б) о структуре и деятельности Американского общества инженеров-механиков.

Text 2A

READING AND COMPREHENSION

1. **Переведите заголовок текста (он полностью раскрывает его содержание).**
2. **Прочитайте текст и определите:**

1. о каких двух основных направлениях современного машиностроения упоминается в первом абзаце;
2. в каком абзаце перечисляются новые виды автоматизированных машин и механизмов;
3. в каких абзацах говорится о методах повышения срока службы и надежности современных машин.

Trends in the Modern Machine-Building Industry

The scientific and technological progress will continue in engineering along two main headlines. Firstly, it is automation, including the creation of "unmanned" industries. Secondly, raising the reliability and extending the service life of machines.

This certainly requires new technology. The machine modules which have only begun to be made on a large scale are well suited for "unmanned" industries.

Intense work is being carried out on new robots. What we need is not merely manipulators which can take up a workpiece and pass it on, but robots which can identify objects, their position in space, etc.

We also need machines that would trace the entire process of machining. Some have been designed and are manufactured. Over the past few years this country has created new automated coal-digging complexes and machine systems, installations for the continuous casting of steel, machines for spindless spinning and shuttleless weaving, machine-tools for electrophysical and electrochemical treatment of metals, unique welding equipment, automatic rotor transfer lines and machine-tool modules for flexible industries.

New technologies and equipment have been designed for most branches of engineering.

In the shortest time possible we are to start producing new generations of machines and equipment, which would allow us to increase productivity several times and to find a way for the application of advanced technologies.

Large reserves in extending service life for machines can be found in the process of designing. At present, advanced methods have been evolved for designing machines proceeding from a number of criteria. Automatic design systems allow for an optimizing of the solutions in design and technology when new machines are still in the blueprint stage.

A promising reserve in increasing the life of parts is strengthening treatment. In recent years new highly efficient methods have been found.

First and foremost of them is the vacuum plasma methods for coating components with hard alloy compounds, such as nitrides and carbides of titanium, tungsten and boron. Methods have been designed for reinforcing machine parts most vulnerable to wear and tear, such as in grain harvesters, to make them last several times longer.

Thus, it is not merely numbers engineers and scientists are after, rather it is a matter of major characteristics. In other words, this is a matter of quality, and not of the mere number of new machines, apparatuses and materials.

WHILE-READING SECTION

Language Study

Practice 1. Догадайтесь о значении следующих интернациональных слов. Найдите данные слова в тексте и уточните их значения по контексту.

module, robot, to identify, manipulator, electrophysical, electrochemical, unique, rotor, line, productivity, to reserve, criteria, to optimize, vacuum, plasma, component, nitride, carbide, titanium, apparatus

Practice 2. a) Выпишите из 4-го абзаца текста словосочетания, обозначающие названия новых машин, механизмов, установок, и уточните их значения с помощью политехнического словаря.

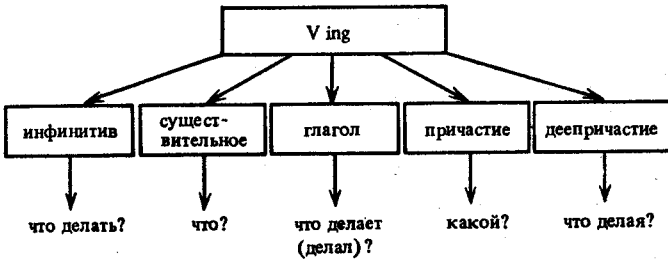
b) Переведите предложение с данными словосочетаниями на русский язык.

Practice 3. Найдите в тексте эквиваленты для следующих русских словосочетаний.

срок службы, передовые методы, электрофизическая обработка, модуль станка, система проектирования, составы из твердых сплавов, методы вакуумной плазмы, упрочнение деталей машин, гибкое производство, полностью автоматизированное производство

Practice 4.

В зависимости от места в предложении слова с суффиксом **-ing** могут иметь разные функции и, соответственно, разный перевод.



Например:

	инфинитив	— *увеличивать*
	существ.	— *увеличение*
increasing	глагол	— *увеличивает (увеличивал)*
	причастие	— *увеличивающий*
	деепричастие	— *увеличивая*

a) Переведите следующие отрезки предложений.

1. ...automation including the creation of "unmanned" industry. 2. ...a promising reserve... 3. ...strengthening treatment...

b) Найдите в 1-м и 8-м абзацах текста предложения с данными отрезками и переведите их на русский язык.

c) Найдите в 6-м, 7-м и 9-м абзацах текста предложения с -ing формами и переведите их на русский язык.

d) Переведите предложения, содержащие -ing формы. Обратите внимание на взаимосвязь между позицией -ing формы в предложении и ее переводом на русский язык.

a) Strengthening raises the service life of machine parts. We can raise the service life of machine parts by strengthening them. The technology of strengthening machine parts is called strengthening treatment.

b) Automatic systems designing new machines help the designing engineer to solve many difficult problems. Designing includes a number of criteria. Designing new machines the designer has to solve various engineering problems.

c) The industry producing all types of machines and mechanisms is called machine-building. Producing new generations of machines and equipment increases productivity. Producing new generations of machines and equipment experts find ways for the application of advanced technologies.

Practice 5.

Пассивный залог, длительный вид (Continuous Passive)

A new plant (to construct) on the Volga now.

Если глагол необходимо поставить в пассивном залоге и длительном виде, то сначала порождается форма пассива, так как это более глубокая форма в языке. По модели образования пассива глагол to construct ставится в форму:

I этап (залог) to be constructed

Затем, оставляя форму constructed в стороне по модели длительного вида, мы ставим глагол to be в форму:

II этап (вид) to be being

Далее, оставляя форму being в стороне и ориентируясь на формальные показатели времени, согласовываем форму глагола to be с подлежащим.

Получаем форму:

III этап (время) is

Таким образом, результирующая форма глагола: is being constructed сносится на уровень предложения:

A new plant *is being constructed* on the Volga now.

Формализованно это выглядит так:

A new plant (to construct) on the Volga now.

I этап (залог) to be constructed
II этап (вид) to be being
III этап (время) is

Результат: A new plant **is being constructed** on the Volga now.

The problem (to discuss) at 5 p.m. yesterday.

I этап (залог) to be discussed
II этап (вид) to be being
III этап (время) was

Результат: The problem **was being discussed** at 5 p.m. yesterday.

Notes: 1. В будущем времени форма Continuous Passive не употребляется, так как в английском языке несовместимы рядом стоящие две формы be+being. Вместо формы will be being done употребляется **will be done.**

2. Вопросительные и отрицательные предложения образуются по модели для глагола **to be.**

Найдите в 3-м абзаце текста предложение с глаголом в пассивном залоге длительном виде и объясните, какое значение оно имеет для всего последующего текста.

Practice 6. Переведите следующие предложения.

1. Much attention is being given at present to the modern equipment of research laboratories. 2. The idea of constructing a new auto plant in Tataria was being widely discussed some years ago. 3. Much is being done to improve the conditions for research work. 4. Wide investigation is being carried on in the field of machine-building now. 5. Many old plants and shops are being expanded and reconstructed now. 6. Quite new scientific research laboratories and institutes were being organ-

ized during some time in the first years of the Soviet power.

Practice 7. Составьте предложения, используя следующие формы глагола; не забудьте о формальных признаках.

1. ...was investigating... 2. ...is supplied... 3. ...will design... 4. ...is being established... 5. ...will be reconstructed... 6. ...works... 7. ... was being operated... 8. ...is provided... 9. ...will be expanding... 10. ...was being developed... 11. ...shall complete...

Practice 8. Раскройте скобки и поставьте глагол в нужную форму времени, залога, вида.

1. The question about the new laboratory (to discuss) at a special meeting yesterday at 6 p.m. 2. Different types of cars and lorries (to produce) in our country now. 3. This plant (to achieve) great results in producing fuel equipment years ago. 4. Many new scientific centres (to build) in our country now. 5. The work still (to finish). 6. My friend (to work) at a new design of this forging when I came to his laboratory a week ago. 7. Different body fixtures (to test) in this laboratory. 8. This matter (to speak about) now. 9. What you (to do) when I came in? — I (to read) an article on internal combustion engines. 10. The scale of producing a new car (to increase) with every passing year.

Practice 9. Подберите необходимые формальные показатели к следующим предложениям.

1. Great progress is being made in machine-building. (at present, last year, regularly) 2. When I came to their plant a new model of the sporting car was being tested. (tomorrow, still, soon, now, at present) 3. The greatest importance is given to the further development of specialization. (yesterday, not long ago, now, today, at that time) 4. Machine-building is a major Soviet industry. (last year, last century, today, next year) 5. The process of the technical reequipment of transport is going on. (soon, continuously, the day before yesterday, at that time) 6. The Soviet automobile industry is making progress in all types of transport. (tomorrow, next month, a year ago, soon, nowadays) 7. It is expected that cars with less toxic exhaust gases will be widely used. (now, last year, at present, in future, tomorrow, not long ago)

Practice 10. Найдите в тексте предложения со сказуемым, образованным по модели have + V ed, и переведите их на русский язык.

Practice 11. Заполните таблицу недостающими формами глаголов, использованных в тексте.

I	II	III
be	...	...
...	...	begun
make	...	...
...	carried	...
...	...	designed
create	...	...
find	...	...
...	started	...
take	...	...

Practice 12. Объясните, какое значение придают всему предложению выделенные формы глагола, переведите предложения на русский язык.

1. Although machine-building *has been* a branch of human activity for centuries, only in the 20th century *have* machines *begun* to assume such an all-important role. 2. The engineer *had visited* many plants and designing offices, he *had* personally *examined* a great deal of different types of machines and *had done* a lot of work on his thesis, performing a large number of experiments. 3. I'd like to know whether the series of experiments I *have* already *performed* and the data which I *have obtained* are enough. 4. These remarkable technological achievements *have become* possible by specially designed mechanisms and machines. 5. Man *has obtained* ultrahigh and ultralow temperatures, ultrahigh vacuums, superhigh pressures, ultrahigh strength, superelastic and superconducting materials and *has been* able to study the interaction of superhigh-energy particles.

Practice 13. Сравните следующие группы предложений по значению. Переведите их на русский язык.

a) I carry out a number of experiments. I am carrying out now a number of experiments. I have carried out a number of experiments. I carried out a number of experiments yesterday.

b) At present the research engineer is establishing the relationship between the time when the pipes were in operation and the breaking force. The research engineer has already established the relationship between the time when the pipes were in operation and the breaking force. 2 years ago the research engineer established the relation-

ship between the time when the pipes had been in operation and the breaking force.

c) Our plant produces more and more tyres with every passing year. Our plant has produced a great amount of tyres this month. Our plant produced a great amount of tyres last month.

Practice 14.

Пассивный залог, перфект (Perfect Passive)

Great progress (to make) in all types of transport since 1925.

Если глагол необходимо поставить в пассивном залоге и перфекте, то сначала порождается форма пассива, так как это более глубокая форма в языке. По модели образования пассива глагол to make ставится в форму:

I этап (залог) to be made

Затем, оставляя форму made в стороне, по модели перфекта мы ставим глагол to be в форму:

II этап (временно́й соотнесенности) to have been

Далее, оставляя форму been в стороне и ориентируясь на формальные показатели времени, согласовываем форму глагола to have с подлежащим предложения:

III этап (время) has

Таким образом, результирующая форма глагола has been made сносится на уровень предложения:

Great progress *has been made* in all types of transport since 1925.

Формализованно это выглядит так:

Great progress (to make) in all types of transport since 1925.

I этап (залог) to be made

II этап (временна́я отнесенность) to have been

II этап (время) has

Результат: Great progress **has been made** in all types of transport since 1925.

Вопросительные и отрицательные предложения образуются по модели для глагола to have.

Найдите в тексте все предложения с глаголами в пассивном залоге перфекта и переведите их на русский язык.

Practice 15. Переведите предложения, обращая внимание на значение глагольных форм.

1. All means of production have been recently expanded in our country. 2. Modern factories of diverse industries have been constructed in this industrial area in the past half decade. 3. Sixteen specialized plants including the first section of a plant in Cheboksary for the manufacture of heavy-duty tractors for melioration and construction work had been put into operation by the end of the 9th Five-Year Plan. 4. The development in all fields of science and technology has always been marked by a characteristic expansion, by a desire to advance man's potentialities in all directions. 5. Of late great attention has been paid to have materials whose properties can be changed and controlled. 6. Every tool, machine and material used by the engineer to accomplish his purpose stems directly from machine-tools or has been evolved from machines which themselves were produced by machine-tools. 7. All these components have been developed into a complicated mechanism, detailed drawings have been made of all component parts.

Practice 16. Составьте предложения, используя следующие формы глагола; не забудьте о формальных признаках.

1. ...has worked out... 2. ...is studying... 3. ...was being developed... 4. ...has been made... 5. ...works... 6. ...has manufactured... 7. ...will be produced... 8. had been finished... 9. ...will have discovered... 10. ...have been developed... 11. ...was referred to... 12. ...has been determined... 13. ...was twisting... 14. ...is bent...

Practice 17. Заполните пропуски пассивной формой глагола из первого предложения. Переведите предложения.

1. Our country *has produced* many new types of vehicles recently. Many new types of vehicles ... in our country recently. 2. The KAMAZ plant *has occupied* a huge territory of almost 1,000 hectares. A huge territory of almost 1,000 hectares ... by the KAMAZ plant. 3. After the engineer *has* finally *checked* the drawings and found them satisfactory, materials are ordered. After the drawings ... finally and found satisfactory, materials are ordered.

4. The scientists *have proved* that materials may exist whose properties are as superior to those of diamond as diamond is superior to carbon. It ... by scientists that materials may exist whose properties are as superior to those of diamond as diamond is superior to carbon. 5. To cooperate in the construction of the KAMAZ the Soviet Union *has invited* several big foreign firms. Several big foreign firms ... to cooperate in the construction of the KAMAZ. 6. Soviet specialists and representatives of the Renault Company of France *have worked out* the technological processes of manufacturing the engines. Technological processes of manufacturing the engines ... by Soviet specialists and representatives of the Renault Company of France.

Practice 18. Подберите необходимые формальные показатели к следующим предложениям.

1. Cars with less toxic exhaust gases will have been used. 2. The first Soviet automobile laboratory had been reorganized into the Automobile Research Institute. 3. This difficult problem hasn't been solved. 4. Our students have been engaged in research under the guidance of instructors this year. 5. Superplasticity of metal alloys has been discovered. 6. This astonishing phenomenon had been closely studied by many Soviet and foreign scientists. 7. What new designs will have been suggested by stylists?

---

by 1920, for 2 months, lately, by 1980, yet, for many years, by 1970, by 2000

Practice 19. Раскройте скобки и поставьте глагол в нужную форму времени, залога, вида, временной соотнесенности.

1. Our plant (to reequip) recently with every facility for body work including cold stamping of the main body components. 2. New machines (to design) nowadays to deal with new problems which continually arise in modern industry. 3. Half a century ago the phenomenon of superconductivity (to discover). 4. Now we (to enter) already the era of anisotropic multilayer and reinforced materials. 5. At present great progress (to make) in technical reequipment of automobile transport. 6. These new cars (to produce) by the Volzhsky Car Works in Togliatti. 7. An all-plastic car (to exhibit) lately: nearly the whole car except the engine and transmission is of plastics or reinforced plastics.

Practice 20. Задайте товарищу вопросы, к которым следующие положения могут служить ответами.

1. The characteristics of engineering materials affect manufacture and application of materials. 2. Mechanical properties of a material are of great interest to the engineer. 3. Superplasticity has been detected in a great number of metals and alloys. 4. Many Soviet scientists have contributed to the solution of all these fundamental problems.

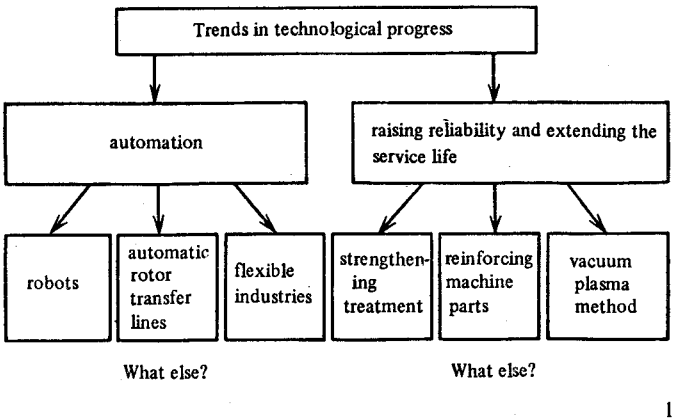
Practice 21. Поставьте специальные вопросы к каждому абзацу текста.

Text Study

Practice 1. Определите, какие из данных высказываний соответствуют содержанию текста.

1. There are two main trends in modern machine-building: automation and raising of the reliability of machines. 2. The creation of "unmanned" industries is included into automation. 3. Machine madules and robots are not suited for "unmanned industries". 4. Automation and raising of the reliability of machines require new technologies. 5. Advanced technologies are applied in most branches of engineering. 6. The service life of machine parts can't be increased by strengthening treatment. 7. Hard alloy compounds are employed for coating components. 8. The process of designing can also be automated. This gives the advantage of optimizing solutions in design and technology.

Practice 2. a) Изучите приведенную ниже диаграмму. b) Найдите в тексте 2A абзацы, соответствующие положениям схемы. c) Дополните диаграмму, если это необходимо.



AFTER-TEXT SECTION

Text Discussion

Practice 1. Ответьте на вопросы по теме "Trends in Modern Machine-building Industry".

1. Name the main trends in modern machine-building. 2. What does automation include? 3. In what way can automation be achieved? 4. What is the role of new technologies? 5. Give some examples of advanced methods for increasing the service life of machine parts. 6. How can the process of designing be improved? 7. What is the main task of the engineers and scientists developing new machines and technologies?

Practice 2. Подготовьте сообщения по теме "Trends in Modern Machine-building Industry" (при подготовке воспользуйтесь диаграммой Practice 2, с. 165 и нижеприведенным активным словарем).

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы, глагольные сочетания	Слова — организаторы научной и технической мысли
научный и технический прогресс	**automation** **unmanned industry** **flexible industry** **advanced technology** **intense work**	**to raise reliability** **to extend the service of life** **to increase productivity**	**firstly** **secondly** **in other words**
машины, механизмы и их работа	**robot** **manipulator** **welding equipment** **transfer line** **machine-tool** **module installation**	**to trace the process** **to take up a workpiece** **to identify an object**	**thus** **such as** **certainly**
процессы, методы	**continuous casting treatment** **strengthening treatment** **reinforcing** **manufacturing** **machining** **vacuum plasma method**		

Text 2B

PRE-TEXT SECTION

Practice 1. Прочитайте заголовок и скажите, о чем, по вашему мнению, пойдет речь в тексте.

Practice 2. В каком абзаце говорится об исследованиях влияния трения на износостойкость деталей машин?

Practice 3. В 4-м абзаце текста перечисляются способы проверки качества компонентов различных машин. Сколько именно?

Practice 4. Найдите предложение, формулирующее значение надежности для решения задачи широкомасштабной автоматизации.

Reliability

Reliability is a basic requirement of any instrument, plant or machine. The most ingenious machine is nothing but useless unless it is reliable.

At present the main defect in any machine is the different service life of its parts. The first to break down are parts with friction, the most numerous in any machine. Until quite recently scientists differed in their explanations of why parts subject to friction break.

At present scientists at the Blagonravov Institute for the Study of Machines at the USSR Academy of Sciences are engaged in research into friction and wear-and-tear resistance. The results of their comprehensive research will extend the useful life of units with friction by thirty to fifty percent as compared with what we have now.

Sufficient reliability and long service life of highly complicated automatic complexes, spaceships and assembly lines can be ensured by the high quality of their components, their accurate assembly and continuous checking while in operation, as well as by detecting faults as soon as they appear. This means that instruments are necessary for checking metal billets; all kinds of test installations and multiple switching control devices by which temperature, pressure and density in any part of a system may be inspected a number of times over a period of only one second. We need diagnostic systems and many different types of flaw detectors and sensors because, as is known, reliability is the key which opens the way to large-scale automation.

AFTER-TEXT DISCUSSION

Practice 1. Суммируйте информацию текста, дополнив следующую таблицу.

Факторы, влияющие на срок службы и надежность компонентов		Способы проверки качества компонентов	
англ.	русск.	англ.	русск.
1.	высокое качество компонентов	checking metal billets	
2.	точная сборка	employing test installations	
3. continuous checking while in operation			использование контрольных приборов для проверки температуры, давления, плотности
4. immediate detecting faults			применение диагностических систем, дефектоскопов и датчиков

Practice 2. Ответьте на следующие вопросы.

1. Why is the service life of different machine parts different? 2. What factors do the service life and reliability of complicated systems depend on? 3. In what ways can the quality of machine parts be inspected?

Text 3A

READING AND COMPREHENSION

Прочитайте текст и определите:

1. о каких двух характерных чертах машиностроения XX века идет речь;
2. в каком абзаце идет речь о повышении производительности сборочного конвейера;
3. в связи с каким событием упомянуты в тексте 40-е годы XX века.

Industrial Engineering and Automation

A major advance in twentieth century manufacturing was the development of mass production techniques. Mass production refers to manufacturing processes in

which an assembly line, usually a conveyer belt, moves the product to stations where each worker performs a limited number of operations until the product is assembled. In the automobile assembly plant such systems have reached a highly-developed form. A complex system of conveyer belts and chain drives moves car parts to workers who perform the thousands of necessary assembling tasks.

Mass production increases efficiency and productivity to a point beyond which the monotony of repeating an operation over and over slows down the workers. Many ways have been tried to increase productivity on assembly lines: some of them are as superficial as piping music into the plant or painting the industrial apparatus in bright colors; others entail giving workers more variety in their tasks and more responsibility for the product.

These human factors are important considerations for industrial engineers who must try to balance an efficient system of manufacturing with the complex needs of workers.

Another factor for the industrial engineer to consider is whether each manufacturing process can be automated in whole or in part. Automation is a word coined in the 1940s to describe processes by which machines do tasks previously performed by people. The word was new but the idea was not. We know of the advance in the development of steam engines that produced automatic valves. Long before that, during the Middle Ages, windmills had been made to turn by taking advantage of changes in the wind by means of devices that worked automatically.

Automation was first applied to industry in continuous-process manufacturing such as refining petroleum, making petrochemicals, and refining steel. A later development was computer-controlled automation of assembly line manufacturing, especially those in which quality control was an important factor.

WHILE-READING SECTION

Language Study

Practice 1. Расположите слова списка (a) в алфавитном порядке. Найдите по словарю их перевод. Переведите словосочетания списка (b).

a) production, belt, line, engineer, process, manufacturing, automation;

b) mass production, conveyer belt, assembly line, industrial engineer, manufacturing process, continuous-process manufacturing, assembly line manufacturing, computer-controlled automation

Practice 2.

V + ing → процесс

to control управлять — controlling управление

Прочитайте текст еще раз и определите, какие процессы в производстве описаны в тексте.

1. ...piping music into the plant... 2. ...painting an industrial apparatus... 3. ...refining petroleum... 4. ...making petrochemicals... 5. ...refining steel...

Practice 3.

$V + \begin{matrix}er\\or\end{matrix}$ → деятель, производитель

to produce производить — producer производитель

Определите производителей следующих процессов, упомянутых в тексте. Ответ дайте на русском и английском языках. Для самоконтроля воспользуйтесь словарем.

to convey, to work, to manufacture, to control, to paint

Practice 4. Перефразируйте следующие отрезки предложений, следуя образцу, и переведите их. После этого найдите предложения в тексте и переведите предложения полностью.

Model: ...another factor to consider... → another factor which should be considered → другой фактор, который следует рассмотреть

1. ...the parts to assemble... 2. ...a word to describe the process... 3. ...windmills to turn... 4. ...steel to refine...

Practice 5. Прочитайте текст еще раз и найдите в нем словосочетания, равнозначные по значению следующим.

1. ...manufacturing of large quantities of similar products with each worker in the plant performing only a limited number of operations on the product... 2. ...an arrangement of equipment, machines and workers so that work passes in line until the product is assembled... 3. ...the process of operating and controlling mechanical

devices by automatic means without action by human beings...

Practice 6. a) Найдите слово с обобщающим значением.

system, conveyer, drive, assembly line

b) Найдите словосочетания с обобщенным значением.

continuous-process manufacturing, making petrochemicals, steel refining, petroleum refining

c) Найдите слова, которые используются для характеристики производства.

production, productivity, efficiency, operation, process, belt, advance

Practice 7.

Определение технического понятия объекта включает в себя: название технического понятия N_1, класс (группу), к которому оно относится N_2, характеристику понятия, обычно представленную придаточным предложением с wh-word. Модели:

1. N_1 means N_2 N_1 refers to N_2 N_1 is defined as N_2	Aluminium is defined as metal.
2. N_1 is N_2	Aluminium is metal.
3. N_1 is N_2 wh-word	Aluminium is metal which is used in engineering.

Используя информацию Practice 4 и содержание текста, заполните таблицу.

Term	Class	Characteristics
mass production	manufacturing process	in which...
conveyer belt	...	which...
automation	...	...

Practice 8. Найдите в тексте предложения со сказуемым, образованным по модели have + V ed, и объясните необходимость употребления этих форм с точки зрения их значимости для всего текста.

Practice 9. Переведите следующие предложения на русский язык; обратите особое внимание на значение глагольных форм.

1. The technology used at this plant has been improved. 2. Every object of our industrialized world has flown from the machine-tool. 3. The production engineer has planned the flow of the material into the finished product. 4. After the engineer had made the necessary calculations he applied his results in designing a new project. 5. By the 1920's Soviet engineers had introduced some automatic machine-tools into most processing industries. 6. The distinguishing qualities of aluminium have been described in this article. 7. The new plastic has been selected for manufacturing the body of a new car. 8. The properties of this substance had been determined by the end of last month. 9. All the variables affecting the strength of this metal have been controlled in the mechanical test, the strength will have been determined by the end of this week.

Practice 10. Найдите во 2-м абзаце предложение со сравнительной конструкцией, образованной по модели "N_1 is as A as N_2". Переведите его на русский язык.

Сравнительные конструкции

N is as A as N
N is not so A as N

Cast-iron	is	as useful almost as useful almost as useful a material	as	steel.
Cast-iron	is	not so expensive not quite so expensive not quite such an expensive material not quite such an expensive material to produce	as	steel.

Practice 11. a) Переделайте предложения, употребив конструкцию as ... as.

Model: This car is the same size as that.
This car is *as* big (small) *as* that.

1. This device is the same price as that. 2. This machine is the same size as that. 3. This tyre is the same height as that. 4. This suspension is the same weight as that. 5. This tyre is the same width as that. 6. These materials are the same hardness as those. 7. This road is the same length as that.

b) Переделайте предложения, употребив отрицательную конструкцию not so ... as.

Model: This problem is hardly as important as that.
This problem is *not so* important *as* that.

1. This method is hardly as effective as that. 2. These results are hardly as interesting as Comrade Petrov's. 3. Mr. Smith's research is hardly as important as Mr. Black's. 4. This device is hardly as useful as that. 5. The apparatus is hardly as cheap as that. 6. Comrade Klimov's knowledge in physics is hardly as deep as Comrade Ivanov's.

Practice 12. Предложения, полученные в Practice 11, переделайте в новые, употребив конструкцию less ... than.

Model: This problem is not so important as that.
This problem is *less* important *than* that.

Practice 13. Запомните следующую таблицу сравнения с количественными данными. Обратите внимание на место слов, обозначающих количество, в конструкциях сравнения.

The plant	is	25 years older than twice more efficient than twice as old as 3 times as old as half as old as half the size of	that plant.

Practice 14. Соедините два предложения в одно, используя одну из моделей сравнения:

Model: 1. A is larger *than* B.
2. B is *not so* large *as* A.
3. B is smaller *than* A.
4. A is *not so* small *as* B.

1. The British engine weighs 3 tons; the French engine weighs $3^1/_2$ tons. 2. The temperature in this room is 28 °C; the temperature outside the room is 22 °C. 3. Alcohol boils

at 78 °C; water boils at 100 °C. 4. The journey takes 4 hours by day; it takes 5 hours at night. 5. Our car moves fast. Their car moves faster. 6. Your experiment is difficult. Our experiment is more difficult.

Practice 15. Закончите предложения, используя сравнительную степень в конструкции the ... the (чем ... тем) по модели.

Model: *The more* you read *the more* you enlarge your vocabulary.

1. The earlier the problem's solution is found the ... . 2. The greater the efforts of scientists and engineers the ... . 3. The better the experimental design the ... . 4. The more accurate the calculations the ... . 5. The clearer the definition of a task the ... . 6. The better the experimental technique the ... . 7. The more reliable the results the ... .

Practice 16. Найдите в 1-м абзаце текста предложение, в котором говорится об обозначении определенного количества операций. Переведите его на русский язык. Обратите внимание на то, что обозначение количества в английском языке находится в прямой зависимости от исчисляемости/неисчисляемости существительных.

Обозначение количества с исчисляемыми существительными

<table>
<tr><td rowspan="3">There are</td><td colspan="3">few
not many
a few
some</td><td rowspan="3">cars in front of the plant.</td></tr>
<tr><td rowspan="2">a</td><td>small
certain</td><td rowspan="2">number of</td></tr>
<tr><td>large
great
considerable</td></tr>
<tr><td colspan="3">a great many
a lot of
plenty of</td></tr>
</table>

Обозначение количества с неисчисляемыми существительными

<table>
<tr><td rowspan="4">There is</td><td colspan="3">little
not much
a little
some</td><td rowspan="4">fresh air in this shop.</td></tr>
<tr><td rowspan="2">a</td><td>small
certain</td><td rowspan="2">amount of</td></tr>
<tr><td>large
great
considerable</td></tr>
<tr><td colspan="3">a great deal of
a lot of
plenty of</td></tr>
</table>

Practice 17. Ответьте на следующие вопросы, используя подходящую фразу из таблиц, приведенных выше.

1. How many tyres a year does this plant produce? 2. How much power do you need to drive a large liner through the water? 3. Are there many plants in our country? 4. Now much petroleum is pumped out of the ground every year? 5. What percentage of people in our country work in factories? 6. How much oxygen is needed to burn a ton of coal? 7. How much of our country's electrical supply is derived from water power?

Practice 18. Выберите из текста предложения с исчисляемыми или неисчисляемыми существительными, к которым можно было бы поставить вопросы How many? и How much? Запишите полученные вопросы в таблицу.

с исчисляемыми существительными	с неисчисляемыми существительными

Text Study

Practice 1. Определите, какие из приводимых парных высказываний соответствуют содержанию текста.

a) 1. Mass production *referred* to manufacturing processes with an assembly line. 2. Mass production *refers* to manufacturing processes with an assembly live.

b) 1. Automated processes do tasks which *have been performed* by people. 2. Automated processes do tasks which *were performed* by people.

c) 1. Automation was *first* applied to assembly line manufacturing, *then* to continuous-process manufacturing such as refining steel. 2. Assembly line manufacturing was a *later* development of industrial automation.

Practice 2. Соедините следующие пары предложений между собой с помощью союзов, предлогов и других коннекторов.

a) where

A conveyer belt moves the product to stations. Each worker performs a limited number of operations.

b) who

A complex system moves car parts to workers. The workers perform necessary assembly tasks.

c) by + ...V ing

Model: Productivity was increased. The music was piped into the plant.
Productivity was increased *by piping* music into the plant.

1. Productivity was increased. The industrial apparatus was painted in bright colors. 2. Productivity was increased. The workers were given a variety of tasks.

Practice 3. Заполните следующую таблицу отрывками предложений из текста и их переводом.

Характерные черты современного машиностроения		Примеры воплощения этих черт	
англ.	русск.	англ.	русск.
1. Mass production technique 2. Automation		1 2 3	

AFTER-TEXT SECTION

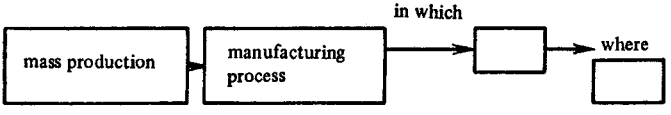
Text Discussion

Practice 1. Ответьте на вопросы.

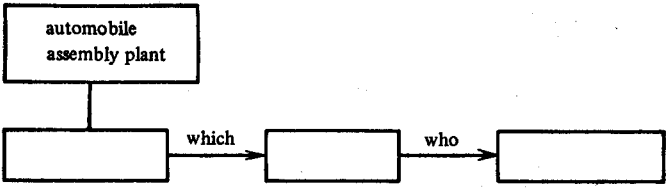
1. What is a major development in manufacturing in the twentieth century? 2. How is mass production often exemplified by the assembly of automobiles? 3. Discuss efficiency and productivity in mass production. 4. Describe some experiments to increase productivity on assembly lines. 5. When and why was the word "automation" coined? 6. Give some examples of automation that were in use before the word itself was created. 7. To what kinds of industries was automation first applied? 8. What was a later development in industrial automation?

Practice 2. Приготовьте сообщение на данные темы, предварительно заполнив следующие схемы. Воспользуйтесь разделом Active Vocabulary (с. 178).

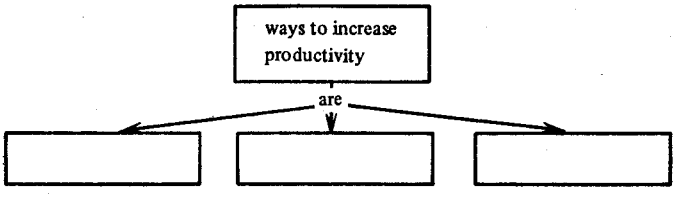
1. Характерные черты массового производства.



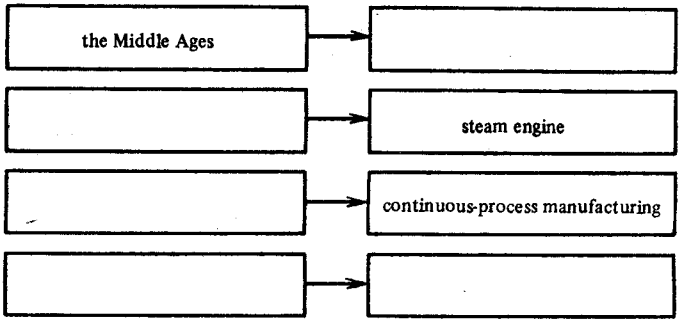
2. Сборочный конвейер на автомобильном заводе.



3. Способы увеличения производительности конвейера.



4. Внедрение автоматизации в производство.



Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы	Слова — организаторы научного мышления
виды производства	**assembly line** **conveyer belt** **chain drive** **manufacturing process** **machine** **steam engine**	**to move** **to assemble** **to perform** **to increase** **to produce** **to work**	**first** **long before that** **especially**
автоматизация	**automatic valve** **continuous-process manufacturing** **refining steel** **computer-controlled automation** **quality control**		
характеристика производства	**efficiency** **productivity** **responsibility for the product** **advance** **development** **monotony**		

Text 3B

PRE-TEXT SECTION

Practice 1. Прочитайте текст и определите, что составляет основные части автоматической системы.

Practice 2. Даются ли в тексте функции каждого элемента системы?

Practice 3. Озаглавьте текст.

We now use the term automation for specific techniques combined to operate automatically in a complete system. These techniques are possible because of electronic devices, most of which have come into use in the last thirty years. They include program, action, sensing or feedback, decision, and control elements as components of a complete system.

The program elements determine what the system does and the step-by-step manner in which it works to produce the desired result. A program is a step-by-step sequence that breaks a task into its individual parts. Some steps in an industrial automation program direct other parts of the system when and how to carry out their jobs.

The action elements are those which do the actual work. They may carry or convey materials to specific places at specific times or they may perform operations on the materials. The term mechanical handling device is also used for the action elements.

Perhaps the most important part of an automated system is sensing or feedback. Sensing devices automatically check on parts of the manufacturing process such as the thickness of a sheet of steel or paper. This is called feedback because the instruments return or feed back this information to the central system control.

The decision element is used to compare what is going on in the system with what should be going on; it receives information from the sensing devices and makes decisions necessary to maintain the system correctly. If some action is necessary the decision element can give instructions or commands to the system.

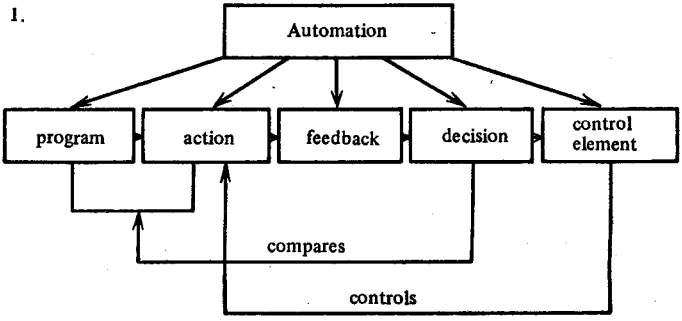
The control element consists of devices to carry out the commands of the decision element. They may be many kinds of devices: valves that open or close, switches that control the flow of electricity, or regulators that change the voltage in various machines; they make the necessary corrections or adjustments to keep the system in conformity with its program.

An industrial engineer working with automated systems is part of a team. Many components of the system, such as computers, are electronic devices so electronic engineers and technicians are also involved. Many of the industries in which automation has proved particularly suitable — chemicals, papermaking, metals processing — involve chemical processes, so there may be chemical engineers at work too. An industrial engineer with expertise in all these fields may become a systems engineer for automation projects thereby coordinating the activities of all the members of the team.

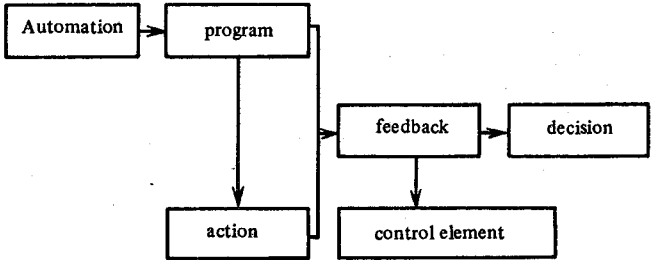
AFTER-TEXT DISCUSSION

Practice 1. Определите, какая из схем точнее отражает основное содержание текста.

1.



2.



Practice 2. Назовите функции каждого элемента автоматической системы по-русски.

Practice 3. Ответьте на следующие вопросы.

1. What are some elements of an automated system? What makes them possible? 2. What is a program? What

does it do in an automated system? 3. Name two terms used to describe the elements which do the actual work. What are some jobs these elements may do? 4. What are some of the things sensing devices do? 5. How do sensing devices act on the information they receive? Why is the process sometimes called feedback? 6. What is the function of the decision element? What can it do? 7. What does the control element consist of? What can these devices do? What is their purpose?

SELF-TRAINING PRACTICE: SUPPLEMENTARY TEXTS

Text 1

Pre-Text Section

Practice 1. Прочитайте текст и скажите, о каких четырех этапах в развитии мировой индустрии идет речь и чем каждый из них характеризуется.

Four Industrial Revolutions

The history of mechanical engineering goes back to the time when the man first tried to make machines. We can call the earlier rollers, levers and pulleys, for example, the work of mechanical engineering.

Mechanical engineering, as we understand it today, starts from the first Industrial Revolution.

People have labelled as "revolutions" three episodes in the industrial history of the world and now we are entering the fourth.

The first industrial revolution took place in England between 1760 and 1840. Metal became the main material of the engineer instead of wood, and steam gave man great reserves of power. This power could drive not only railway engines and ships but also the machines which built them.

In the second revolution, from 1880 to 1920, electricity was the technical driving force. It provided power for factories that was easier and cheaper to control than steam. It was marked also by the growing importance of science-based industries such as chemicals and electrical goods, and the use of scientifically-designed production methods such as semi-automatic assembly lines.

The third industrial revolution coincided with the advent of automation — in its inflexible form. In this revolu-

tion, the main features were advances in the control of manufacturing processes so that things could be made more cheaply, with greater precision and (often) with fewer people. And this change, which occurred around the middle of this century, also featured a new machine that was to greatly influence the world, the electronic computer.

What is the fourth industrial revolution?

The fourth industrial revolution will be characterized by automated machines that are versatile and programmable and can make different things according to different sets of computer instructions. It will be characterized by flexible, automated machinery, the most interesting example of which are robots.

---

to coincide совпадать
advent приход, появление
inflexible негибкий
advance успех, прогресс
to occur происходить
to influence оказывать влияние на
versatile гибкий
sets of computer instructions программы компьютера

After-Text Section

Practice 1. Суммируйте информацию текста, заполнив следующую таблицу.

N	Period	Main features
1.	1760-1840	1. metal — the main material for the engineer. 2. steam — the driving technical force.
2.		1. 2. 3.
3.		1. 2.
4.		1.

Text 2

Pre-Text Section

Practice 1. Прочитайте следующее утверждение из текста.

Mechanical engineers are at the core of production. Without them production would be impossible.

Согласны ли вы с подобным утверждением? Какими факторами, по-вашему, определяется значимость роли инженера-механика в производстве? Перечислите их.

Practice 2. Прочитайте текст с целью определения правильности ваших предположений.

Practice 3. Озаглавьте текст.

Demand for qualified mechanical engineers is high.

Mechanical engineers have a wide range of job opportunities. They may be management, sales, development, research, or design or production engineers in industries such as food, steel, chemicals and heavy and light engineering. They also can work in service industries such as transport and gas, water and electricity.

Mechanical engineers are vital to the running of plants. Without them production would be impossible. Each plant is likely to be different. Some are large, some are small and most are complex. The main operational objectives of safety, efficiency and profitability are common to them all and demand a range of technical and personal skills from the engineers.

Mechanical engineers are concerned with machines, mechanisms and energy convertion. Mechanical equipment is at the core of the plants. Each plant is different from the next: the machines are particular to the process involved in making the end product and mechanical engineers are involved in their design, building and operation. They are at the forefront of technology: pressing the limits of material capability, developing new materials of construction, specifying complex machines and doing all of this with the most sophisticated design techniques.

Mechanical engineers' jobs are demanding and exciting. Their skills, technical and managerial, are used to the fullest. In plant operation the job is to keep the plant running and stimulate the team to make better use of equipment to improve performance.

Mechanical engineers are at the core of production: they manage plant and equipment, they manage people. In fact, they manage our future.

---

vital важный, существенный
running of the plant работа завода
objective цель
profitability прибыльность, рентабельность
to be at the core of занимать ключевое положение
at the forefront на переднем плане
to push the limits of ... capability расширять возможности
sophisticated сверхсложный

After-Text Section

Practice 1. Вы ознакомились с содержанием текста. Подтвердились ли ваши предположения? Прочитайте предложения, подтверждающие ваши предположения.

Practice 2. Опираясь на информацию текста, перечислите сферы деятельности инженера-механика.

Text 3

Pre-Text Section

Practice 1. Переведите заглавие текста, предварительно выписав из словаря все значения слова efficiency.

Practice 2. Прочитайте текст и определите, в каком значении слово efficiency употреблено в нем.

Practice 3. Внесите, если необходимо, корректировку в ваш перевод заглавия.

Practice 4. В тексте часто встречаются слова input и output, перевод которых дан в конце текста. Прочитайте текст еще раз и скажите, что подразумевается под этими словами в данном тексте.

Efficiency in Engineering Operation

Unlike the scientist, the engineer is not free to solve problems which interest him. He must solve problems as they arise, his solution must satisfy conflicting requirements. Efficiency costs money, safety adds complexity, performance increases weight. The engineering solution is the optimum solution, taking into account many factors. It may be the cheapest for a given performance, the most reliable for a given weight, the simplest for a given safety, or the most efficient for a given cost. Engineering is optimizing.

To the engineer, efficiency means output divided by input. His job is to secure a maximum output for a given input or to secure a given output with a minimum input. The ratio may be expressed in terms of energy, materials, money, time or men. Efficiency is achieved by using efficient methods, devices, and personnel organisations.

The need for efficiency leads to the large, complex operations which are characteristic of engineering. The processing of the new antibiotics in the test-tube stage belongs in the field of biochemistry. But when great quantities must be produced at low cost, it becomes an engineering problem. It is the need for efficiency and economy that differentiates ceramic engineering from the work of the potter, textile engineering from weaving, and agricultural engineering from farming.

Since output is input minus losses, the engineer must keep losses and waste to a minimum. One way is to develop uses for products which otherwise would be waste. Losses due to friction occur in every machine and in every organisation. Efficient functioning depends on good design, careful attention to operating difficulties, and lubrication.

The raw materials with which engineers work seldom are found in useful forms. Engineering of the highest type is required to conceive, design and achieve the convertion of the energy of a mountain stream into the powerful torque of an electric motor. Similarly, many engineering operations are required to change the sands of the seashore into the precise lenses which enable us to observe the microscopic amoeba in a drop of water. In a certain sense, the successful engineer is a person always trying to change things for the better.

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to arise возникать, появляться
complexity сложность
performance рабочие характеристики
output выходная величина
input входная величина
ratio соотношение
to belong in относиться к
quantity количество
potter гончар
to weave ткань
waste отходы
losses due to friction потери, вызванные трением
torque крутящий момент

After-Text Section

Practice 1. На основании информации текста перечислите проблемы, с которыми сталкивается инженер при обеспечении наивысшего КПД.

Text 4

Pre-Text Section

Practice 1. Прочитайте заглавие. Какую информацию вы предполагаете получить в тексте с подобным заглавием?

Practice 2. Прочитайте текст с целью подтверждения правильности ваших предположений.

Practice 3. Вы ознакомились с содержанием текста. Подтвердились ли ваши предположения? Достаточно ли полно отражает заглавие содержание текста? Предложите свой вариант заглавия.

The Planemakers

There are 2 main things that make aircraft engineering difficult: the need to make every component as reliable as

possible and the need to build everything as light as possible.

Given a certain power of engine and a certain fuel consumption, there is a practical limit to the total weight of aircraft, that can be made to fly. Out of that weight as much as possible is wanted for fuel, radio navigational instruments and, of course, for passengers or freight themselves. So the structure of the aircraft has to be as small and light as safety and efficiency will allow. The designer must calculate the normal load that each part will bear. This specialist is called the "stress man".

The stress man's calculations go to the designer of the part, and he must make it as strong as the stress man says. One or two samples are always tested to prove that they are as strong as the designer intended. Each separate part is tested, then a whole assembly — for example, a whole wing, and finally the whole aeroplane. When a new type of aeroplane is being made normally only one of the first three made will be flown. Two will be destroyed on the ground in structural tests. The third one will be tested in the air.

Two kinds of ground strength tests are carried out. The first is to find the resistance to loading of the wings, tail, etc. until they reach their maximum load and collapse. The other test is for fatigue strength. Small loads are applied thousands of times. Each may be well as a single load, but many repetitions can result in collapse.

When a plane has passed all the tests it can get a government certificate of airworthiness without which it cannot fly.

Making the working parts reliable is as difficult as making the structure strong enough. The flying controls, the electrical equipment, etc. must not only be light in weight, but must work both at high altitudes where the temperature may be below freezing point and in the hot air in the tropics.

To solve all these problems the aircraft industry has a large number of research workers, with elaborate laboratories and test houses. And new materials to give the best strength in relation to weight are constantly being tested.

---

fuel consumption потребление топлива
load нагрузка
to bear выдерживать
sample образец
fatigue strength сопротивление усталости
assembly узел
altitude высота
freezing point точка замерзания

After-Text Section

Practice 1. Выберите ответ, который наиболее точно соответствует информации текста.

1. The 2 main requirements of aircraft design are:
   — speed and passenger comfort
   — making things both light and reliable
2. The maximum possible weight of an aircraft is determined by
   — the engine power.
   — the number of passengers
3. The stress man's job is to calculate
   — how safe the plane is
   — how strong each part must be.
4. The first three aeroplanes of a new type
   — do not fly
   — are used for testing purposes
5. All equipment in an aircraft must
   — work especially well at high temperature
   — work perfectly within a wide range of temperature
6. Certificates of airworthiness are given by
   — the aircraft industry
   — the government
7. Research workers
   — are employed in large numbers by the aircraft industry
   — do not need elaborate laboratories
8. New materials are
   — too expensive to use in the aircraft industry
   — put to a variety of tests.

Practice 2. Суммируйте информацию текста, воспользовавшись составленными вами предложениями из Practice 1.

Text 5

Pre-Text Section

Practice 1. Прочитайте текст и скажите:

1. чем вызвана необходимость создания гибкого производства;
2. что входит в понятие гибкого производства.

Towards Flexible Production Facilities

Present-day industry, in particular engineering, is defined by the fact that its products — machine-tools, devices, instruments, etc.— are normally produced for a very short period of time and replaced by other more advanced products. The range of products is growing and the size of batches is decreasing. The new production environment has brought about new requirements. Thus, for example, earlier functionally "rigid" automatic production lines require considerable changes to be introduced or the line to be fully dismantled when the factory switches to a new product. Unlike the above lines, flexible production lines can be switched over to a new product virtually instantaneously. When operated on a 24-hour basis, these lines need only a minimal team of operators to attend the production.

A set of modules can be combined by a transport-and-storage system and a control system into a production line (or a production area). In the Soviet Union such lines form the basis for automated workshops capable of producing 100-250 parts of similar shape, sizes and requiring similar machining operations (milling, cutting, drilling, etc.).

The highest level of a flexible production facility, an automatic factory, incorporates several flexible production workshops. Such a factory has both automated equipment and automated services, including computer-aided design of products and processes, and software development for its control systems. Such automated factories are being designed and are expected to become fully operational in the near future. The USSR and other industrialized countries are currently making use of flexible modules and workshops.

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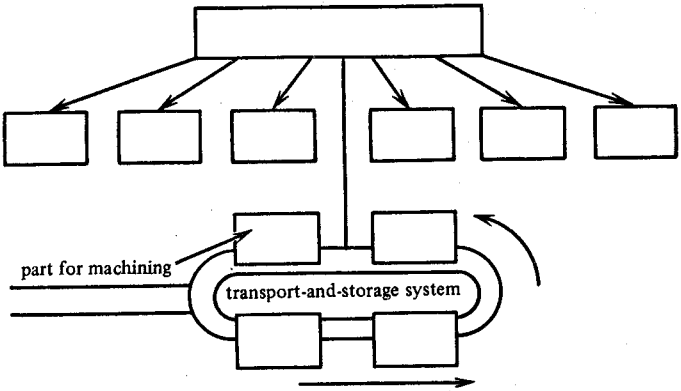
to define определять
range ассортимент
batch партия, серия
to dismantle демонтировать
to switch переходить, переключаться на
part заготовка
software программное обеспечение

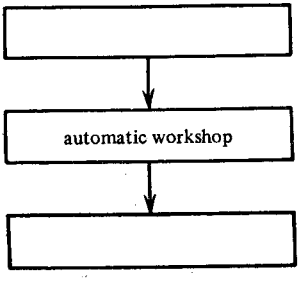
After-Text Section

Practice 1. На основании полученной из текста информации заполните следующие схемы.

1. Automatic Production Line



2. Flexible Production Facilities



Text 6

Pre-Text Section

Practice 1. В тексте прослеживается путь развития производства от ранней стадии механизации до автоматизации. Прочитайте текст и определите основные этапы этого пути.

Practice 2. Предложите свои варианты заглавия текста.

Machines Through the Age

Mechanization, or the use of machines to do the work of animals or people, has been with us for centuries. There are six basic kinds of mechanization. Classification depends on whether machines, or combinations of animals

and people, are responsible for the three fundamental elements that occur in every type of activity — power, action and control.

The first kind of mechanization is introduced by typing. In typing words, a body produces "the power" to drive a machine, but the machine produces "action"; control is with the body. In one of the early mechanized devices, the horse and cart, an animal is responsible for power, while a person controls the mechanism, but the element responsible for action — the cart's wheels and axles — is mechanical. The horse and cart is a simple example of a mechanism that saves the human body from doing something.

In the second kind of mechanization, hardware is responsible for both power and action. In a car, for example, the wheels, gears and so on provide action while the engine supplies power.

Wind-and water-mills are another kind of mechanized device. Like cars, they use inanimated power source (air or water). But these power sources are not within a person's control.

The next 2 types of mechanized devices are all partly automatic. They are mechanically controlled; a person does not have to be present to supervise them.

Simple automatic devices are not new. Soon after the first machine-tools appeared late in the 18th century, engineers modified them so that they could work by themselves for some of the time. An operator would set his machine so that it cut a piece of metal automatically. He would not have to do anything while the operation took place. The control devices here were camshafts and stops.

The fifth example of mechanization is semi-automatic equipment. Here people are required for only some elements of control. In this category are assembly lines with the conveyer systems of the 19th and early 20th centuries with which, for instance, Henry Ford's first factories assembled cars. In this system parts move from one part of the factory to another on an automatic conveyer. But people have to be present. They stand next to the lines to fit things onto the parts as they move past.

Finally, the sixth kind of mechanization is truly automatic devices, such as transfer lines, computer controlled machine-tools, robots.

So to get a strict definition of automation, we can say: automation = mechanization + automatic control.

activity деятельность
action действие
typing печатание
axle мост
hardware схема ЭВМ
partly частично
inanimate неживой
to supervise смотреть, наблюдать (за чем-либо)
to set the machine наладить машину
camshaft коленвал
to fit устанавливать
strict definition точное определение

After-Text Section

Practice 1. Опираясь на информацию текста, заполните следующую таблицу.

Mechanization			Mechanization with automatic control		
without mechanical power	with controllable mechanical power	with incontrollable mechanical power	automatic devices	with semi-automatic control	automation
1. 2. horse and cart	1.	1. 2.	1. automatic machine-tool	1.	1. 2. 3. robots

Practice 2. Сделайте сообщение на тему "From Mechanization to Automation". Воспользуйтесь при этом составленной вами таблицей.

Text 7

Pre-Text Section

Practice 1. Этот текст, как и предыдущий, посвящен автоматизации производства. Вспомните все, что вы знаете об этом.

Practice 2. Прочитайте текст и скажите, какую новую информацию вы получили, в каких абзацах она содержится.

Practice 3. Не пользуясь словарем, определите на основании информации текста значение следующих слов и словосочетаний.

system approach, programmability, feedback

Practice 4. Озаглавьте текст.

Automation is the third phase in the development of technology that began with the industrialization of the 18th century. First came mechanization which created the factory system and separated labour and management

in production. Mechanization was a technology based on forms and applications of power. Mass production came next. It was a technology based on principles of production and organization. Automation is a technology based on communication, computation and control.

The truly automated devices must possess one or more of the following elements: system approach, programmability, feedback.

With a system approach, factories which make things by passing them through successive stages of manufacturing without people intervening to transfer lines, which made their debut in car factories before the Second World War, are considered automated systems. These carry components past lines of machine-tools which each cuts them automatically. People are not required; the machines clamp the parts out of themselves without a workman being present. Thus transfer lines are different from assembly lines where people are very much in evidence.

With programmability, a system can do more than one kind of job. An industrial robot is an automated machine. It works automatically and an operator can reprogram the computer that controls it to make the machine do different things.

Finally, feedback makes an automatic device vary its routine according to changes that take place around it. An automatic machine-tool with feedback would have sensors that detect, for example, if the metal it is cutting is wrongly shaped. If it is, the sensors instruct the machine to vary its routine accordingly. Other examples of devices with feedback are robots with "vision" or other sensors that can "see" or "feel" what they are doing.

Most examples of automation in factories today are not "programmable"; neither do they work with feedback. They are simply sets of machine-tools linked together according to "systems" approach. These mechanisms are inflexible. They turn out only one kind of part, which is all very well if the manufacturer wants to make thousands of identical components. But if he wants to change his routine, the machinery is not very useful. This is the case while automation is inflexible, flexible automation is on the way. Here, automated machinery has programmability and feedback and can turn out different kinds of components. The equipment will make a tremendous difference to factory floors throughout the world. Flexible automation adds up to a new industrial era.

to separate отделять, разделять
successive stages последовательные стадии
to intervene вмешиваться
to count полагать, считать
to carry нести
to cut резать
to clamp закреплять
routine *зд.* режим работы
to detect обнаруживать
a set of ряд, комплект
to turn out точить, обтачивать

After-Text Section

Practice 1. На основании полученной из текста информации заполните следующие таблицы.

1. Stages in the Development of Technology

Stage	What it is based on
mechanization	
	principles of production and organization
automation	

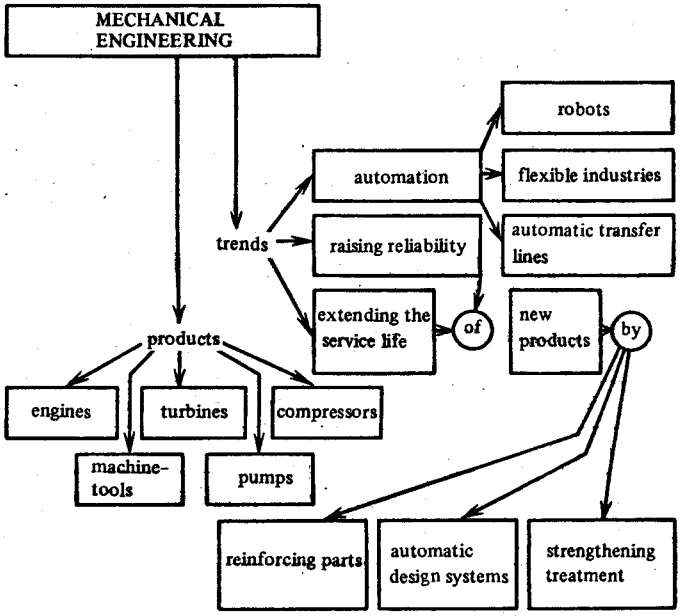
2. Automation

elements of automation / type of automation	automated device	system approach	programmability	feedback
inflexible automation	+			—
flexible automation	+		+	

Practice 2. Суммируйте информацию текста, закончив следующие предложения.

1. Automation is a third... 2. It is based on... 3. The truly automated machines must possess one of the... 4. Flexible automation is automation where machines possess... 5. Automation adds up...

ДЕНОТАТНАЯ СХЕМА



UNIT V

Engineering Materials

Text 1A

READING AND COMPREHENSION

1. **Переведите заголовок (он точно отражает содержание текста).**
2. **Прочитайте текст, выполните следующие задания и ответьте на вопросы:**

1. разделите текст на две основные части и озаглавьте их;
2. в какой из частей говорится о подразделении всех металлов на два типа?
3. о каких неметаллах упоминается в тексте?

Engineering Materials

Engineers have to know the best and most economical materials to use. Engineers must also understand the properties of these materials and how they can be worked. There are two kinds of materials used in engineering — metals and non-metals. We can divide metals into ferrous and non-ferrous metals. The former contain iron and the latter do not contain iron. Cast iron and steel, which are both alloys, or mixtures of iron and carbon, are the two most important ferrous metals. Steel contains a smaller

proportion of carbon than cast iron contains. Certain elements can improve the properties of steel and are therefore added to it. For example, chromium may be included to resist corrosion and tungsten to increase hardness. Aluminium, copper, and the alloys, bronze and brass, are common non-ferrous metals.

Plastics and ceramics are non-metals; however, plastics may be machined like metals. Plastics are classified into two types — thermoplastics and thermosets. Thermoplastics can be shaped and reshaped by heat and pressure but thermosets cannot be reshaped because they undergo chemical changes as they harden. Ceramics are often employed by engineers when materials which can withstand high temperatures are needed.

WHILE-READING SECTION

Language Study

Practice 1. Прочитайте текст снова и выпишите из него:

1. существительные, обозначающие различные материалы;
2. словосочетания, используемые при классификации объектов;
3. глаголы и глагольные сочетания, дающие характеристику материалам.

Эти слова и сочетания слов являются активными словами данного раздела.

Practice 2. Замените выделенные слова и словосочетания словами и словосочетаниями из текста.

Model: There are two kinds of *engineering materials.*
There are two kinds of *materials used in engineering.*

1. Nickel steel is *a mixture* of iron, carbon and nickel. 2. Chromium *can be included in* steel to provide a good cutting edge. 3. There are many *kinds* of steel used in industry. 4. Ceramics are *used* by engineers where heat-resistant materials are needed. 5. Chromium steels *resist* corrosion.

Practice 3. a) Найдите в тексте предложения, построенные по модели can, may, must/have (has) to + V, и переведите их.

b) Определите, какие из высказываний соответствуют содержанию текста.

1. Engineers must know the properties of engineering materials. 2. All metals can be classified as metals and non-metals. 3. Non-ferrous metals can contain iron. 4. Steels have to contain more carbon than cast iron. 5. Ceramics can resist high temperatures. 6. Thermosets may be machined. 7. Thermoplastics can be shaped and reshaped.

Practice 4.

Слова — организаторы научной и технической мысли определяют логику научно-технического текста: however *однако,* therefore *следовательно,* because *так как.*

Соедините следующие предложения.

Model 1. (a) Copper does not rust.
(b) Copper corrodes.
(a + b) Copper does not rust; *however* it corrodes.

Model 2. (a) Cast iron is a brittle metal.
(b) Cast iron is not used to withstand impact loads.
(a + b) Cast iron is a brittle metal, *therefore* it is not used to withstand impact loads.

Model 3. (a) Titanium is used for aircraft frames.
(b) Titanium is light and strong.
(a + b) Titanium is used for aircraft frames *because* it is light and strong.

1. Chromium resists corrosion. Chromium is added to steels to make them rust proof. 2. Cutting tools are made from high-speed steels. High-speed steels retain their cutting edge at high temperatures. (...these steels...) 3. Under normal conditions aluminium resists corrosion. Serious corrosion occurs in salt water. (...serious corrosion...) 4. Manganese steel is very hard. Manganese steel is used for armour plate. 5. Bronze has a low coefficient of friction. Bronze is used to make bearings. 6. Nylon is used to make fibres and gears. Nylon is tough and has a low coefficient of friction. 7. Tin is used to coat other metals to protect them. Tin resists corrosion. 8. Tin is expensive. The coats of tin applied to other metals are very thin. (...the coats of tin...) 9. Stainless steels require little maintenance and have a high strength. Stainless steels are expensive and difficult to machine at high speeds. 10. Nickel, cobalt and chromium improve the properties of metals. Nickel, cobalt and chromium are added to steels.

Practice 5. Соедините следующие предложения с помощью данных коннекторов. Вы можете опускать слова и делать любые перестановки, необходимые для сохранения английской модели предложения.

Model: because/and/however

Plastics are used widely in engineering. They are cheap. They have a resistance to atmospheric corrosion. Plastics are not particularly strong.

Plastics are used widely in engineering *because* they are cheap *and* have a resistance to atmospheric corrosion; *however,* they are not particularly strong.

1. and: There are two types of plastics. Thermoplastics are plastics. Thermosets are plastics.

2. and/whereas/and: Thermoplastics will soften when heated. Thermoplastics will harden when cooled. Thermosets set on heating. Thermosets will not remelt.

3. from/to: Plastics are used to make a great variety of products. Plastics are used to make textiles. Plastics are used to make engineering components.

4. such as: Plastics are available in many forms. Plastics are available in the form of sheets, tubes, rods, moulding powders and resins.

5. to: Various methods are used. These methods convert raw plastic into finished products. Compression moulding is a common method. Compression moulding is used for shaping thermosets.

6. with/which: The equipment consists of a press. The press has two heated platens. The two heated platens carry an upper and a lower mould.

7. then: Powder is placed in the lower mould. This is moulding powder. The upper mould is pressed down on the lower mould.

8. to/which: The pressure and the heat change the powder. The powder becomes liquid plastic. The liquid plastic fills the space between the moulds.

9. when/and: The chemical changes have taken place. The mould is opened. The moulding is extracted.

10. by: Plastic bowls are made. The compression moulding method is used.

Practice 6. Найдите в последнем абзаце текста сложные предложения и объясните логику их построения, ориентируясь на коннекторы. Переведите последнее предложение абзаца на русский язык.

Practice 7. Запомните значения вторых элементов атрибутивных сочетаний.

-tight — характеризует соединения, -proof, -resistant — характеризует свойства материалов. Например: an air-tight connection — a connection which air cannot pass through; a heat-resistant material — a material which is not damaged by heat; a moisture-proof coating — a coating which moisture cannot pass through; an acid-proof cement — a cement which is not damaged by acid

Переведите следующие сочетания.

a gas-tight seal, an oil-proof cement, a water-resistant grease, a light-proof coating, a water-tight connection, a sound-proof engine cladding, a rust-proof surface, a shock-proof mounting, a corrosion-resistant steel, a weather-proof surface

Practice 8. Найдите в 1-м абзаце текста прилагательные, обозначающие превосходную степень качества, и дайте исходные формы этих прилагательных.

Practice 9. Найдите в этом же абзаце слова-заместители и укажите, какие слова из текста они замещают.

Practice 10. Нижеприведенной таблицей рекомендуется пользоваться, когда речь идет о классификации.

Classification

There are		two three several many	types kinds sorts classes varieties	of materials	
Materials	are of fall into				
We can	classify divide split	materials	into several	classes categories groups types	according to...
Engineering materials	consist of include	metals and non-metals.			

Найдите в тексте предложения, в которых говорится о классификации материалов, и переведите их на русский язык.

Practice 11. Пользуясь таблицей Practice 10, произведите классификацию:

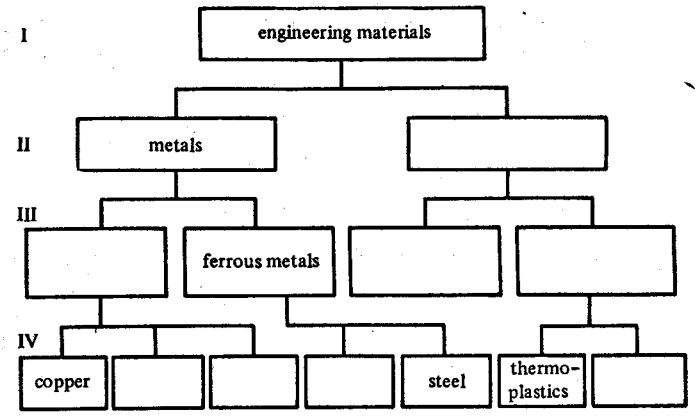
1. учебных заведений СССР;
2. высших учебных заведений Великобритании;

3. факультетов вашего учебного заведения;
4. специалистов в области машиностроения;
5. видов инженерных материалов.

Text Study

Practice 1. a) Пользуясь информацией текста, дополните схему.

Classification of Engineering Materials



b) Составьте как можно больше предложений, пользуясь схемой. Например:

1. Steel is a ferrous metal. 2. Iron and steel are ferrous metals. 3. Steel is an engineering material. 4. Steel is a metal. 5. Ferrous metals are engineering materials. 6. Metals are engineering materials.

Practice 2. a) Начертите схемы, отражающие связь между следующими объектами.

1. alloys, copper, brass, pure metals, aluminium, metals; 2. milling machines, copy-miller, shaping machines, drilling machines, vertical shaper, radial arm drill, machine-tools; 3. petrol engines, external-combustion engines, diesel engines, heat engines, steam turbines, internal-combustion engines

b) Составьте как можно больше предложений, пользуясь своими схемами. Например:

Metals can be classified as pure metals and alloys. Copper and aluminium are examples of pure metals and brass is an example of an alloy.

AFTER-TEXT SECTION

Text Discussion

Practice 1. Ответьте на вопросы по теме "Engineering Materials".

1. Name two kinds of materials used in engineering. 2. How are metals classified? 3. What's the difference between ferrous and non-ferrous metals? 4. For what purpose are some elements (such as chromium and tungsten) added to steel? 5. Name two kinds of non-metals. 6. What can you say about plastics' classification and properties? 7. In what cases are ceramics used?

Practice 2. Приготовьте сообщение по теме "Engineering Materials" (воспользуйтесь для этого схемой Practice 1 из раздела "Text Study" и активной лексикой).

Practice 3. Ситуации для высказывания.

1. Вы инженер-металлург. Ваша задача — получить высококачественную легированную сталь. Скажите, как вы можете добиться этого.
2. Ваша лаборатория проводит опыты в условиях высоких температур. Скажите, какими качествами должно обладать лабораторное оборудование, какие материалы можно использовать для его изготовления.

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы, глагольные сочетания	Слова — организаторы научной и технической мысли
виды инженерных материалов	**cast iron** **steel** **alloy** **ferrous metal** **non-ferrous metal** **tungsten** **copper** **brass** **thermosets** **thermoplastics**		**however** **therefore** **because**

Продолжение

Область применения	Существительные и сочетания с существительными	Глаголы, глагольные сочетания	Слова — организаторы научной и технической мысли
характеристики материалов	**corrosion** **hardness**	**to resist/to withstand corrosion** **to improve the properties**	
классификация объектов		**to classify** **to divide into**	
виды воздействия на материалы		**to undergo changes** **to shape** **to add elements**	

Text 1B

PRE-TEXT SECTION

Practice 1. Изучите диаграмму и дайте русские эквиваленты английским терминам, обозначающим названия отдельных частей автомобиля.

Practice 2. Прочитайте текст и определите, из каких материалов изготовлены обозначенные на диаграмме части автомобиля.

Practice 3. Выпишите из 2-го абзаца названия отдельных частей двигателя. Найдите их значения в словаре. Определите, из каких материалов изготовлены эти части.

Materials a Car is Made of

A car is made of different materials. The windscreen, for example, is made of glass. The headlights are also made of glass. The tyres are made of rubber. They are filled with air. The air in the tyres is compressed (to approximately 1,5 gm/cm ^{3}). The body is made of metal. The metal is painted. The steering wheel is made of plastic. The mirrors are made of plastic and glass. This car has two mirrors. The rear-view mirror is fixed to the roof. The wing mirror is fixed to the door.

The engine is made of different metals. The pistons are made of aluminium and the valves are made of steel. The springs are also made of steel.

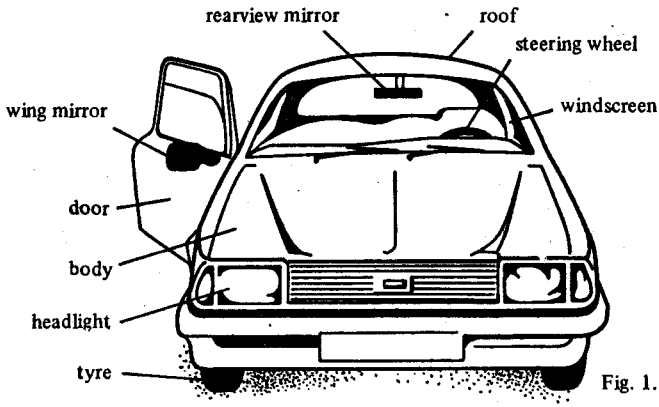


Fig. 1.

AFTER-TEXT DISCUSSION

Большинство предложений текста построено по модели: N + is/are made of N, где первое N — технический объект, а второе — название материала.

Practice 1. Прочитайте текст и подберите из него предложения к рис. 1.

Practice 2.

What is a car made of?

Назовите материалы, из которых сделаны указанные узлы и детали (рис. 2).

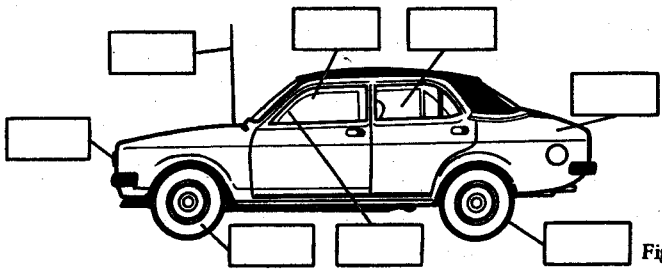


Fig. 2.

Practice 3. Изучите рисунок мотоцикла и заполните пропуски в нижеприведенном отрывке.

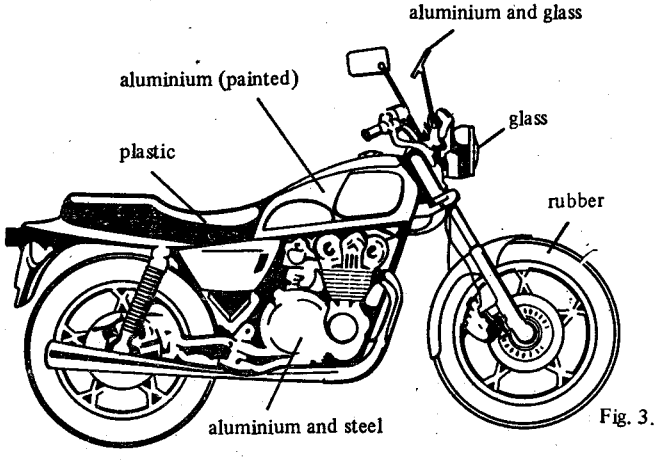


Fig. 3.

A motorcycle is made of different... The headlight, for example, ... The tyres... They ... air. The fuel tank... The metal... The saddle... The engine ... steel ... aluminium and ... glass. It is ... to the handlebars.

Practice 4. Опишите мопед на рис. 4. Используйте текст Practice 3 как образец.

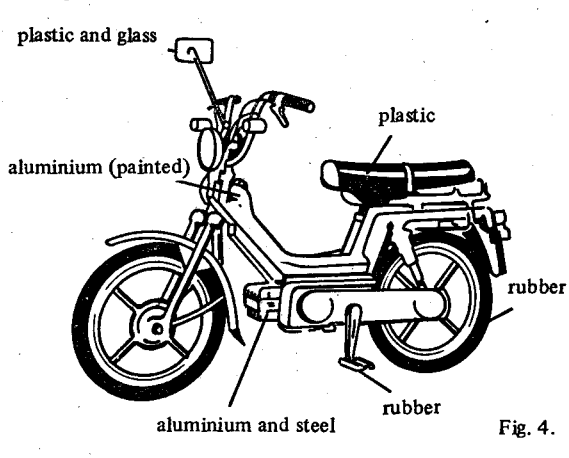


Fig. 4.

Practice 5. Опишите следующие рисунки, следуя образцу.

Model: This cylinder block is made of cast iron. There is a little carbon in cast iron.

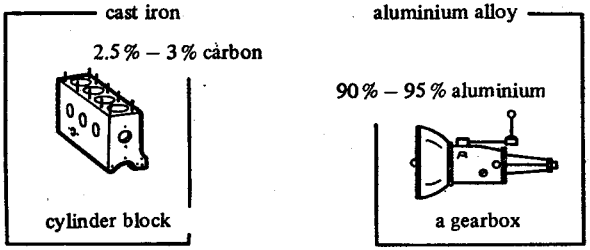


Fig. 5.

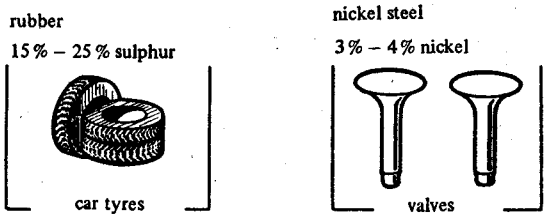


Fig. 6.

Practice 6. Опишите двухтактный бензиновый двигатель, предварительно заполнив пропуски в тексте и используя информацию этого текста. При пересказе используйте конструкции: there is/there are; is/are made of.

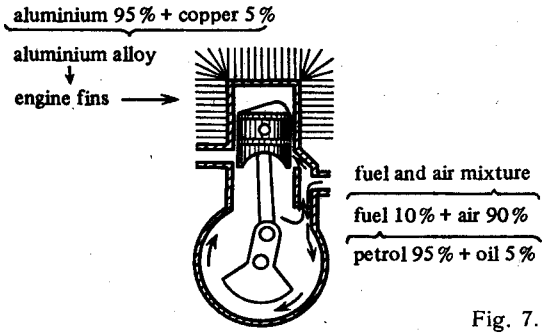


Fig. 7.

The engine fins ... made ... aluminium alloy. Aluminium alloy ... made ... two metals. There is ... aluminium (about 95 %) and ... copper in most aluminium alloys... Motorcycle engines (about 90 %) have aluminium alloy fins. There ... oil sump in this engine. There is ... oil in the petrol. There is ... air and ... fuel in the fuel and air mixture.

Text 2A

READING AND COMPREHENSION

1. Переведите заголовок (он точно отражает содержание текста).

2. Прочитайте текст и определите:

1. в каком абзаце обобщенно изложены требования к современным конструкционным материалам;
2. в каких двух абзацах идет речь о свойствах стали;
3. какой абзац текста обобщает содержание таблицы (с. 207).

New Steels Meet Changing Needs

As a structural material steel has two drawbacks: its weight and its susceptibility to rust. Yet steel has long been used, and in great quantities, in structural applications from bridges and buildings to ships, automobiles and household appliances. This is because of many advantages of steel. It is superior to other structural materials in strength, toughness, workability and other properties that are critical for such applications, and it is mass-produced with uniform, reliable quality and at low cost.

Since steel is the most popular structural material available, steel-makers make every effort to meet the changing needs of these markets. New, more sophisticated processes for steel-making and treatment have led to steel products of higher grade and greater variety.

Yet, it can no longer be said that a steel product is satisfactory if it is simply a good structural material. Today's market needs can be classified broadly as: 1) the need for lighter weight; 2) the need for new properties; 3) the need for maximum performance; and 4) the need for cost reduction.

The need for lighter weight is really a requirement for materials having higher specific strength (strength/specific gravity). Materials offering new properties not found in conventional materials will include new breeds of steel, hybrid materials and truly novel materials such as amorphous metal. The need for maximum performance calls for materials approaching the limits of durability, toughness and the like. Finally, the need to reduce costs is leading to materials diversification in which steel materials precisely suited to a specific application are developed.

New families of steel products are steadily emerging to meet these needs.

Let us look now at how steel needs have changed in automotive industry and how steelmakers have met these needs.

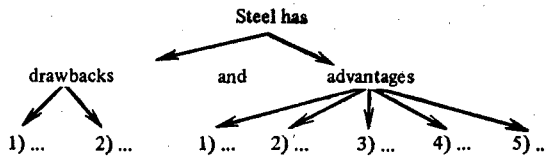
What is Needed in New Steels by Automotive Industry

Changes in auto industry's environment →	New requirements for steel by auto industry →	Steels which meet auto industry's requirements
Fuel efficiency	Weight reduction, lighter gauge of steel	High-strength sheets with good formability (dual-phase steel)
Durability	Corrosion resistance	Coated sheets (one-side galvanized sheets)
Exhaust gas restriction	Heat resistance	Heat-resistant stainless sheets, aluminized sheets
Noise restriction	Noise reduction	Vibration-damping sheets
Safety requirements	Rigid structure	High-strength low-alloy steel

WHILE-READING SECTION

Language Study

Practice 1. Выпишите из 1-го абзаца английские слова и словосочетания, выражающие понятия, связанные с недостатками (drawbacks) современных сталей и с их преимуществами (advantages). Пользуясь политехническим словарем, заполните получившуюся схему русскими словосочетаниями.



Practice 2. Выпишите из 3-го абзаца текста словосочетания, выражающие требования к конструкционным сталям на современном этапе. Найдите в 4-м абзаце и выпишите параметры (словосочетания), отвечающие этим требованиям. Схемы должны быть составлены на английском и русском языках.

1) need for lighter weight → highest specific strength

(русский язык)	(русский язык)
2) . . .	→ new ...
3) . . .	→ limits of ...
4) . . .	→ ... diversification

Practice 3. Ниже приведена таблица свойств металлов, не упомянутых в тексте. Выберите из первого абзаца текста свойства металлов и закончите ими таблицу.

Property

Every engineering material possesses certain properties, or characteristics or qualities which we can find by experiment; these properties may make the material suitable or unsuitable for any particular purpose.

Here are some of the properties which metals may have:

Property				Definition
The metal is	fluid.	It has	fluidity.	It flows easily when it melts.
	plastic.		plasticity.	It pulls out of shape without breaking.
	elastic.		elasticity.	It always returns to its original shape.
	ductile.		ductility.	It can be stretched without breaking.
	malleable.		malleability.	It can be hammered out of shape without breaking.
	...		...	
	...		...	

Practice 4. Обратите внимание на еще одну модель обозначения свойств. Заполните таблицу до конца по аналогии.

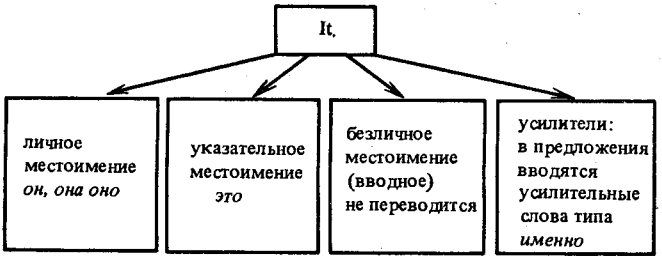
	make/render + N + Adj			
This makes/renders the metal	harder. softer. stronger. weaker.	This	hardens softens strengthens weakens	the metal.
This makes the screw	tighter. looser. flatter.	This	... ...	the screw.

Practice 5. Переведите следующие слова и словосочетания на русский язык, при этом догадайтесь о значении выделенных курсивом интернациональных слов. Слова, выделенные жирным шрифтом,— «ложные друзья переводчика». Проверьте их значения по словарю и уточните значение в данном словосочетании.

structural *material, application,* **critical** properties, **uniform** properties, **popular** *material, steel product, to classify,* **specific** strength, *hybrid material,* **specific** application, **automotive** *industry*

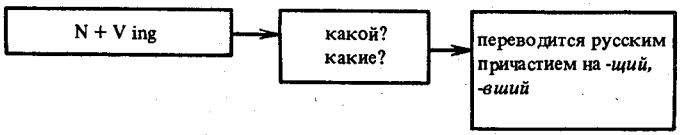
Practice 6. a) Прочитайте 1-й абзац, определите функцию it (its) в каждом предложении. Определите, какое слово заменяет it в каждом случае.

b) Прочитайте 3-й абзац текста. Какие функции выполняет и как переводится it в первом предложении абзаца?

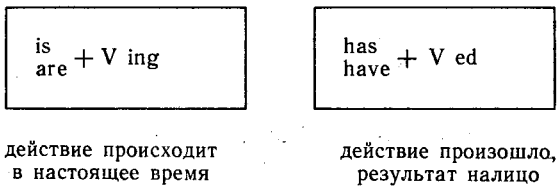


Practice 7. Переведите следующие отрезки предложений. Пользуясь схемой Practice 2, переведите 3-й абзац текста на русский язык.

1. ...materials having higher specific strength... 2. Materials offering new properties... 3. ...materials approaching the limits of...



Practice 8.



Определите, какие из высказываний отвечают содержанию текста.

a) 1. New processes for steelmaking are leading to higher grade steels. 2. New processes for steelmaking have led to higher grade steels.

b) 1. Modern steels have approached the limits of durability. 2. Modern steels are approaching the limits of durability.

c) 1. The need to reduce cost has led to materials diversification. 2. The need to reduce cost is leading to materials diversification.

d) 1. Materials precisely suited to a specific application have been developed. 2. Materials precisely suited to a specific application are being developed.

Practice 9.

Причастие (Participle)

Причастие	Действительный залог	Страдательный залог
Participle I (Indefinite) выражает действие, одновременное с действием сказуемого предложения	1. форма: **V ing** **using** 2. функции: а) определение; место — рядом с определяемым существительным; перевод: *использующий, использовавший;* б) обст-во; место — начало или конец предложения; перевод: деепричастием — *используя;* в) часть простого сказуемого; место — после гл. to be; перевод: глаголом в личной форме (...he is using... ...*он использует*...)	1. форма: **being V ed** **being used** 2. функции: а) определение; место — рядом с определяемым существительным; перевод: *используемый, использованный, который используется;* б) обст-во; место — начало или конец предложения; перевод: *будучи использован; когда (его) использовали*
Participle I (Perfect) выражает действие, предшествующее действию сказуемого предложения	1. форма: **having+V ed** **having used** 2. функция: обст-во; место — начало или конец предложения; перевод: деепричастием, придаточным предложением — *использовав, когда (он) использовал*	1. форма: **having been + V ed** **having been used** 2. функция: обст-во; место — начало или конец предложения; перевод: *когда (его) использовали*

Продолжение

Причастие	Действительный залог	Страдательный залог
Participle II	—	1. форма: ... **V ed used** 2. функции: а) определение (правое и левое); место — рядом с определяемым существительным; перевод: *используемый, использованный;* б) обст-во; место — начало или конец предложения; перевод: *когда (его) использовали*

Найдите в 3-м абзаце текста причастные обороты и замените их на придаточные предложения, сохранив значение всего предложения в целом.

Practice 10. Сгруппируйте предложения в зависимости от функции Participle I.

1. We were demonstrated an operating engine. 2. Designing new systems we can use electronic computers. 3. Having finished the experiment the engineers started a series of new tests. 4. Introducing steam into engine cylinders we drive a steam engine. 5. A barometer is an instrument measuring atmospheric pressure. 6. Metals being used in industry in the form of alloys have better properties than pure metals. 7. Having made many experiments scientists proved that electricity had an atomic character. 8. Being the cheapest of the metals cast iron is widely used everywhere. 9. A neutron is a particle having the same mass as a proton but carrying no electrical charge.

Practice 11. Переведите предложения из Practice 10 на русский язык.

Practice 12. В каком из нижеприведенных предложений Participle II имеет функцию обстоятельства? Переведите предложения на русский язык.

1. An automobile begins its life in the fully mechanized assembly department. 2. The area of the recently built car works on the Kama river is almost 1000 hectares. 3. The cars are going through special tests called "the Belgian road" and the washboard road. 4. The results obtained were carefully studied. 5. When frozen, water is a colourless solid known as ice. 6. The steering system

used has been tested by the research engineers of the safety device laboratory. 7. When assembled the car undergoes various tests.

Practice 13.

Слова — организаторы научной и технической мысли определяют логику научно-технического текста: yet *однако* (противопоставление), since *так как* (причина), if *если* (условие).

Соедините следующие предложения, сохранив логику текста и используя нужный коннектор.

1. Steel has some drawbacks. Steel has long been used as structural material. (since, yet) 2. Steel is superior to other structural materials. Steel has long been used as structural material. (since, yet) 3. Steel is the most popular structural material. Steel-makers create new processes for steelmaking. (since, yet). 4. Steel product is not satisfactory. Steel product is simply a good structural material. (if, since, yet) 5. The need for maximum performance will be met. The materials approach the limits of toughness. (if, yet). 6. The need to reduce costs has not yet been met. The materials precisely suited to a specific application are not developed. (if, since)

Text Study

Practice 1. Изучите таблицу на с. 207. Найдите, какие из ее частей соответствуют той части текста, где изложены требования к современным сталям. Постройте аналогичную таблицу для области машиностроения, в которой вы специализируетесь.

AFTER-TEXT SECTION

Text Discussion

Practice 1. Ответьте на следующие вопросы.

1. Name two drawbacks of modern steel materials. 2. Name the advantages of steel over other metals. 3. In what fields of engineering has steel been long used? 4. What are the modern needs for steel development? 5. How could these needs be met? (Use Practice 2, p. 201). 6. How have modern steel needs changed in automotive industry? (Use the table on p. 207).

Practice 2. Приготовьте сообщения на следующие темы (воспользуйтесь активным словарем).

1. Достоинства и недостатки современных конструкционных сталей (воспользуйтесь также диаграммой Practice 1, с. 207).
2. Требования к современным конструкционным сталям (воспользуйтесь Practice 2, с. 207).
3. Тенденции в современном развитии сталей (см. Practice 2, с. 207).
4. Тенденции в развитии сталей в автомобилестроении (воспользуйтесь таблицей в тексте).

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы, глагольные сочетания	Слова — организаторы научной и технической мысли
качественные и количественные характеристики материала	**strength** **specific strength** **toughness** **workability** **grade, high grade** **weight** **property** **performance** **cost** **durability** **uniform quality** **reliable quality**		**since** **as** **finally** **yet**
типы, виды материалов	**structural material** **hybrid material** **amorphous metal**		
область производства и применения материалов	**specific application** **structural application**	**to meet the needs of markets** **to be mass-produced** **to offer new properties** **to call for** **to reduce cost**	

Text 2B

PRE-TEXT SECTION

Practice 1. Прочитайте текст и укажите, какие материалы упомянуты в нем.

Practice 2. Расшифруйте данные, характеризующие различные материалы. Обратите при этом внимание на размерность:
1) вес; 2) точка плавления; 3) содержание металла в земле, в морской воде.

Practice 3. В разделе "Aluminium" сообщается о свойствах чистого алюминия, его сплавов и об улучшении этих свойств в процессе обработки. Определите:

1. какие это свойства; 2. с какими элементами сплавляют алюминий; 3. какие процессы улучшают свойства алюминия и его сплавов

Non-Ferrous Metals

Although ferrous alloys are specified for more engineering applications than all non-ferrous metals combined, the large family of non-ferrous metals offers a wider variety of characteristics and mechanical properties. For example, the lightest metal is lithium, 0,53 g/cm^3, the heaviest, osmium, weighs 22,5 g/cm^3 — nearly twice the weight of lead. Mercury melts at around — 38 °F, and tungsten, the metal with the highest melting point, liquefies at 6,170 °F.

Availability, abundance, and the cost of converting the metal into useful forms — all play important parts in selecting a non-ferrous metal. One ton of earth contains about 81,000 g of the most abundant metal of land, aluminium. One ton of sea water, on the other hand, contains more magnesium than any other metal (about 1,272 g). All sources combined, magnesium is the most abundant metal on earth. But because magnesium is difficult to convert to a useful metal, it may cost several times that of the least expensive and most easily produced metal, iron billet.

Although nearly 80% of all elements are called "metals", only about two dozen of these are used as structural engineering materials. Of the balance, however, many are used as coatings, in electronic devices, as nuclear materials, and as minor constituents in other systems.

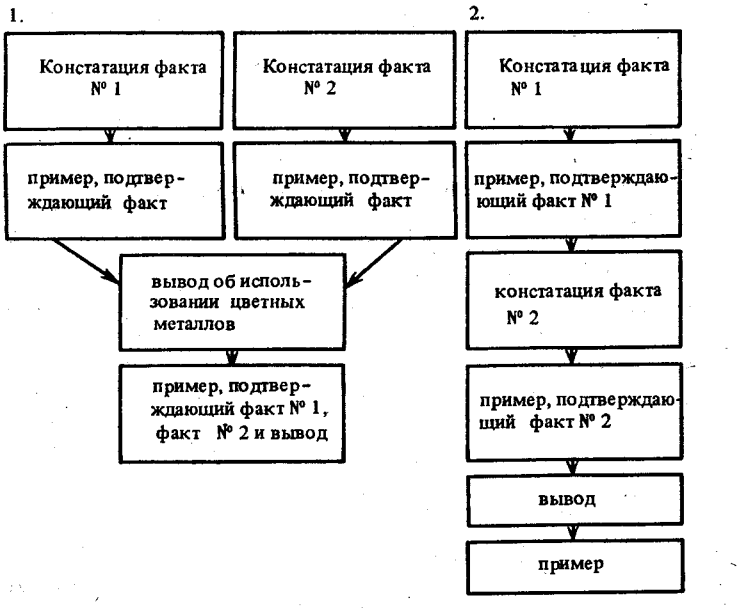
Aluminium

Aluminium is lightweight, strong, and readily formable. Aluminium and its alloys, numbering in the hundreds, are available in all common commercial forms. Because of their high thermal conductivity, many aluminium alloys are used as electrical conductors.

Commercially pure aluminium has a tensile strength of about 13,000 psi. Cold-working the metal approximately doubles its strength. For greater strength aluminium is alloyed with other elements such as manganese, silicon, copper, magnesium or zink. Some alloys are further strengthened and hardened by heat treatments. Most aluminium alloys lose strength at elevated temperatures, although some retain significant strength to 500 °F.

AFTER-TEXT DISCUSSION

Practice 1. Определите, какая из схем точнее передает логику текста.



Practice 2. Выпишите свойства различных материалов, упоминаемых в тексте (отточием обозначена графа, требующая заполнения).

Материалы		Свойства					
англ.	русск.	вес thermal weight	прочность strength	наличие в природе abundance	точка плавления melting point	цена cost	теплопроводность conductivity
lithium		0.53g/cm³	—				
osmium		22.5g/cm³	—				
mercury		—	—		+	—	—
tungsten		—	—		+	—	—
aluminium		+	+	...	—	+	+
magnesium		—	—	most abundant	—	+	—

Practice 3. Ответьте на следующие вопросы.

1. Which of the non-ferrous metals is the most abundant metal of earth? 2. Which is the most abundant metal of land? 3. What factors define the selection of materials? 4. Why is magnesium so expensive? 5. Name the properties of aluminium. 6. How are the properties of pure aluminium improved?

Text 3A

READING AND COMPREHENSION

1. Прочитайте текст и определите функцию каждого абзаца. Варианты даны ниже:

1. требования к пластмассам;
2. характеристики и применение пластмасс;
3. определение понятия «пластмасса» и способы ее получения;
4. различные взгляды на возможности применения пластмасс и подтверждение (опровержение) этих взглядов (два абзаца).

2. Используя ответы задания 1, постройте диаграмму, отражающую логическую структуру текста.

Plastics

Plastics are a large and varied group of materials consisting of combinations of carbon and oxygen, hydrogen, nitrogen, and other organic and inorganic elements. While solid in its finished state, a plastic is at some stage in its manufacture, liquid and capable

of being formed into various shapes. Forming is most usually done through the application, either singly or together, of heat and pressure. There are over 40 different families of plastics in commercial use today, and each may have dozens of subtypes and variations.

A successful design in plastics is always a compromise among highest performance, attractive appearance, efficient production, and lowest cost. Achieving the best compromise requires satisfying the mechanical requirements of the part, utilizing the most economical resin or compound that will perform satisfactorily, and choosing a manufacturing process compatible with the part design and material choice.

Most people have now outgrown the impression that plastics are low-cost substitute materials. Those that still view plastics as cheap and unreliable have not kept up with developments in polymer technology for the past ten years.

Many plastics did indeed evolve as replacements for natural products such as rubber, ivory, silk or wool, which became unavailable or on short supply. But the new materials did not necessarily replace the older ones permanently nor make them obsolete. In many cases, they met an increased demand that could not be met by the natural product alone.

Today's engineering resins and compounds serve in the most demanding environments. Their toughness, lightness, strength, and corrosion resistance have won many significant applications for these materials in transportation, industrial and consumer products. The engineering plastics are now challenging the domains traditionally held by metals: truly load-bearing, structural parts.

WHILE-READING SECTION

Language Study

Practice 1. Переведите следующие слова и словосочетания; разбейте их на тематические группы и разместите в соответствующую графу таблицы (форму таблицы предложите сами).

а) существительные:

carbon, forming, manufacture, performance, production, appearance, resin, compound, oxygen, hydrogen, inorganic element, polymer technology, rubber, silk, wool,

toughness, nitrogen, transportation, consumer goods, lightness, corrosion resistance, strength, heat, pressure, commercial use

b) глаголы:

to achieve, to require, to satisfy, to outgrow, to keep up, to become, to replace, to meet demands, to increase demands, to win

c) прилагательные:

solid, liquid, satisfactory, high, attractive, efficient, economical, cheap, unreliable, available, significant

Возможная тематика соответствующих граф таблицы:

1. виды материалов, элементов;
2. характеристики материалов (пластмасс);
3. сферы применения пластмасс;
4. условия изготовления пластмасс;
5. прогресс в развитии новых материалов (для глаголов);
6. физическое состояние материалов (для прилагательных);
7. преимущества пластмасс.

Проверьте правильность выбранных вами значений слов и словосочетаний по контексту.

Practice 2. Выпишите из 2-го абзаца текста словосочетания, выражающие понятия, определяющие требования к конструкции изделий из пластмасс. Найдите и выпишите из этого же абзаца словосочетания, определяющие способы удовлетворения этих требований. Схемы должны быть составлены на английском и русском языках. Например:

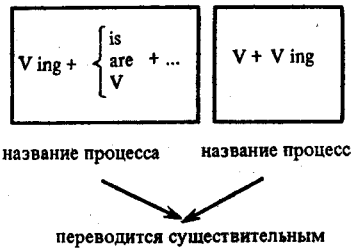
1. highest performance → mechanical requirements of the part
   высшие характеристики → механические свойства детали
2.
3.
4.

Practice 3. Переведите следующие слова и словосочетания на русский язык, при этом догадайтесь о значении выделенных курсивом интернациональных слов. Значения слов, выделенных жирным шрифтом, необходимо уточнить по контексту.

group, combination, organic element, **finished** state, **forming, commercial** use, *compromise, efficient produc-*

tion, mechanical requirement, *substitute material,* **natural** *product, transportation,* **structural** part

Practice 4.



Переведите следующие отрезки предложений на русский язык. Найдите эти предложения в тексте и переведите их полностью.

1. *Forming* is usually... 2. *Achieving* ... requires... 3. ...requires *satisfying* the... 4. ...requires *utilizing* the... 5. ...requires *choosing* the...

Practice 5.

Герундий (Gerund)

Это неличная форма глагола, выражающая процесс действия и совмещающая в себе свойства глагола и существительного.

1. Форма	Действительный залог	Страдательный залог
Indefinite (выражает действие, одновременное с действием сказуемого)	**V ing** **using**	**being + V ed** **being used**
Perfect (выражает действие, предшествующее действию сказуемого)	**having + V ed** **having used**	**having been + V ed** **having been used**
2. Функция	Место в предложении	Перевод
1. подлежащее	перед сказуемым	существительное, инфинитив
2. именная часть сказуемого	после глагола-связки **to be**	существительное

Продолжение

2. Функция	Место в предложении	Перевод
3. дополнение	после сказуемого	существительное, инфинитив
4. определение		
а) правое	после определяемого существительного с предлогом **of**	существительное
б) левое	перед определяемым существительным	
5. обстоятельство	начало или конец предложения; как правило, после предлогов	существительное с предлогом; деепричастие

Сгруппируйте предложения в зависимости от функции герундия.

1. Casting is a process of forming metal objects. 2. The open-hearth process is one of the most important methods of making steel. 3. Numerous methods have been developed for producing metal castings. 4. The test needed increasing the temperature of the molten metal. 5. There are some ways of obtaining high quality alloys. 6. After pouring, the molten metal is allowed to solidify in a mold. 7. Aluminium has a melting point of 658,7 °C.

Practice 6. Переведите предложения из Practice 5 на русский язык.

Practice 7. Переведите группы слов и предложения. Обратите внимание на перевод предлогов перед герундием:

in *при;* on, upon *по, после, при;* by *путем, посредством, при помощи;* without *без*

in building, in melting; on heating, on completing, on melting; by introducing; without employing, without machining

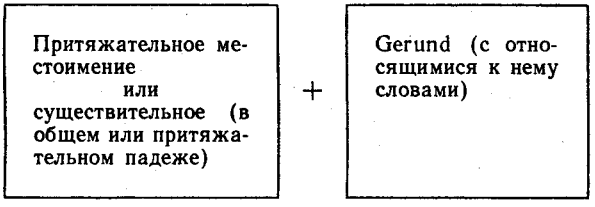
1. In building new metallurgical works, engineers have to solve many different problems. 2. In melting steel, foundrymen use electric furnaces, crucible furnaces and converters. 3. Liquids and gases expand on heating. 4. On completing the construction, the cupola was tested in operation. 5. Casting is a process of forming metal objects by melting metal and pouring it into molds. 6. By introducing new foundry methods the engineers improve the quality of castings and the speed of manufacture. 7. High-grade castings can't be produced without employ-

ing electric furnaces. 8. Most castings can't be employed as parts of complex mechanisms without machining and finishing.

Practice 8.

Сложный герундиальный оборот

1. Форма.



2. Перевод.

Переводится придаточным предложением, вводимым словами: *то, что; того, что; о том, что.* При этом существительное (местоимение), стоящее перед герундием, становится подлежащим, а герундий — сказуемым. Например:

Your working at the plant helps you to master technical subjects. То, что вы работаете на заводе, помогает вам усваивать технические дисциплины.

a) Найдите герундиальные обороты и переведите предложения на русский язык.

1. We know of Newton's having developed principles of mechanics. 2. Mankind is interested in atomic energy being used only for peaceful purposes. 3. We know of Soviet metallurgical industry having made a great progress. 4. We speak about cupolas being used for melting cast iron. 5. Great attention is paid to the metal being heated to the proper temperature. 6. That sand molds are the oldest method for producing metal castings is a well-known fact. 7. We speak about casting metals, molding sands and refractories being the main foundry materials.

b) Определите формы и функции герундия. Переведите предложения на русский язык.

1. Melting may be done in cupolas, air furnaces, electric furnaces, etc. 2. Some metals require treatment before being placed in the melting furnace. 3. Carrying

molten metal is usually performed in crane ladles. 4. The most favourable characteristic of a sand casting is its retaining good strength at moderately elevated temperature. 5. Melting is very important in the production of high-quality castings. 6. We know of electric furnaces being used for the production of high-grade castings. 7. A foundry can't operate without employing proper foundry materials.

Practice 9. Выпишите следующие действия, следуя приведенному образцу и инструкции.

Model: Plastics are a large group of materials. This group *consists of* a combination of different elements.
Plastics are a large group of materials *consisting of* a combination of different elements.

1. Plastics are a group of new materials. These materials replace natural products. 2. Plastics achieve high toughness, lightness and strength. These properties win many significant applications for these materials. 3. A successful design in plastics is a compromise among highest performance, attractive appearance, efficient production and lowest cost. This compromise needs satisfying the mechanical requirement of the part, utilizing the most economical resin and meeting other requirements.

Practice 10.

Сопоставление Participle I и Gerund

1. Формы полностью совпадают.
2. Отличительные признаки:
   а) Participle I — ø
   б) Gerund — наличие предлогов, притяжательных местоимений (существительных в притяжательном или общем падеже) перед -ing формой.
3. Функции:

Функция	Gerund	Participle I
1. Подлежащее.	**Melting** is performed in melting furnaces.	—
2. Часть простого сказуемого.	—	The engineer is **preparing** a series of experiments.

Продолжение

Функция	Gerund	Participle I
3. Именная часть сказуемого.	The best way to solve this problem is **experimenting.**	—
4. Определение.	The principle of **operating** this mechanism is simple.	We were demonstrated an **operating** furnace.
5. Прямое дополнение.	The foundrymen completed **melting** in time.	—
6. Обстоятельство.	**After being subjected to** all tests the machine was stopped.	**Having been subjected to** all tests the machine was stopped.

4. Перевод:

а) Participle I — причастием (активным и пассивным) настоящего и прошедшего времени; придаточным предложением.

б) Gerund — существительным, инфинитивом, деепричастием, придаточным предложением.

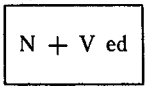
Определите форму и функцию V ing. Переведите предложения на русский язык.

1. Heating the gas increases the speed of the molecules. 2. Having made the experiment, the research engineer recorded the data. 3. Translating from one language to another we can use electronic computers. 4. Translating from one language to another has been accomplished by an automatic computer. 5. The failure was due to the operator's having been careless in using the instrument. 6. The cupola is the most generally used melting process for cast iron, the fuel economy being highest and ease of manipulation greatest. 7. The Bessemer converter is used in steel making. 8. Cupola melting is continuous. 9. All non-ferrous alloys having a lower melting temperature than iron alloys are melted in crucible furnaces, open-flame furnaces and electric furnaces.

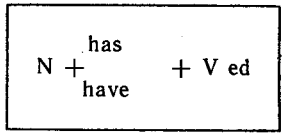
Practice 11. Найдите в тексте слова на -ing и распределите их в таблицу.

Participle I	Gerund

Practice 12. Определите, какие из высказываний соответствуют содержанию текста.



действие происходило в прошлом



действие произошло в прошлом, но результат налицо

a) 1. Plastics *evolved* as replacements for natural products. 2. Plastics *have evolved* as replacements for natural products.

b) 1. Those people who considered plastics unreliable *did not keep up* with the developments in polymer technology in the past. 2. Those people who consider plastics unreliable *have not kept up* with the developments in polymer technology for the past ten years.

c) 1. Plastics properties *won* many applications for these materials in the past. 2. Plastics properties *have won* many applications for these materials.

Practice 13. Найдите в тексте предложения, в которых употреблены данные конструкции; переведите их на русский язык.

1. either ... or *либо ... либо;* 2. such as *такие как*

Practice 14. Соедините следующие предложения, использовав слова — организаторы научной и технической мысли:

that is why *вот почему,* however *однако,* thus *следовательно*

1. Plastics are solid in finished state. Plastics are liquid at some stage in manufacture. (that is why, however) 2. Plastics are light, strong, corrosion-resistant. They have won many significant applications in industry and transportation. (thus, however) 3. Most people have outgrown the impression that plastics are low-cost substitute materials. There are people who still view plastics as cheap and unreliable. (however, that is why)

Practice 15. Найдите в тексте прилагательные, обозначающие сравнительную и превосходную степень качества, и дайте исходные формы этих прилагательных.

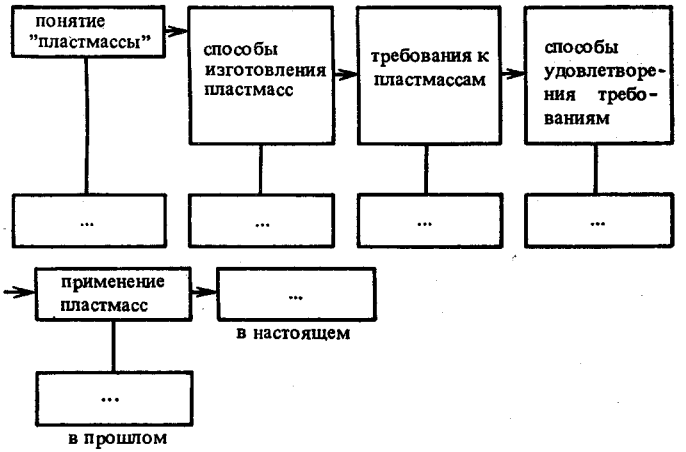
Practice 16. Найдите во 2-м и 3-м абзацах слова-заместители и укажите, какие слова из текста они замещают.

Practice 17. Какими словами и словосочетаниями данного текста можно было бы дополнить таблицу классификации, приведенную в Practice 10 на с. 199?

Practice 18. Поставьте всевозможные вопросы ко всем предложениям последнего абзаца текста, пользуясь вопросительными словами: what, what kind of, where, which, how many, when.

Text Study

Practice 1. Заполните пропуски в логической схеме текста предложениями из текста.



AFTER-TEXT SECTION

Text Discussion

Practice 1. Перескажите текст, используя вышеприведенную схему как план для пересказа. Воспользуйтесь также активным словарем.

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы	Прилагательные
виды элементов материалов	**carbon** **oxygen** **hydrogen** **nitrogen** **organic element** **inorganic element** **plastics**		

Продолжение

Область применения	Существительные и сочетания с существительными	Глаголы	Прилагательные
свойства материалов	**corrosion resistance** **strength** **lightness** **toughness**		
условия изготовления и способы изготовления пластмасс	**forming** **heat** **pressure**		
прогресс в развитии материалов		**to achieve** **to satisfy requirements** **to meet demands** **to keep up** **to outgrow** **to win**	
физическое состояние веществ; преимущества одного материала перед другим			**solid** **liquid** **attractive** **reliable** **cheap** **available** **economical**

Text 3B

Pre-Text Section

Прочитайте текст и определите:

1. какие существуют две основные группы волокна;
2. в каком абзаце идет речь о видах синтетического волокна;
3. какие два аспекта, связанные со стекловолокном, рассматриваются в последнем абзаце.

Fibers

Fibers are probably the oldest engineering materials used by man. Jute, flax, and hemp have been used for "engineered" products such as rope, cordage, nets, water hose, and containers since antiquity. Other plant and animal fibers have been used for felts, paper, brushes, and heavy structural cloth.

The fiber industry is clearly divided between natural fibers (from plant, animal, or mineral sources) and synthetic fibers. Many synthetic fibers have been developed specifically to replace natural fibers, because synthetics often behave more predictably and are usually more uniform in size.

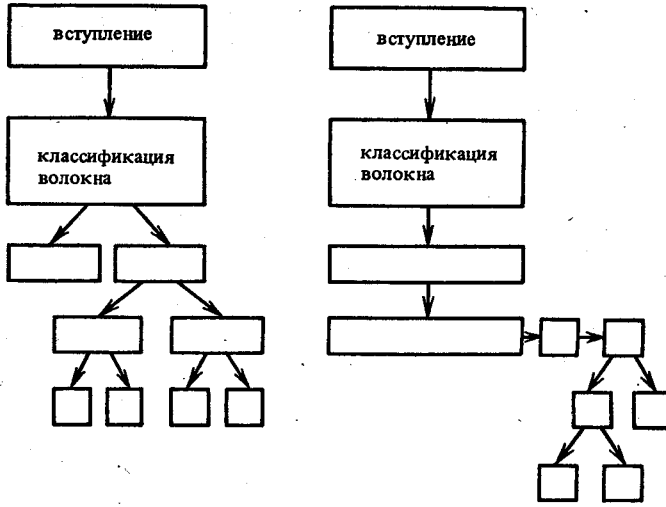
For engineering purposes, glass, metallic, and organically derived synthetic fibers are most significant. Nylon, for example, is used for belting, nets, hose, rope, parachutes, webbing, ballistic cloths, and as reinforcement in tyres.

Metal fibers are used in high-strength, high-temperature, light-weight composite materials for aerospace applications. Fiber composites improve the strength-to-weight ratio of base materials such as titanium and aluminium. Metal-fiber composites are used in turbine compressor blades, heavy-duty bearings, pressure vessels and spacecraft re-entry shields. Boron, carbon, graphite, and refractory oxide fibers are common materials used in high-strength fiber composites.

Glass fibers are probably the most common of all synthetic engineering fibers. These fibers are the finest of all fibers, typically 1 to 4 microns in diameter. Glass fibers are used for heat, sound, and electrical insulation; filters; reinforcements for thermoplastics and thermoset resins and for rubber (such as in tyres); fabrics; and fiber optics.

After-Text Discussion

Practice 1. Определите, какая из схем точнее передает логику текста.



Practice 2. Заполните следующую таблицу.

Вид волокна		Свойства		Применение	
англ.	русск.	англ.	русск.	англ.	русск.
1. metal fiber 2. glass fiber					

Practice 3. а) Внимательно изучите таблицу и выполните предлагаемые задания.

Plastics vs. Metals

Properties of plastics which may be...

Favorable: 1. Lighter weight. 2. Better chemical and moisture resistance. 3. Better resistance to shock and vibration. 4. Transparent or translucent. 5. Tend to absorb vibration and sound. 6. Higher abrasion and wear resistance. 7. Self-lubricating. 8. Often easier to fabricate. 9. Can have integral color. 10. Cost trend is downward.

Unfavorable: 1. Lower strength. 2. Much higher thermal expansion. 3. More susceptible to creep, cold flow, and deformation under load. 4. Lower heat resistance — both to thermal degradation and heat distortion. 5. More subject to embrittlement at low temperature. 6. Softer. 7. Less ductile. 8. Change dimensions through absorption of moisture or solvents. 9. Flammable. 10. Some varieties are degraded by ultraviolet radiation. 11. Most cost more (per cu in.) than competing metals. Nearly all cost more per pound.

Either favorable or unfavorable: 1. They are flexible. Even rigid varieties are more resilient than metals. 2. They are electrical non-conductors. 3. They are thermal insulators. 4. They are formed through the application of heat and pressure.

Exceptions: 1. Some reinforced plastics (glass-reinforced epoxies, polyesters, and phenolics) are nearly as rigid and strong (particularly in relation to weight) as most steels. They may be even more dimensionally stable.

2. Some oriented films and sheets (oriented polyesters) may have greater strength-to-weight ratios than cold-rolled steels.

3. Some plastics are now cheaper than competing metals (nylons vs. brass, acetal vs. zinc, acrylic vs. stainless steel).

4. Some plastics are tougher at low than at normal temperatures (acrylic has no known brittle point).

5. Many plastic-metal combinations extend the range of useful applications of both (metal-vinyl laminates, leaded vinyls, metallized polyesters).

6. Plastic and metal components may be combined to produce a desired balance of properties (plastic parts with molded-in, threaded metal inserts; gears with cast-iron hubs and nylon teeth; gear trains with alternate steel and phenolic gears; and rotating bearings with metal shaft and housing and nylon bearing liner).

7. Metallic fillers in plastics can make them electrically or thermally conductive or give them magnetic properties.

b) 1. Расскажите об основных свойствах пластмасс. 2. Расскажите о свойствах, которые можно рассматривать как положительные или отрицательные.

c) Сравните основные свойства пластмасс и металлов. (Используйте при сравнении степени сравнения, союзы сравнения).

Text 1

Pre-Text Section

Practice 1. Прочитайте текст и найдите в нем информацию по следующим вопросам:

1. о каких металлах и сплавах упоминается в тексте;
2. в чем состоит суть процесса получения чушкового чугуна в доменной печи;
3. каким образом можно улучшить структуру (качество) чугуна.

Metals for Motoring

The parts of your car come in all kinds of different shapes and sizes and, what is equally important, in a wide variety of different materials. Let us have an in-depth look at car materials.

Iron. Obviously the bulk of a motor car is made from metals based on iron. Iron is an element that has a chemical symbol Fe and is the father of the ferrous family. It is obtained by filling a blast furnace with iron oxides or carbonates and coke, setting light to the mass and blowing air through it. The carbon in the coke and the oxygen in the iron oxide combine to produce carbon monoxide that burns and takes more oxygen from the iron part of the furnace charge to give carbon dioxide. As the temperature increases the iron melts and, from time to time, is allowed to flow out of the bottom of the furnace into special troughs cut into the sand floor of the iron works.

Blast furnace-produced iron, the basic material of steels, contains between 3 and $4^0/_0$ of carbon and smaller percentages of impurities such as sulphur, silicon, phosphorus and manganese.

Cast iron. Ordinary cast iron is produced by melting pig iron and pouring it into moulds, made of sand, to get it to set into complex shapes. It is a cheap material that is soft, fairly brittle and unsuitable for anything that takes a tension or bending load. In compression there is virtually no plastic deformation or elasticity; it just suddenly fractures across a plane at about 55°. So cast iron is used for

castings such as crank-cases, gearboxes and rear axles.

If the pig iron used for casting is specially selected to have smaller amounts of carbon and a low sulphur and phosphorous content and the rate of cooling the casting is controlled to a slow rate, then the structure of the iron is improved. The graphite can be made to form into balls or modules, which are much stronger than the usual plates or starfish shapes and the iron part tends to form as pearlite. These cast irons are two or three times as strong in tension as ordinary grey cast iron and have a certain amount of elasticity and less brittleness. They are used for crankshafts as it is much easier to cast a crankshaft shape than to forge it.

Copper. The main constituent of the brass/bronze family is copper, which is obtained by roasting the copper sulphide ores to remove the arsenic and antimony impurities and then smelting the ores in a furnace to produce the molten metal. Copper is soft, ductile and easily worked and is difficult to produce in a really pure state. Plain copper is seldom used for anything but electrical components in cars, due to its low resistance. It is used for pipework because of its ductility, but has been replaced by cheaper and better materials.

Aluminium. Aluminium is produced by electrolytic means from bauxite, an aluminium hydroxide, and makes a good clean casting with a fairly coarse grain structure. It is a fair substitute for cast iron except that it is a bit more ductile. On the other hand, it can be rolled or drawn into sheets, rods, and tubes that can be bent due to their ductility whereas cast iron cannot.

The aluminium alloys with copper, manganese, silicon and nickel are pretty numerous and are selected either for their corrosion resistance, high electrical conductivity, ductility and/or higher strength.

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blast furnace доменная печь
to set light зажигать
to blow air продувать воздух
charge шихта
to melt плавить
to flow out вытекать
trough желоб
impurities включения
to pour (to cast) into moulds заливать в формы
pig iron чушковый чугун
grey cast iron серый чугун
to forge ковать
to roast выжигать
casting отливка
substitute заменитель

After-Text Section

Practice 1. Суммируйте полученную вами информацию, заполнив следующую таблицу.

Материалы	Исходное сырье	Свойства	Применение
pig iron grey cast iron pearlite copper aluminium			

Text 2

Pre-Text Section

Practice 1. Прочитайте вводный абзац и выделите информацию об основных потребителях новых сортов стали в общем машиностроении. Определите, о каких сортах стали идет речь в текстах A и B.

General Machinery and New Steel Products

With the growing scale of civil engineering works and their spread into frigid zones and underwater sites, construction equipment such as bulldozers, dump trucks, hydraulic cranes and power shovels are becoming larger and larger. Their performance is meanwhile being improved by the addition of microcomputer systems. Petrochemical equipment, too, is being designed for use under severer conditions than ever before. For such steel users, the steel industry has developed more economical steel materials with notable improvements in properties. Some examples are introduced below.

Text A

Non-Quenched/Tempered High-Strength Steel

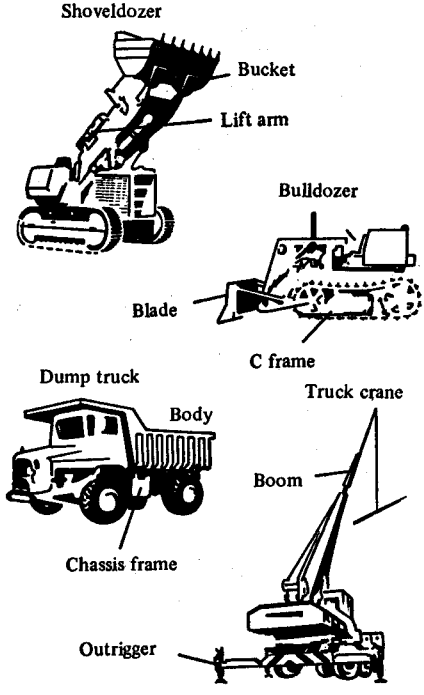
This is a steel with tensile strength above 60 kgf/mm^2 and in the as-rolled (untempered) state. Lowering the material's carbon equivalent and using the latest rolling technique have remarkably improved its weldability, workability and low-temperature toughness. It is highly suited to use in construction equipment — and, being an as-rolled material, it is also quite economical.

Text B

Wear-Resistant Steels

A new series of steels featuring excellent resistance to wear, cracking and deformation are being used for the parts of construction equipment that come into direct contact with rocks, dirt and sand. The series includes three types — one for use where toughness is most needed, one for general use and one for use where economy is most important — and each type is further divided into five grades according to hardness, which ranges from 235 to 401.

Wide Application of Non-Quenched/Tempered Steel in Construction Equipment



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scale масштаб
dump truck самосвал
shovel экскаватор
weldability свариваемость
toughness жесткость, прочность
hardness твердость

After-Text Section

Practice 1. Каковы свойства стали, описанной в тексте? Где она применяется?

Practice 2. Назовите все механизмы, изображенные на рисунке. Опишите по-английски каждый механизм на рисунке, используя модель:

A is made of B.

Practice 3. Каковы отличия в типах стали одной и той же серии, описанной в тексте В?

Text 3

Pre-Text Section

Practice 1. Определите из вводного абзаца, какие нужды автомобилестроения должны удовлетворить заводы, производящие сталь.

Practice 2. О каких сортах стали идет речь в тексте А и в тексте В?

Practice 3. В каких узлах автомобиля используются эти стали?

Automobiles and New Steel Products

Raising fuel efficiency and complying with legal regulations related to safety and durability are pressing issues in the automotive industry. Steelmakers must supply materials that help to meet these goals while reducing users' costs as well. Described below are new steel products that answer the needs of automobile manufacturers in several specific ways.

Lightweight Steel Sheets

Text A

Formable High-Strength Steel Sheets

These sheets, used for the outer panels of automobiles, offer both high strength and good workability — properties which until now were difficult to combine in a single product. They can be thin due to their high strength, and their thinness saves weight. The new sheets resist denting by flying pebbles and are stiff enough to prevent noise and vibration when the vehicle is running. They are now available in several types: sheets for general forming, with good bendability; low-yield ratio sheets with high strength

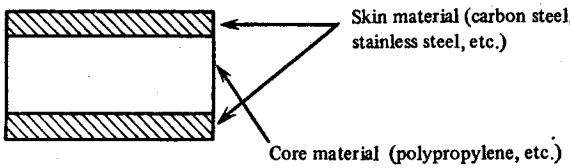
and high ductility; sheets for deep drawing, with high Lankford value; and sheets of bake-hardening type for deep drawing, their strength rising when paint-baked. These products are offered in a range of tensile strength from 35 to 100 kgf/mm^2. Coated and one-side coated high-strength steel sheets are also on the market.

Text B

Plastic-Sandwiching Steel Sheets

In this product, a plastic sheet is sandwiched between two steel sheets. A type recently supplied to one automobile maker, consisting of a 0,6-mm plastic sheet between two 0,2-mm steel sheets, is only half the weight of the usual 1-mm steel sheet and yet has the same rigidity. It is used for trunk-lid panels and air-cleaner covers.

Structure of Plastic - Sandwiching Steel Sheets



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to comply with regulations подчиняться правилам
pressing issues насущные проблемы
goal цель, задача
denting образование вмятин
pebble камень, галька
stiff жесткий
bendability сгибаемость
ductility ковкость
rigidity жесткость
trunk-lid крышка багажника
cover кожух

After-Text Section

Practice 1. О каких свойствах стали идет речь в тексте А? в тексте В?

Practice 2. Что, кроме области применения, объединяет оба текста под одной рубрикой?

Text 4

Pre-Text Section

Practice 1. Каковы специфические потребности в новых сортах стали в строительной технике? (Ср. с общим машиностроением и автомобилестроением.)

Practice 2. О каком виде стали идет речь в тексте?

Construction and New Steel Products

With the trend toward structures of increasing size, the construction industry is emphasizing high strength and low cost when specifying materials, along with effectiveness in shortening the construction term. The importance of corrosion resistance has risen with the increase in construction projects in coastal districts and offshore, and good weathering performance is in great demand for all construction materials. In this field, durability takes priority over low initial cost. A variety of steel materials have been developed to satisfy today's construction needs.

Easy-to-Use Reinforcing Materials

Steel Fiber

Steel fiber for reinforcing concrete is another recent innovation. Its flat shape gives this fiber a large effective surface for good adhesion to concrete. Mixed into concrete in a ratio of 1-2% by volume, it remarkably improves the bending strength, tensile strength and impact strength of the concrete. It has already proved its usefulness in the construction of roads, runways, and floor slabs for bridges and tunnels.

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trend направление, тенденция
to take priority over *зд.* быть более важным
fiber волокно
to reinforce армировать, придавать жесткость
concrete бетон
adhesion сцепление, прилипание
in a ratio of в соотношении, в пропорции
slab плита

After-Text Section

Practice 1. Опираясь на информацию текста, заполните следующую таблицу.

Вид материала		Характеристика		Применение	
англ.	русск.	англ.	русск.	англ.	русск.
A. Steel fiber	...	1. ... 2. ... 3. ...	...	1. ... 2. ... 3. ...	...

Text 5

Pre-Text Section

Practice 1. Прочитайте текст и озаглавьте его.

Pure aluminum has good corrosion resistance and working and forming properties but poor machining characteristics and low mechanical strength. By adding other elements to aluminum, its strength and machining characteristics can be improved. Such a combination of two or more elements, at least one of which is metallic, is called an alloy and the predominant metal in the system is referred to as the base metal.

Silicon, copper, zinc and magnesium are common alloying elements and are often added to aluminum in substantial proportions. Iron, manganese, nickel, chromium, titanium, antimony, cadmium, cerium, lithium, beryllium and molybdenum are also added in smaller proportions with various beneficial effects.

Titanium, tungsten, cerium and molybdenum all contribute to grain refinement of cast aluminum. Manganese and antimony are often added to improve corrosion resistance. Cobalt and nickel affect strength and workability while cadmium and tin increase hardness in heat treatable alloys.

The market penetration of ZA alloys has been aided by the fact that traditional high volume foundry metals have significant shortcomings that detract from their inherent advantages:

cast iron has high energy and machining costs, protective finishes are nearly always required and there are industry environmental problems;

bronze has high material and energy costs and the environmental problem of lead for many important alloys;

aluminum has limitations in strength, bearing properties and finishing along with moderately high energy costs. Of course, each of these classic materials does have distinct advantages in given applications.

In contrast, the zinc casting alloys have advantages that are highly attractive to foundries:

excellent casting properties;

low energy consumption;

pollution free melting and casting;

excellent machinability;

lower material cost and density than bronze.

shortcoming = drawback недостаток
protective finish защитное покрытие
environmental problems проблемы защиты окружающей среды
bearing properties свойства нести нагрузку
ZA = zink + aluminum

After-Text Section

Practice 1. Суммируйте информацию текста, дополнив следующие таблицы.

Исходный материал	Легирующие добавки	Цель внесения добавок	
		англ.	русск.
Pure aluminum	1.	to improve grain refinement	улучшение измельчения зерна
	2.	to increase hardness in heat treatable alloys	
	3. manganese and antimony		
	4.		увеличение прочности и способности к механической обработке

Материал		Преимущества		Недостатки	
англ.	русск.	англ.	русск.	англ.	русск.
1. cast iron 2. bronze 3. aluminum 4. ZA alloys		cheap — *		very brittle	

* Знаком (—) отмечены графы, не требующие заполнения.

Text 6

Pre-Text Section

Practice 1. Прочитайте текст.

A Wonder Metal

The story of titanium is extraordinary. To begin with, it was discovered twice. A British scientist, William Gregor, found it first and called it menachanite, and six years later, in 1797, M. H. Klaproth, a German chemist, also found it and gave it its present name.

For many years, titanium was of inretest only to research chemists — it was considered too brittle to be of any practical value. Yet it was the impurities with which it was usually associated (it forms compounds easily with nearly every known element) that made it brittle.

It cost the chemists in many countries endless efforts to isolate pure titanium and even more to start producing it commercially. In 1948 the world stock of pure titanium was only ten tons. Today the output is much larger.

Titanium has one surprising property — it is completely inert in biological media, something the medical community was quick to notice. It is being used to make artificial joints and many other things necessary in surgery at the Priorov Central Institute of Traumatology and Orthopedics. Titanium instruments do not corrode, and are thirty per cent lighter than instruments made of stainless steel.

Titanium's high standard of corrosion resistance, lightness, tensile strength, and the ease of forging, rolling and stamping are finding it more and more uses. Titanium alloys are very useful in mechanical engineering, and for chemical and refractory apparatus. Titanium helped Soviet design engineers to surmount the sound and heat barriers in supersonic and high-altitude aircraft designing. On earth, it shows good work at chemical plants, in the pulp-and-paper and food industries. Moreover, it is still a source of surprise for the investigator.

A group of researchers at our Institute, under the leadership of Professor. I. Kornilov, D. Sc. (Chemistry), produced a material that has a kind of "memory", as the following experiment shows: a thin bent strip of the new alloy was clamped to a stand, a 500-gram weight hung on the free end. A current was passed through for several seconds, which heated the strip to more than 100 °C. As if commanded by an enigmatic force, it straightened out

like a tight spring and lifted the load. When the current was switched off, the strip gradually went back to its original shape. The cycle was repeated a number of times, and the strip always "remembered" its original shape. The surprising phenomenon of direct conversion of thermal energy into mechanical is seen with the naked eye.

The explanation is in the crystalline modifications of titanium-nickel alloy which, changing with the temperature, also changes back again.

This is why the material has a "memory" and special acoustic properties. At room temperature, the alloy called titanium nickeloid becomes soft, ductile and does not produce the characteristic metallic sound when struck. However, when it is heated to a certain temperature, it becomes hard, resilient and ringing.

There will undoubtedly be some unusual applications for this phenomenon in the future — even at this early stage it is clear that titanium-nickeloid-based alloys will be useful in many areas. For instance, in sensitive pickups which are activated by a change in temperature, in acoustics for sound absorption, etc., etc.

Titanium and its alloys are coming out in the commercial field — they have already made quite a name for themselves as structural materials.

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brittle хрупкий
impurity примесь
output выпуск
media среда
artificial joints искусственные суставы
surgery хирургия
tensile strength прочность на разрыв
refractory огнеупорный
to surmount the barrier преодолеть барьер
pulp-and-paper industry целлюлозно-бумажная промышленность
strip полоска
to clamp закреплять
current ток
to straighten out выпрямляться
tight spring тугая пружина
load = weight *зд.* груз
conversion преобразование, превращение
when struck при ударе
sensitive pickup чувствительный адаптер, звукосниматель

After-Text Section

Practice 1. Вы ознакомились с содержанием текста. Отметьте, какие из нижеприведенных утверждений соответствуют содержанию текста.

1. Titanium was discovered twice. 2. Pure titanium is found in nature. 3. Titanium forms compounds with many elements. 4. To isolate pure titanium isn't difficult.

5. Titanium is light, strong and corrosion resistant. 6. It is active in biological media. 7. Titanium can be used in surgery. 8. Titanium alloys can't be used as structural materials.

Practice 2. Перечислите области применения титана и его сплавов.

Practice 3. Скажите, о чем свидетельствует результат опыта, описанного в тексте. Подтвердите свой ответ соответствующими положениями текста.

Text 7

Pre-Text Section

Practice 1. Переведите заголовок текста и скажите, о чем, по вашему мнению, пойдет в нем речь.

Practice 2. Прочитайте текст. Соответствует ли ваше предположение фактическому содержанию текста?

Practice 3. Найдите в тексте ответы на следующие вопросы.

1. What is plastic memory? 2. In what cases is this memory undesirable? 3. What phenomena does the change in mechanical properties of polymers result from? 4. List four ways of plastic memory exploitation.

Plastic Parts That Remember

Thermoplastics can be bent, pulled, or squeezed into various useful shapes. But eventually — especially if you add heat — they return to their original form. This is known as plastic memory. Plastic memory offers some interesting design possibilities.

Thermoplastics never forget. You deform them; and after a while, depending on temperature, they move back toward their original shape.

When most materials are bent, stretched, or compressed, they somehow alter their molecular structure or grain orientation to accommodate the deformation — permanently. Not so with polymers. Polymers temporarily assume the deformed shape but always maintain internal stresses that want to force the material back to its original shape. Usually, this desire to change shape is called plastic memory.

This so-called memory is often undesirable. Sometimes people prefer that thermoplastic parts forget their original shape and stay put — especially when the parts

must be formed, machined, or rapidly cooled. However, this memory, or instability, can be used advantageously.

The time/temperature-dependent change in mechanical properties results from stress relaxation and other viscoelastic phenomena typical of polymers. When the change is an unwanted limitation, it is called creep. When the change is skilfully adapted to the overall design, it is called plastic memory.

Most plastic parts can be produced with a built-in memory. That is, the tendency to move into a new shape is included as an integral part of the design. So then, after the parts are assembled in place, a small amount of heat can make them change shape.

Seals, gaskets and seamless covers for tubing and wiring are typical examples.

In other applications, plastic parts can be deformed during assembly, then allowed to return to their original shape. In this case, parts can be stretched around obstacles without permanent damage.

Potential memory exists in all thermoplastics. Polyolefins, neoprene, silicone, and some other polymers can be given a memory either by radiation or by a chemical change.

Memory can be exploited in four ways:

1) The component is deformed at room temperature. Upon heating, the component recovers its original dimensions.

2) The component is deformed at an elevated temperature and — while held in the strained condition — it is cooled to room temperature so that the deformation is "frozen in". Upon reheating, the component returns to its original dimensions.

3) The component is used in a confined situation under constant stress. The deformed sections try to return to their original dimensions or form. Since the part is restrained from doing this, a stress — in addition to the normal elasticity — is produced which is most often used for sealing.

4) The component is deformed for a short interval, then the stress is removed. After a time, at room temperature, most of the deformation is recovered. This condition is often used for installation of parts over obstructions.

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to bend (bent) изгибать
to pull = to stretch тянуть, натягивать
to squeeze = to compress сжимать
memory память

to maintain stress сохранять напряжение
(un)desirable (не)желательный
to stay put оставаться неизменным
creep крип, ползучесть, пластическая деформация
built-in memory запрограммированная (встроенная) память
seals, gaskets and seamless covers for tubing and wiring различного рода прокладки и бесшовные покрытия для труб и проволоки
is "frozen in" приостановлена
to confine ограничивать, держать в границах
to restrain удерживать

Text 8

Pre-Text Section

Practice 1. Прочитайте заголовок текста и переведите его.

Practice 2. Прочтите текст и найдите в нем информацию по следующим вопросам:

1. свойства нового материала;
2. какие традиционные материалы он может заменить;
3. область применения нового материала.

Glass Fiber Reinforced Phenolic Thermosets

An extensive series of high performance glass fiber reinforced phenolic thermosets, the RX 800 series, has been introduced by the Molding Materials Div., Rogers Corp. Free of asbestos, the series' initial six grades are said to possess the high performance mechanical, electrical, and thermal properties normally found in asbestos reinforced compounds. They are designed for demanding automative and electrical appilcations and are said to be an excellent choice for replacement of die cast metal parts.

Combinations of impact strength, electrical properties, dimensional stability, processibility, heat resistance, and price appear to make the RX 800s cost-effective replacements for asbestos-containing thermosets, engineering thermoplastics, and die cast metal. Processing characteristics are suitable for injection or compression molding.

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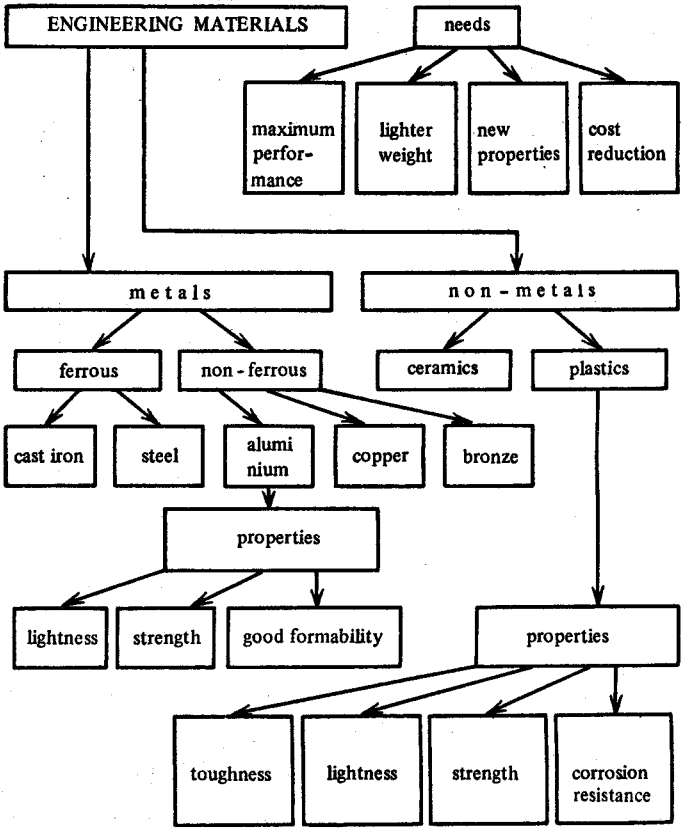
initial grades первые марки
replacement замена
diecast parts детали, отлитые под давлением
dimensional stability способность сохранять размеры
processibility способность к обработке
injection / compression moulding инжекционное прессование / прессование в формах

ДЕНОТАТНАЯ СХЕМА



UNIT VI

Materials Technology

Text 1A

READING AND COMPREHENSION

1. **Прочитайте заглавие и последний абзац текста. О прогрессе какой области науки или техники идет речь в тексте? Можно ли об этом узнать, прочитав только заглавие?**
2. **Просмотрите 2-й и 3-й абзацы текста и найдите предложения, содержащие сообщение о целях, с которыми проводятся изменения в технологии машиностроения.**

Changes in Materials Technology

Since the technology of any age is founded upon the materials of the age, the era of new materials will have a profound effect on engineering of the future.

Not only new materials, but related, and equally important, new and improved and less wasteful processes for the shaping, treating and finishing of both traditional and new materials are continuously being developed. It is important that an engineer should be familiar with them. These include casting, injection molding and rotational molding of components of ever increasing size, complexity and accuracy; manufacture of more complex components by powder metallurgy techniques; steel forming and casting processes based on new, larger and more mechanized machines, giving reduced waste and closer tolerances; the avoidance of waste in forging by the use of powder metallurgy or cast pressforms and new finishing

processes for metals and plastics, just to name a few. A high proportion of these processes is aimed at the production of complex, accurate shapes with a much smaller number of operations and with far less waste than the traditional methods of metal manufacture.

Joining techniques have developed to unprecedented level of sophistication and are also providing opportunities for economies. It is necessary to mention that these newer techniques allow the manufacture of complicated parts by welding together simpler sub-units requiring little machining; such assemblies can be made from a variety of materials. The methods can also be used effectively for assembly, allowing savings to be made in both materials and machine utilization.

The brief review of new processes above has indicated that a new materials technology is rapidly emerging, providing new opportunities and challenges for imaginative product design and for more efficient manufacture.

WHILE-READING SECTION

Language Study

Practice 1. Догадайтесь о значении выделенных курсивом интернациональных слов. Значение слов, выделенных жирным шрифтом, уточните по словарю. Проверьте правильность выбранных вами значений по контексту.

technology, *era,* to have **an effect,** *process,* **finishing,** *traditional* materials, *manufacture, complex component, mechanized* machine, *pressform,* **accurate** shape, joining **technique, assemblies, assembly,** to *indicate*

Practice 2. Пользуясь словарем, переведите слова, обозначающие изделия, получаемые в результате определенных технологических процессов. Пример приведен в 1-й строке таблицы.

Процесс				Результат	
глагол		существительное			
англ.	русск.	англ.	русск.	англ.	русск.
to cast	отливать	casting	литье	casting	отливка
to forge	ковать	forging	ковка	forging	...
to assemble	собирать	assembly	сборка	assembly	...
to mould	формовать, отливать в форму	moulding	формовка, прессование в формах	moulding	...

Practice 3.

Модальные глаголы, встретившиеся вам в тексте, могут иметь следующие значения: should *желательно, следует; вполне вероятно;* can/could *возможно, реально; вполне вероятно.*

a) Определите, в каком значении выступают эти глаголы в данном тексте (2-й абзац, 3-й абзац).

b) Составьте предложения, пользуясь таблицей. Предварительно вспомните значения других модальных глаголов.

The engineer	should	be used effectively for welding.
These methods	could	know the cost of materials.
New materials	can	develop new and improved processes.
technology	must	provide new opportunities for more efficient manufacture.

Practice 4. a) Изучите шкалу, показывающую степень вероятности действий, выражаемую модальными глаголами.

uncertain — might, may, could, can, should, ought to, would, will — certain must

b) Заполните пропуски в следующем тексте модальными глаголами. Переведите получившийся вариант текста. Уточните, насколько вероятно действие, которое вводит модальный глагол.

Corrosion

Corrosion attacks all engineering materials, especially metals.

No material ... be completely corrosion-resistant. Even stainless steels ... corrode. Engineers ..., however, fight corrosion. For example, they ... use high-purity metals because these metals are more resistant than alloys. They ... also make sure that two dissimilar metals are not allowed to touch each other. Finally engineers ... protect the surfaces of the metals in many different ways. One of the most common methods ... be to paint them.

Practice 5.

1. Adj + er — сравнительная степень прилагательных
2. more/less + Adj

close tolerances точные допуска — closer tolerances более точные допуска

a) Найдите в тексте прилагательные в сравнительной степени и назовите предметы, качества которых сравниваются.

b) Измените форму прилагательных в следующих сочетаниях так, чтобы получившиеся сочетания отражали изменение в процессе производства в лучшую сторону. Переведите сочетания на русский язык.

Model: wasteful process — less wasteful process

complex component, large machine, accurate shape, a small number of operations, little waste, new techniques, simple unit, efficient manufacture

Practice 6.

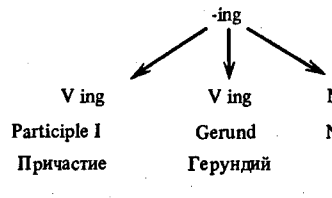
Группа существительного (NP)

Усилители	Прилагательные	Исчисляемые существительные
many far	more fewer	materials processes
Усилители	Прилагательные	Неисчисляемые существительные
much far	more less	space time

Проанализируйте существительные 3-го абзаца текста с тем, чтобы установить, в какой из двух вышеприведенных классов подпадает каждое из них.

Practice 7. Проанализируйте последнее предложение 2-го абзаца; вычлените две группы существительных, аналогичные приведенным в таблице выше; переведите их на русский язык.

Practice 8.



Отличительными особенностями отглагольного существительного являются: **a/the; ...ing(s); of.**

Найдите в тексте слова на -ing и распределите их по разным разделам таблицы.

Participle I V ing	Gerund V ing	Noun N ing

Practice 9. Найдите в тексте предложения, в которых употреблены нижеприведенные конструкции; переведите их на русский язык.

1) not only ... but
не только... но и

2) both ... and
как ... так и

Practice 10.

have + V ed → результат действия,

is/are + V ing → длительность действия

Какое из следующих предложений соответствует содержанию текста?

1. Joining techniques *have developed* to the high level of sophistication. Joining techniques *are developing* to a high level. 2. The review of new processes *has indicated* that a new materials technology is rapidly developing. The review of new processes *is indicating* that a new materials technology is rapidly developing. 3. The avoidance of waste in forging *has been achieved* by the use of powder metallurgy. The avoidance of waste in forging *is being achieved* by the use of powder metallurgy.

Practice 11.

Сложное предложение (The Complex Sentence)

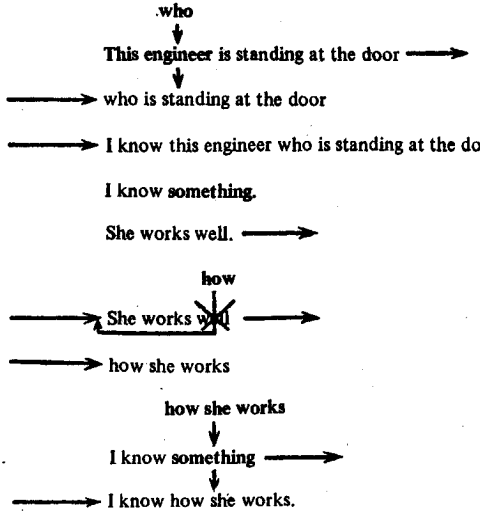
$$S_1 + S_2 + ... \rightarrow S$$

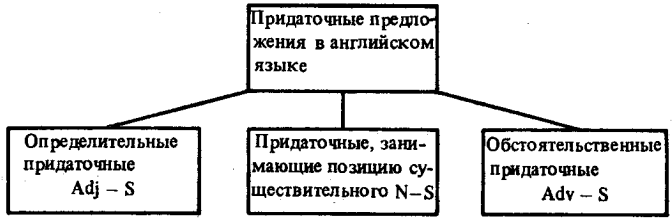
Помните, что придаточные предложения занимают одну из позиций членов простого предложения.

П	С	Д	
He	did	*this.*	
He	did	*what he could.*	
П	С	Д	(Опр.)
I	know	the engineers *of this plant.*	
I	know	the engineers *working at this plant.*	
I	know	the engineers *who are working at this plant.*	

При порождении сложноподчиненного предложения из простых предложений одно из них становится как бы матричным (главным) предложением, а другое превращается во вставочное (придаточное) предложение.

I know *this engineer.*
This engineer is standing at the door.





Сложноподчиненное предложение отличается от простого тем, что имеет два и более ядра (т. е. по крайней мере два сказуемых и два подлежащих). Поэтому перевод на русский язык следует всегда начинать с нахождения центра (ядра) главного предложения, после чего легко определить тип придаточного и правильно перевести его.

Проанализируйте сложные предложения из текста, дайте полный набор их составляющих.

Practice 12. Определите, какие из приведенных ниже предложений простые, а какие — сложноподчиненные.

1. They also undertake the training of people who want to work at the new plant but do not have the required qualification. They also undertake the training of people working at the new plant but do not have the required qualification. 2. The students know how to conduct this experiment. The students know how they have to conduct this experiment. 3. He shows me the results of his work. He shows me what results he has obtained. 4. There is a growing need for engineers who are familiar with the fundamental problems in metal processing and manufacturing. There is a growing need for engineers familiar with the fundamental problems in metal processing and manufacturing. 5. When new types of autos are designed all the latest achievements of scientific and engineering progress are taken into account. When designing new types of autos all the latest achievements of scientific and engineering progress are taken into account. 6. On receiving his diploma the engineer does not finish his education. When the engineer receives his diploma he does not finish his education.

Practice 13. Сгруппируйте предложения в зависимости от типа придаточного, ориентируясь на порядок слов в английском предложении.

1. The history of civilization shows that transport always was and still remains one of the largest branches in the general system of world economy. 2. In those days people thought that a cart with an engine instead of a horse was dangerous. 3. The program was launched in 1918 by the establishment of the automobile laboratory which two years later was reorganized into NAMI. 4. The question was how we could repair this machine. 5. All students know that to become an engineer they must study hard. 6. The newly built and reconstructed motor works soon

had strong designing and engineering teams, which later produced world-famous scientists. 7. The fact is that they are very good engineers.

Practice 14. Переведите следующие предложения на русский язык, определив предварительно тип придаточного.

a) 1. One of the specific features of Soviet automaking is the high degree of specialization, which constitutes one of the main factors for raising the efficiency of production. 2. At present Moscow has 2,000 cars running on liquid gas, which is cheaper than gasoline. 3. The exploitation of gas-driven cars and scientific experiments show that it is now possible to produce engines operating on gas. 4. As a rule a mechanic tells you what is wrong with your car. 5. It is expected that cars with less toxic exhaust gases will be widely used soon. 6. Nowadays it is possible to produce engines operating on gas whose exhaust is 60-90 percent less toxic than that of gasoline engines.

b) 1. The new era of composite materials will have a profound effect on engineering of the future. 2. The engineer designed the insides of components that give non-uniform properties in a preferred direction. 3. It is not only plastics and their reinforcement which are changing the materials scene. 4. The ceramic magnets we use now in electric engineering have replaced the traditional steel pole-piece plus copper field coil. 5. That the quantitative changes are associated with radical changes in technology is a well-known fact. 6. The rapidity of change in materials technology is typified by the fact that plastics are now being used in large volumes. 7. Plastics are used in volumes which have exceeded those of all the non-ferrous metals put together.

Practice 15.

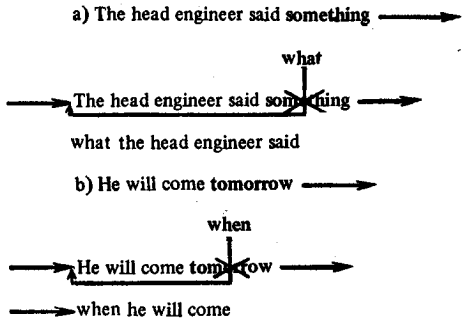
Придаточные предложения, занимающие позицию существительного (N — S)

Придаточные предложения, занимающие позицию существительного, образуются из простых предложений после ряда трансформаций (см. с. 253).

Исходя из позиции существительного, этот тип придаточных предложений распадается на

1) дополнительные придаточные:
   a) I know *what the head engineer said.*
   b) I know *when he will come.*

S_1	+	what who when where that whom which how why whether if	+	$S_2 \rightarrow S$



2) придаточные подлежащие:
   a) *What the head engineer said* is very important.
   b) *When he will come* is not known.
3) предикативные придаточные:
   a) The question is *what the head engineer said.*
   b) The question is *when he will come.*

Найдите в тексте предложения, в которых придаточные занимают место существительного.

Practice 16. В каких предложениях употреблены придаточные-существительные?

1. The fact is that all elementary forms of matter are composed of very small units. 2. A machine that produces power is called an engine. 3. We know that this engine may be mounted on the "Moskvitch". 4. How the economy of this work was obtained was one of the most important questions. 5. Electronic machines work according to a programme that is prepared in advance. 6. That student design bureaus play a big role in developing scientific activity among students is very important.

Practice 17. Переведите на русский язык следующие сложные предложения. Особое внимание обратите на перевод многозначных союзов if, that.

1. In those days people thought that a cart with an engine instead of a horse was dangerous. A cart that had an engine instead of a horse was thought dangerous. 2. If the reinforced plastics will be used in this car depends on the results of the test. If we obtain good results the reinforced plastics will be used in this car. 3. That future improvements in productivity largely depends on the application of science to manufacturing is a well-known fact. The improvements of science that are applied to manufacturing increase the productivity in all branches of industry.

Practice 18. Переведите следующие сложные предложения с придаточными, занимающими место существительного.

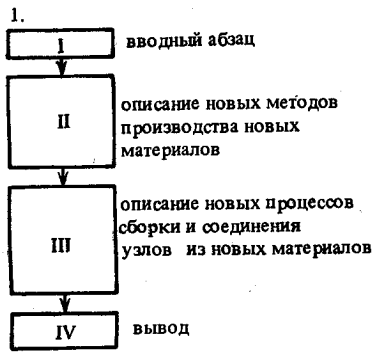
1. Why the machine was out of order was not clear to me. 2. Specialists have estimated that the amount of energy in the uranium and thorium reserves in the earth's crust is from 10 to 20 times greater than that in all deposits of coal and oil put together. 3. We must define now how the conditions change with temperature. 4. Under such conditions the problem arises whether the unit will operate properly. 5. You will learn what a diesel engine is and then you will know how it works and how it differs from a gasoline engine. 6. The advantage of the diesel engine is that it has a higher thermal efficiency.

Practice 19. Переведите следующий отрывок со словарем. Особое внимание обратите на перевод придаточных предложений различных типов.

Chemistry has had a new birth in our century, essentially organic chemistry. The new light clothes that are so popular everywhere in the world are often made out of synthetic man-made materials based on cellulose. Beautiful paints, plastics, cosmetics and many medicines are all based on cellulose. What is most important is that there is cellulose in all trees, vegetables and fruits, cellulose is easily found everywhere in nature, in all things that grow. Every day, chemists are finding new uses for this wonderful material.

Text Study

Practice 1. Какая из схем точнее отражает логику текста?



Practice 2. Найдите в первом предложении 2-го, 3-го и 4-го абзацев слова, указывающие на связь содержания каждого абзаца с одним из предыдущих абзацев.

Practice 3. Найдите во 2-м и 3-м абзацах выражения, которые подчеркивают, что именно эти абзацы являются наиболее важными.

AFTER-TEXT SECTION

Text Discussion

Practice 1. Ответьте на вопросы к тексту 1А.

1. Is materials technology changing? 2. What do the new manufacturing processes include? 3. What are they aimed at? 4. Can complicated parts be manufactured by welding together simpler sub-units? 5. Can these assemblies be made from a variety of materials? 6. What has the brief review of new materials and processes indicated? 7. Why is it necessary that an engineer should know these processes?

Practice 2. Выразите свое отношение к следующим положениям, используя разговорные формулы.

That's right! I'm afraid you're wrong.
I quite agree with you. I don't think so.
I believe (suppose)...
In my opinion...

1. A good engineer must have a thorough knowledge of new processes to utilize them properly. 2. These new processes increase productivity. 3. Only a few of these

processes are aimed at the production of complex shapes. 4. Joining techniques are providing opportunities for economies. 5. The joining technique methods can't be used effectively for assembly.

Practice 3. Расскажите о новых тенденциях в технологии материалов. (При составлении рассказа воспользуйтесь Practice 1 как планом и активным словарем.)

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы и глагольные сочетания	Прилагательные	Наречия
названия технологических процессов	**shaping** **treating** **finishing** **casting** **injection/rotational moulding** **powder metallurgy techniques**	**to shape** **to treat** **to finish** **to cast** **to mould**		
	forging **joining techniques** **welding** **machining** **assembly**	**to forge** **to join** **to weld** **to machine** **to assemble**		
характеристика и результат технологического процесса	**comlexity** **accuracy** **waste** **close tolerance** **economy** **saving**	**to reduce waste** **to avoid waste** **to require little machining** **to make savings**	**profound** **accurate** **efficient** **complex**	**effectively** **equally**

Text 1B

PRE-TEXT SECTION

Practice 1. Вводный абзац текста выдвигает условия для получения оптимальной конструкции и способы осуществления этих условий. Прочитайте внимательно вводный абзац и укажите на эту связь.

Model:

highest performance → satisfying mechanical requirements
← utilizing the material that will perform satisfactorily

Practice 2. Просмотрите весь текст и найдите в нем информацию (если она имеется), раскрывающую содержание вводного абзаца.

Practice 3. Прочитайте заключение и найдите в нем характеристики машин и материалов будущего, которые были отмечены во вводном абзаце.

Working With New Materials

A successful design is almost always a compromise among highest performance, attractive appearance, efficient production, and lowest cost. Achieving the best compromise requires satisfying the mechanical requirements of the part, utilizing the most economical material that will perform satisfactorily, and choosing a manufacturing process compatible with the part design and material choice. Stating realistic requirements for each of these areas is of the utmost importance.

The rapidity of change in materials technology is typified by the fact that plastics, a curiosity at the turn of the century, are now being used in volumes which have for many years exceeded those of all the non-ferrous metals put together, and which are beginning to rival steel.

The changes which are taking place are, of course, not only quantitative. They are associated with radical changes in technology — in the range and nature of the materials and processes available to the engineer.

The highest specific strength (i. e. the strength available from unit weight of material) now available comes from non-metals, such as fibreglass, and from metals, such as berillium and titanium, and new ultra-high strength steels.

Fibre technology, in its modern form, is of more recent origin than plastics, but composites based on glass and/or on carbon fibres are already being applied to pressure vessels, to lorry cabs and to aircraft engines, and may well replace aluminium for the skin and structure of aircraft. An all plastic car has been exhibited: nearly the whole car, except the engine and transmission is of plastics or reinforced plastics.

It is not only plastics and their reinforcement which are changing the materials scene. Ceramics too are gaining an increasing foothold. Their impact as tooling materials in the form of carbides, nitrides and oxides is also well known — cutting tools made of these materials are allowing machining rates which had previously been

considered quite impossible. Silicon nitride seems to offer particular promise for a wide variety of applications. Amongst these is liquid metal handling. Pumps for conveying liquid aluminium are now on trial which could revolutionize the foundry industry. Silicon nitride is also being tested for the bearing surfaces of the Wankel rotary engines which are being developed as potential replacements for the conventional piston engines of our motor cars. And ceramic magnets have replaced the traditional steel pole-piece plus copper field coil for providing the engineering field for many electric motors.

It is clear that the number of combinations of all kinds of original trends in the production of new materials is practically unlimited. This, in turn, opens new realms for the designing of still cheaper, effective and unthinkably perfected, compared to that we have today, machines and mechanisms.

AFTER-TEXT DISCUSSION

Practice 1. Прочитайте основную часть текста еще раз и выделите из нее следующие сведения:

1. названия материалов, применяемых в машиностроении;
2. их характеристики;
3. область их применения.

Practice 2. Пользуясь материалом Practice 1, подготовьте сообщение на тему "New Materials Technology". При сообщении можете воспользоваться следующими структурами и словосочетаниями, типичными для текстов описания:

1. N_1N_2 ... are used in...
2. N_1 offers...
3. N_1 is applied for producing...

Text 2A

READING AND COMPREHENSION

1. Переведите заголовок (он полностью отражает содержание текста).

2. Прочитайте текст и определите:

1. абзац, в котором дано определение отливки;
2. в каком абзаце говорится о применении отливок;
3. абзац, в котором кратко изложена суть изготовления отливок;
4. какой вывод содержится в заключительном, 4-м абзаце текста.

Foundry. Metal Casting — a Basic Manufacturing Process

One of the basic processes of the metal-working industry is the production of metal castings. A casting may be defined as "a metal object obtained by allowing molten metal to solidify in a mold", the shape of the object being determined by the shape of the mold cavity. A foundry is a commercial establishment for producing castings.

Numerous methods have been developed through the ages for producing metal castings but the oldest method is that of making sand castings in the foundry. Primarily, work consists of melting metal in a furnace and pouring it into suitable sand molds where it solidifies and assumes the shape of the mold.

Most castings serve as details or component parts of complex machines and products. In most cases they are used only when they are machined and finished to specified manufacturing tolerances providing easy and proper assembly of the product.

At present the foundry industry is going through a process of rapid transformation, owing to modern development of new technological methods, new machines and new materials. Because of the fact that casting methods have advanced rapidly owing to the general mechanical progress of recent years there is today no comparison between the quality of castings, the complexity of the patterns produced and the speed of manufacture with the work of a few years ago.

WHILE-READING SECTION

Language Study

Practice 1. a) Выпишите из 1-го и 2-го абзацев текста английские слова и словосочетания, служащие для обозначения основных процессов в литейном производстве.

b) Уяснив их смысл с помощью политехнического словаря, дополните таблицу по образцу:

Процесс		Место протекания	
англ.	русск.	англ.	русск.
1. production of metal castings	производство металлических отливок	in the foundry	в литейном цехе

Продолжение

Процесс		Место протекания	
англ.	русск.	англ.	русск.
2. melting the metal			
3.		into the mould	
4.	затвердевание металла		

Practice 2. Найдите в тексте английские эквиваленты для следующих русских слов и словосочетаний.

быстро развиваться, обрабатывать механически, качественные отливки, правильная сборка, до установленных допусков, служить деталями, сложные модели, обрабатывать начисто

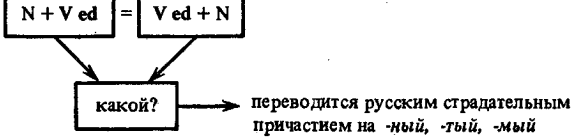
Practice 3. Переведите словосочетания на русский язык, при этом догадайтесь о значении выделенных курсивом интернациональных слов. Слова, выделенные жирным шрифтом,— «ложные друзья переводчика». Проверьте их значения по словарю и уточните смысл в данном словосочетании. Проверьте по контексту правильность выбранных вами значений.

basic *process, metal object,* **commercial** establishment, numerous *methods*, to serve as *details* and *component* parts, **complex** *machines* and *products*, proper **assembly,** rapid *transformation*, *technological methods*, **general** *mechanical progress*

Practice 4. Найдите пары слов, близкие по значению.

to define, to progress, nowadays, proper, parts, to produce, quick, details, to advance, to manufacture, rapid, to determine, suitable, at present

Practice 5.



the casting *produced* = the *produced* casting (in the foundry)

отливка, *изготовленная* = *изготовленная* отливка (в литейном цехе)

a) Переведите следующие отрезки предложений.

1. ...a metal object obtained by... 2. ...the poured mold... 3. ...machined and finished castings... 4. ...specified tolerances... 5. ...the complexity of patterns produced...

b) Найдите в 1-м, 3-м и 4-м абзацах текста предложения, в которых употреблены отрезки под номерами 1, 4, 5. Переведите эти предложения на русский язык.

c) Сравните приведенные ниже сочетания слов, построенные по модели V ed + N и уже известной вам модели V ing (какой) + + N, в которой V ing переводится русским причастием на «-щий(ся)», «-вший(ся)». Объясните смысловую разницу между ними.

1. developed methods — developing methods; 2. solidified castings — solidifying castings; 3. melted (molten) cast iron — melting cast iron; 4. poured metal — pouring metal; 5. machined parts — machining parts.

Practice 6.

Независимый причастный оборот

Причастный оборот:

The engineer was carrying out this experiement → The engineer made a lot of calculations.

→ *Carrying out this experiment* the engineer made a lot of calculations.

Независимый причастный оборот:

The engineer was carrying out this experiment. → The workers made a lot of calculations.

→ *The engineer carrying out this experiment*, the workers made a lot of calculations.

Формальным показателем независимого причастного оборота является наличие запятой в письменном тексте и место в предложении.

В зависимости от места в предложении оборот может переводиться:

а) самостоятельным предложением с союзами *а, и, причем, при этом*, если стоит в конце предложения (после запятой).

Model: New machines were brought to the plant, all of them being in good order. На завод привезли новые машины, причем все они были в хорошем состоянии.

б) обстоятельственными придаточными причины (союзы *так как, поскольку*), времени (союзы *когда, после того, как*), условия (союз *если*), когда стоит в начале предложения, перед подлежащим.

Model: An electron leaving the surface, the metal becomes positively charged. Когда электрон покидает поверхность, металл становится положительно заряженным.

a) Найдите в нижеприведенных предложениях указанную конструкцию. Переведите предложения на русский язык.

1. The first metals used by men were gold, silver and copper, these metals being found in nature in the native or metallic state. 2. The melting point of pure iron reaches 1535 °C, most steels melting at about 1300 to 1500 °C. 3. There are several branches of the metal working industry, foundry being one of the most important ones. 4. There is a lot of methods for producing metal castings, the production of sand castings in the foundry being the oldest one. 5. After the metal has been melted it is poured into the mold, the casting assuming the shape of the mold.

b) Найдите в 1-м абзаце текста предложение с данной конструкцией и переведите его на русский язык.

Practice 7.

Слова — организаторы научной мысли определяют логику научно-технического текста: owing to *благодаря*, in case *в случае (если)*, in most cases *в большинстве случаев*, because of *из-за, вследствие.*

Дополните предложения соответствующими словами-организаторами, сохранив логику текста 2А.

1. ...the general development of new technological methods the foundry industry is rapidly advancing. (in most cases, owing to) 2. ...this general development the quality of castings has greatly improved. (in case, because of) 3. ...castings are produced in sand molds. (owing to, in most cases) 4. ...castings are used as details and component parts of complex machines and mechanisms. (in most cases, because of) 5. ...castings must be ma-

chined and finished to specified manufacturing tolerances. (owing to, in this case)

Practice 8. Найдите в тексте слова на -ing и распределите их по разным разделам таблицы.

Participle I V ing	Gerund V ing	Noun N ing

Practice 9. Поставьте глаголы в форму Participle I, II, Gerund, отглагольного существительного.

1. A pattern (to make) of metal may be used longer than one (to make) of any other material. 2. Sand is the basic moulding material (to use) by foundry-men. 3. The most important of cast metals is cast iron which is made from pig iron by (to remelt) it in a cupola. 4. (To have made) all the necessary calculations the engineers began (to design) a new furnace. 5. The (to pass) of electricity through the charge heats it.

Practice 10. Найдите во 2-м абзаце текста предложение со словом-заместителем и назовите существительное, которое оно замещает.

Practice 11.

Обстоятельственные придаточные предложения

S_1 + when / as / while / before / after / as soon as / till / until / since / because / where / (al)though / if / so that / that + S_2 → S

Обстоятельственные придаточные предложения указывают на время, место, причину, условие, следствие и другие обстоятельства, при которых совершается действие, выраженное сказуемым главного предложения.

Обстоятельственное придаточное предложение занимает позицию обстоятельства в английском предложении. Например:

The engineers of the Research Institute test all the parts of the cars. Any automobile is put into mass production. → The engineers of the Research Institute test all the parts of the cars before any automobile is put into mass production.

Найдите в тексте предложения с обстоятельственными придаточными, дайте их изначальные простые предложения.

Practice 12. Выучите союзные слова из вышеприведенной таблицы.

Practice 13. Определите, в каких из приведенных предложений обстоятельство выражено группой слов, причастным оборотом, герундиальным оборотом, придаточным предложением. Переведите на русский язык.

1. Until the invention of "magic batteries" the electric car will remain the car of the future. Until "magic batteries" are invented, the electric car will remain the car of the future. 2. When taking a work break on the assembly line, workers are replaced by other workers. When workers on the assembly line take a work break, they are replaced by other workers. 3. On receiving his diploma, an engineer does not finish his education. An engineer does not finish his education when he receives his diploma. 4. The charges being equal, the atom is electrically neutral. The charges are equal so that the atom is electrically neutral. 5. Knowing something about ordinary gasoline engines such as those in automobiles you will notice that diesel engines, in many respects, work in the same way. If you know something about ordinary gasoline engines such as those in automobiles, you will notice that diesel engines, in many respects, work in the same way.

Practice 14. Переведите предложения с обстоятельственными придаточными на русский язык.

1. In the field of auto-making we started from nothing, because tsarist Russia left the young Soviet state no production or research and development facilities. 2. The parts of the first motor-cars were made to very rough measurements, so that the shaking and bumping on bad roads often broke them. 3. By "speeding up", the output of the conveyer line rose rapidly although the health of many of the workmen broke down. 4. Term papers, research

work, graduation theses of practical importance to industry — such are the stages of turning students into highly-skilled and thinking engineers ready for independent work even before they get their diplomas. 5. Many young scientists try their hand in research long before they enter post-graduate course. 6. Most automobile engines have six or eight cylinders, although some four-, twelve-, and sixteen-cylinder engines are in use. 7. Since the technology of any age is founded upon the materials of the age, the era of new materials will have a profound effect on engineering of the future. 8. Although ferrous alloys are specified for more engineering applications than all non-ferrous metals combined, the large family of non-ferrous metals offers a wider variety of characteristics and mechanical properties.

Text Study

Practice 1. Завершите предложения, подобрав соответствующие окончания в правом столбце.

1. A foundry is a commercial establishment for...	...the shape of the mold cavity.
2. A casting is a metal object obtained by...	... one of the oldest methods for producing metal castings.
3. The shape of the casting is determined by...	...the shape of the sand mold.
4. Sand casting production is ...	...allowing molten metal to solidify in a mold.
5. This method consists of...	...complex machines and products.
6. Then the metal solidifies and assumes...	...producing castings.
7. Most castings serve as details or component parts of...	...specified tolerances.
8. But at first they are machined and finished to...	...melting metal in a furnace and pouring it into sand molds.

Practice 2. a) Прочитайте приведенный ниже текст, тематика которого дополняет тематику основного текста 2A.

b) Скажите, какую дополнительную информацию о производстве отливок вы получили в области:

1) транспортировки жидкого металла;
2) способа заполнения литейной формы.

How a Casting Is Made

The process of making an iron casting can simply be described as the pouring of hot liquid or molten iron into a mold of a desired shape. Molten iron is poured from the ladles (ковш) into the sand molds. The iron travels along a series of passageways (*зд.* отверстие) in the molds to the cavities. It then falls from the bottom to top. The iron in the molds is allowed to cool for some time and the casting solidifies and hardens (отверждаться). At this time the casting is separated from the mold and the raw (*зд.* необработанный) casting is born.

Then the casting undergoes cleaning and checking before final processing.

AFTER-TEXT SECTION

Text Discussion

Practice 1. Ответьте на вопросы по теме "How a Casting Is Made".

1. What is a foundry? 2. What is a casting? 3. Is the shape of the casting determined by the shape of the mold cavity? 4. What basic processes does sand casting production consist of? 5. Where is metal melted? 6. In what molds is it poured then? 7. Does the metal assume the shape of the mold? 8. Can most castings be used as parts of machines immediately following their solidification? 9. What operations should a casting be subjected to?

Practice 2. a) Приготовьте сообщения по теме "How a Casting Is Made" по следующему плану:

1. Место изготовления отливок.
2. Основные процессы литейного производства.
3. Применение отливок.

(При подготовке воспользуйтесь информацией текста 2A, Practice 2 из раздела "Text Study", таблицей на с. 259 из раздела "Language Study", а также активным словарем на с. 267.)

b) Ситуации для высказывания.

1. Вам предстоит объяснить неспециалисту (т. е. в популярной форме), что такое литейное производство, какова его основная продукция и ее (этой продукции) назначение. Как вы это сделаете?
2. Вы побывали в литейном цехе машиностроительного завода. Расскажите, какие процессы вы там наблюдали.

Active Vocabulary

Область применения	Существительные и сочетания сущ.+сущ.	Глаголы	Прилагательные	Слова — организаторы научной мысли
место изготовления отливок	**foundry**			**owing to** **because of** **in case** **in most cases**
оборудование и продукция литейного производства	**(sand) casting mould** **mould cavity** **furnace** **pattern**			
процессы		**to melt** **to pour** **to solidify** **to form** **to machine** **to finish**		
характеристика материала, процессов, продукции	**tolerance** **quality** **shape**		**molten** **suitable** **proper** **rapid** **complex** **easy**	
классификация, спецификация изделий, процессов		**to define** **to determine** **to specify**		

Text 2B

PRE-TEXT SECTION

Practice 1. В 1-м абзаце сообщается об истории развития ковочного производства. Какие словосочетания и глагольные формы говорят о том, что речь идет о прошлом?

Practice 2. Во 2-м абзаце сообщается, что ковочные изделия используются в наиболее нагруженных узлах машин. Какие параметры ковочных изделий обеспечивают это?

Practice 3. В 3-м абзаце объясняется, как процесс ковки улучшает механические свойства металла. Опираясь только на значение вводного элемента therefore, определите причину улучшения механических свойств.

Practice 4. Словосочетание controlled plastic deformation связывает содержание последних двух абзацев. В каком предложении подчеркивается важность данного понятия для процесса ковки?

The Fundamentals of Forging

Forging is the oldest known metalworking process. It is believed to have begun when early man discovered he could beat pieces of ore into useful shapes. History tells us that forging was widely practised at the time when written records first appeared.

The blacksmith was one of the first to realize the advantages of forging. Although he did not know why, he knew that hammering a piece of hot metal not only resulted in a usable shape, it improved its strength. It is this inherent improvement in strength of metal that has placed forgings in the most highly stressed applications in machines.

To understand why forging improves the mechanical properties of metal, it is important to recognize that metal is made up of grains. Each grain is an individual crystal, and when the grains are large, cracks can occur and propagate along the grain boundaries. Therefore, it is desirable to minimize the grain size in a metal.

Reducing the metal's grain size is one of the things forging does so well. Forging breaks down a coarse-grained structure producing a chemically homogeneous wrought structure with much smaller grains by controlled plastic deformation. In forging, cortrolled plastic deformation whether at elevated temperature or cold (at room temperature) results in greater metallurgical soundness and improved mechanical properties of the metal.

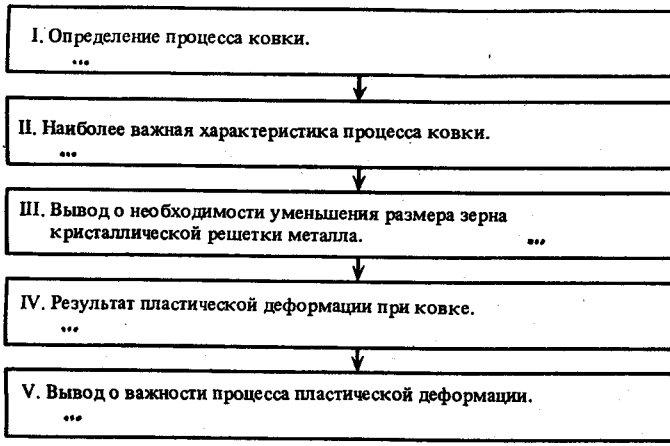
Metal shaping by controlled plastic deformation is the basis for all forging operations. Because of the diversity of forging end-use applications, however, a wide range of processes and equipment have been developed to produce forgings. Some processes are ideally suited to make large parts, others, small parts, and still others, rings. Modern forging is not only carried out in virtually all metals, it is done at temperatures ranging from more than 2500 °F to room temperature. Part configuration generally determines the forging method chosen.

AFTER-TEXT DISCUSSION

Practice 1. Прочитайте 3-й и 4-й абзацы. Выделите предложения, в которых сообщается: а) о недостатках металлов с крупнозернистым строением; б) о том, что дает, с точки зрения улучшения свойств, уменьшение размеров зерна решетки. Переведите эти предложения на русский язык.

Practice 2. В последнем абзаце подчеркивается (1-е предложение), что пластическая деформация металла лежит в основе всех ковочных процессов. Однако далее сообщается о большом многообразии ковочных процессов и оборудования. Чем это обусловлено?

Practice 3. Заполните следующую схему, предетавляющую собой логическую структуру текста, английскими предложениями из текста. Из каждого абзаца должно быть по одному предложению.



Text 3A

READING AND COMPREHENSION

1. **Переведите заголовок (он полностью отражает содержание текста).**
2. **Прочитайте текст и определите:**

1. абзац, в котором дана классификация металлорежущих станков;
2. в каком абзаце описана (в обобщенном виде) технология резания;
3. какой абзац посвящен описанию основных операций, выполняемых на металлорежущих станках;
4. в каком абзаце упоминается о некоторых видах продукции, получаемых в результате механической обработки.

Metal Cutting

Cutting is one of the oldest arts practised in the stone age, but the cutting of metals was not found possible until the 18th century, and its detailed study started about a hundred years ago.

Now in every machine-shop you may find many machines for working metal parts, these cutting machines are generally called machine-tools and are extensively used in many branches of engineering.

Fundamentally all machine-tools remove metal and can be divided into the following categories:

1. Turning machines (lathes).
2. Drilling machines.
3. Boring machines.
4. Milling machines.
5. Grinding machines.

Machining of large-volume production parts is best accomplished by screw machines. These machines can do turning, threading, facing, boring and many other operations. Machining can produce symmetrical shapes with smooth surfaces and dimensional accuracies not generally attainable by most fabrication methods.

Screw-machined parts are made from bar stock or tubing fed intermittently and automatically through rapidly rotating hollow spindles. The cutting tools are held on turrets and tool slides convenient to the cutting locations. Operations are controlled by cams or linkages that position the work, feed the tools, hold them in position for the proper time, and then retract the tools. Finished pieces are automatically separated from the raw stock and dropped into a container.

Bushings, bearings, nuts, bolts, studs, shafts and many other simple and complex shapes are among the thousands of products produced on screw machines. Screw machining is also used to finish shapes produced by other forming and shaping processes.

Most materials and their alloys can be machined — some with ease, others with difficulty. Machinability involves three factors: 1. Ease of chip removal. 2. Ease of obtaining a good surface finish. 3. Ease of obtaining good tool life.

WHILE-READING SECTION

Language Study

Practice 1. a) Выпишите из 2-го абзаца текста слова, обозначающие названия металлорежущих станков, и уточните их значения с помощью политехнического словаря.

b) Выпишите из 1-го и 3-го абзацев слова, обозначающие названия механических операций, выполняемых на металлорежущих станках, и уточните их значения с помощью политехнического словаря.

c) Дополните таблицу по образцу:

Название станка		Операция	
англ.	русск.	англ.	русск.
1. lathe (turning machine)	токарный станок	turning	обточка
2.		drilling	
3.			расточка
4. grinding machine			
5.	винторезный станок		
6.		milling	
7. cutting machine			

Practice 2. Выпишите из 4-го абзаца текста слова, обозначающие названия отдельных частей и узлов винторезного станка и их назначение. Составьте таблицу, аналогичную вышеприведенной.

Название узлов, частей станка		Назначение	
англ.	русск.	англ.	русск.
1. 2. 3.			

Practice 3. Найдите английские эквиваленты для следующих русских слов и словосочетаний.

срок службы, прутковая заготовка, гладкая поверхность, размерная точность, снимать стружку, удобный (подходящий), массовое производство, достижимый, отделка поверхности

Practice 4. Переведите слова и словосочетания на русский язык, при этом догадайтесь о значении выделенных курсивом интернациональных слов. Слова, выделенные жирным шрифтом,—«ложные друзья переводчика». Проверьте их значения по словарю и уточните смысл, если слово употреблено в словосочетании. Проверьте по контексту правильность выбранных вами значений.

detailed study, **fundamentally,** *symmetrical* shapes, **generally, fabrication** *methods*, hollow *spindle*, cutting *location*, **to control** *operations*, *to position* the work, *to separate*, to drop into *a container*, to involve *a factor*

Practice 5. Найдите пары слов, близкие по значению, и предложения с данными словами в тексте.

to work, proper, to produce, convenient, location, to fabricate, to machine, position

Practice 6. Найдите пары слов, противоположные по значению, и предложения с данными словами в тексте.

raw, simple, to feed, difficulty, complex, finished, ease, to retract

Practice 7. a) Переведите словосочетания, построенные по уже известным вам моделям: V ed (какой) + N, N + V ed (какой).

detailed study, screw-machined parts, finished pieces, products produced on screw machines, shapes produced by other processes

b) Найдите в 1-м, 4-м и 5-м абзацах текста предложения с этими словосочетаниями и переведите их на русский язык.

c) Определите, какие из высказываний соответствуют содержанию текста.

1. All machine-tools employed for removing metal are divided into five general categories. 2. Screw-machined parts can't be made from bar stock. 3. Cutting tools held on turrets and tool slides are used for machining metal parts. 4. The workpiece placed on the spindle doesn't rotate. 5. Cams and linkages designed for controlling cutting operations position the work, feed, hold in position

and retract the tools. 6. Metal parts worked on machine-tools have smooth surfaces and high dimensional accuracies. 7. Finished parts are of symmetrical shapes.

Practice 8. Проанализируйте в тексте слова на -ing и распределите их по разным разделам таблицы.

Participle I V ing	Gerund V ing	Noun N ing

Practice 9. Найдите в тексте предложения со сказуемыми, образованными по модели to be + V ed, и переведите их на русский язык, обращая внимание на разные способы перевода этой конструкции.

Practice 10. Поставьте как можно больше специальных вопросов к 5-му абзацу текста.

Text Study

Practice 1. a) Заново изучите таблицу "Classification" из Unit V, с. 200.

b) Пользуясь таблицей "Classification", произведите классификацию:

1) инженерных материалов;
2) металлорежущих станков;
3) типов механической обработки.

Practice 2. Завершите предложения, подобрав соответствующие окончания в правом столбце.

1. There are...
2. They are...
3. These machine-tools can perform...
4. Finished parts possess...
5. A lot of simple and complex shapes...
6. Screw-machining is also used...
7. Most engineering materials can be machined...

...symmetrical shapes, high dimensional accuracies and smooth surfaces.
...for finishing operations.
...five general categories of machine-tools.
...can be produced on screw machines.
...turning, milling, grinding, boring, etc. operations.
...by machine-tools.
...lathes, drilling, boring, milling and grinding machines.

AFTER-TEXT SECTION

Text Discussion

Practice 1. Ответьте на вопросы по теме "Metal Cutting".

1. When did the study of metal cutting start? 2. What is the purpose of metal cutting? 3. What machines are called "machine-tools"? 4. List the general categories of machine-tools. 5. What is the function of the spindle? 6. Where are cutting tools held? 7. By what means are cutting operations controlled? 8. List products produced on screw machines. 9. What are the general advantages of machining over other fabrication methods?

Practice 2. a) Подготовьте сообщения по следующим темам.

1. Основные виды металлорежущих станков и их назначение (при подготовке воспользуйтесь таблицей Practice 1 раздела "Language Study" и активным словарем на с. 275).
2. Производство изделий на винторезном станке; при подготовке воспользуйтесь информацией текста, заполненной вами таблицей Practice 2 раздела "Language Study" и следующим планом:
   1) Виды заготовок, обрабатываемых на станке.
   2) Основные узлы, части станка и их назначение.
   3) Виды изделий, получаемых в результате обработки на станке.
   4) Преимущества обработки на винторезном станке (по сравнению с другими методами производства).

b) Ситуации для высказывания.

1. Вы проходите производственную практику в цехе механической обработки. Вам предстоит обточить заготовку, просверлить в ней отверстия и отшлифовать. Скажите, на каких станках вы будете выполнять эти операции.
2. Вы обрабатываете заготовку на винторезном станке. Скажите, где вы установите режущий инструмент; куда поместите заготовку; с помощью чего будете управлять подачей и отводом резца.
3. Вам предстоит сделать сообщение на тему «Механическая обработка металлических изделий». Скажите, как вы сформулируете основные преимущества механической обработки в разделе «Выводы и заключение».

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы и глагольные сочетания
место выполнения механической обработки	**machine-shop**	
оборудование цеха механической обработки	**machine-tool** **turning machine (lathe)** **drilling machine** **boring machine** **milling machine** **grinding machine** **screw machine**	
детали машин	**machine part** **cam** **linkage** **bushing** **bearing** **nut** **bolt** **stud** **shaft** **spindle** **turret** **tool slide** **(cutting) tool**	
типы заготовок	**bar stock** **tubing**	
операции, выполняемые на металлорежущих станках		**to cut** **to machine** **to turn** **to drill** **to bore** **to mill** **to grind** **to thread** **to face** **to position the work** **to feed the tool** **to retract the tool** **to finish** **to remove metal (chip)**
характеристика изделий	**smooth surface** **dimensional accuracy**	

Text 3B

PRE-TEXT SECTION

Прочитайте текст и определите:

1. В каком аспекте рассматривается в данном тексте способность подвергаться обработке резанием (в 1-м абзаце)?
2. Сколько факторов, влияющих на срок службы режущей кромки инструмента, упоминается в тексте?
3. В каком абзаце идет речь о взаимосвязи между структурой и прочностью обрабатываемого материала и способностью подвергаться механической обработке?
4. Какое свойство материала, связанное со способностью подвергаться механической обработке, рассматривается в последнем абзаце?

Factors Affecting Machinability

Machinability is generally assumed to be a function of tool edge life. The main factors which influence the behaviour, and thus the life of the edge of a cutting tool, are:

— the mechanical characteristics of the material being machined, such as its strength, hardness and metallurgical structure;

— the state of the casting, involving the skin finish, critical dimensions, machining allowances, slag inclusions, the presence of scabs, rust, dirt, etc.;

— the nature of the machining techniques being used;

— the characteristics of the machine-tool being used, such as machine efficiency, available power, and the rigidity of the setup.

Other factors aside, it is primarily the structure of the metal which determines its resistance to the cutting action of the tool, i. e. the potential rate of metal removal, and the resulting abrasion on the tool, i. e. the life of the cutting edge.

Structure, strength and machinability are interrelated to some extent — in general, increased strength implies reduced machinability. This basic relationship must be understood, otherwise difficulties may be experienced in the machine shop if the designer has specified a material with a higher strength than is necessary. Nevertheless, care should be taken in rating machinability on the basis of strength. For example, nodular irons are normally considerably stronger than flake-graphite types, but are

likely to be easier to machine. It is therefore recommended that structure, rather than strength, be adopted as the basis for machining practice.

Hardness provides a more reliable guide to machinability than does strength, for hardness depends mainly on the matrix structure of the casting. Again, however, the relation is of a general nature only, for it is possible to have a metal which exhibits a low hardness value, but which has a very abrasive action on the cutting tool. For example, the presence of hard phosphide particles embedded in a soft, ferritic matrix reduces tool life considerably.

---

tool edge режущая кромка инструмента
skin finish = surface finish
machining allowance припуск на обработку
rigidity of setup жесткость наладки
rate of metal removal скорость резания
nodular iron чугун с шаровидным графитом
flake-graphite iron чугун с чешуйчатым графитом
rather than а не...
abrasive action истирающее воздействие

AFTER-TEXT DISCUSSION

Practice 1. Найдите в тексте ответы на следующие вопросы.

1. List the main factors influencing the tool edge life. 2. Does the structure of the material influence machinability? In what way? 3. What does increased strength result in? 4. Why is hardness more reliable in determining machinability of a material than strength?

Practice 2. Пользуясь информацией текста, заполните следующую таблицу. (Знаком (—) обозначены графы, не требующие заполнения.)

Факторы, влияющие на способность подвергаться механической обработке		Составляющие, из которых эти факторы складываются	
англ.	русск.	англ.	русск.
the characteristics of the material			
the state of the casting			
the characteristics of the machine-tool			
the nature of the machining techniques		—	—

Practice 3. a) Дополните таблицу, устанавливающую взаимосвязь между свойствами материала и способностью подвергаться механической обработке.

Свойство обрабатываемого материала		Его влияние на способность (зависимость от способности) подвергаться механической обработке	
англ.	русск.	англ.	русск.
increased strength			пониженная способность к механической обработке
	структура металла	the resistance to the cutting action of the tool	
hardness		the matrix structure of the casting	

b) Пользуясь информацией текста и таблицей, расскажите о взаимосвязи между свойствами материала и способностью подвергаться механической обработке. Воспользуйтесь для обозначения этой взаимосвязи глаголами:

to depend on, to affect (to influence), to imply (to mean)

SELF-TRAINING PRACTICE: SUPPLEMENTARY TEXTS

Text 1

Pre-Text Section

Practice 1. a) Прочитайте заголовок текста и переведите его. Вспомните, какие процессы термообработки вам известны.
b) Заполните таблицу по образцу (при необходимости воспользуйтесь политехническим словарем).

Название действия		Процессы	
англ.	русск.	англ.	русск.
to treat to anneal to crack to quench to temper	обрабатывать	treating (treatment)	обработка

c) Догадайтесь о значении следующих интернациональных слов и словосочетаний.

characteristic, percentage, critical temperature, molecular structure, to fix

d) Прочитайте текст "Heat Treatment of Steel" и скажите:

а) что общего между тремя видами термообработки;
б) в чем состоит различие между ними;
в) какие свойства приобретают стали в результате различных видов термообработки.

Heat Treatment of Steel

We can alter the characteristics of steel in various ways. In the first place, steel which contains very little carbon will be milder than steel which contains a higher percentage of carbon, up to the limit of about 1,5 %. Secondly, we can heat the steel above a certain critical temperature, and then allow it to cool at different rates. At this critical temperature, changes begin to take place in the molecular structure of the metal. In the process known as annealing, we heat the steel above the critical temperature and permit it to cool very slowly. This causes the metal to become softer than before, and much easier to machine. Annealing has a second advantage. It helps to relieve any internal stresses which exist in the metal. These stresses are liable to occur through hammering or working the metal, or through rapid cooling. Metal which we cause to cool rapidly contracts more rapidly on the outside than on the inside. This produces unequal contractions, which may give rise to distortion or cracking. Metal which cools slowly is less liable to have these internal stresses than metals which cool quickly.

On the other hand, we can make steel harder by rapid cooling. We heat it up beyond the critical temperature, and then quench it in water or some other liquid. The rapid temperature drop fixes the structural change in the steel which occurred at the critical temperature, and makes it very hard. But a bar of this hardened steel is more liable to fracture than normal steel. We therefore heat it again to a temperature below the critical temperature, and cool it slowly. This treatment is called tempering. It helps to relieve the internal stresses, and makes the steel less brittle than before. The properties of tempered steel enable us to use it in the manufacture of tools which need a fairly

hard steel. High carbon steel is harder than tempered steel, but it is much more difficult to work.

These heat treatments take place during the various shaping operations.

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to relieve stresses снимать напряжение
to be liable to smth иметь склонность к чему-л.
to contract сжиматься, давать усадку
distortion искривление
drop *зд.* падение

After-Text Section

Practice 1. Суммируйте информацию текста, заполнив следующую таблицу.

Название процесса		Технология процесса		Преимущества		Недостатки	
англ.	русск.	англ.	русск.	англ.	русск.	англ.	русск.
annealing quenching tempering							

Text 2

Pre-Text Section

Practice 1. Прочитайте заглавие текста и предположите его содержание.

Practice 2. Прочитайте текст с целью подтверждения вашего предположения. Достаточно ли точно отражает заглавие содержание текста? Предложите свои варианты.

Practice 3. Составьте план текста.

Superhard Material from Powder

The development of the engineering, electronic, radiotechnical and electrotechnical industries is unthinkable without materials with special properties. They include, in particular, composite materials, i. e., materials that combine incompatible properties, plastics, etc.

Powder metallurgy figures prominently in obtaining these and other materials. Composite materials have been produced by the hot compaction methods, which are better in their properties, especially in durability, than similar materials obtained abroad. The antivibration

alloys of the "iron-copper" type made it possible to double the durability of drilling tools. This increased labour productivity by 20 percent. Welding electrodes made of powders used for resistance welding are 9-12 times more durable than those made by conventional methods.

The operational principle of powder metallurgy is very well known — an item of necessary size is modeled, in a mould, out of very small metal grains. After that the item is put into an electrothermic furnace where the grains get sintered together.

The coefficient of the use of metal grows by five times. True, powders more often than not cost more than metal-rolling. But labour input is much smaller and labour productivity — higher. As a result of that, an item made of powder is over three times cheaper. This saving is achieved on account of a complete or partial liquidation of machining the item, the reduction of metal consumption by half or more, and automation of pressing and sintering.

The time of operation of powder articles increases considerably. The sintered articles have already proved their advantages working in outer space, in deep sea conditions and inside various machines.

It has been estimated that the output of 1,000 tons of powder articles saves the labour of 190 workers, frees 80 metal-cutting machine tools and saves 2,000 tons of ferrous and non-ferrous rolled stock and some 1.5 million roubles.

Soviet scientists have attained considerable success in powder metallurgy. They were the first in the world to develop, using high-energy moulding methods, a new superhard material out of boron nitride. The priority of the USSR in developing the first article out of the so-called viscous ceramics has been recognized in many countries.

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composite materials композиты
hot compaction method метод горячей прессовки
durability долговечность
alloy сплав
to double удваивать
welding сварка
conventional method обычный метод
item, article изделие
grain зерно
to sinter спекать
consumption потребление
rolled-stock прокат

After-Text Section

Practice 1. Вам необходимо сделать сообщение на тему «Порошковая металлургия». Какую информацию из текста вы включите в свое сообщение? В каких абзацах она содержится?

Text 3

Pre-Text Section

Practice 1. Прочитайте текст и найдите в нем информацию по следующим вопросам:

1. факторы, влияющие на выбор метода литья;
2. технология изготовления отливки методом литья в землю (в обобщенном виде);
3. достоинства и недостатки данного метода литья.

Подтвердите свои ответы соответствующими положениями текста.

Sand Casting

Selection of a casting method depends primarily upon: 1. Quantity of parts. 2. Size of the part. 3. Tolerances and finish. 4. Physical characteristics. 5. Part configuration. 6. The metal to be cast.

Process.

The oldest commercial method of making metal castings consists of forming a cavity in sand and filling the cavity with molten metal. After the metal solidifies, the sand is broken away, and the casting is removed, trimmed, and cleaned.

Sand molds are made in two or more sections: bottom (drag), top (cope), and intermediate sections (cheeks) when required. Joints between sections are the parting lines. The sand is contained in flasks, made of metal or sometimes wood.

Molten metal is poured into the sprue, and connecting runners conduct the metal to the casting cavity. Riser cavities in the cope sand over heavy sections of the casting serve as metal reservoirs. They fill with molten metal as the cavity is filled and, as the casting solidifies and shrinks, the risers feed molten metal to the heavy, slowly solidifying sections, thus minimizing porosity in the part. Slag floats to the top of the risers and thus is not incorporated into the casting. Sprue, runner, and risers are trimmed from the casting after it is removed from the sand.

Cores are hard shapes of sand placed in the mold to produce hollow castings.

Patterns of wood or metal are used to prepare the mold.

Extremely large or heavy castings are made by floor molding. Here, the mold is made in the floor of the foundry using the earth as the flask.

Advantages and disadvantages: Sand casting offers the least expensive method for producing general-purpose castings. Pattern equipment is relatively inexpensive and long lasting.

Sand castings are more subject to human control than parts made by other casting processes. More material must be left on a sand casting to permit machining for a finished surface. Thin sections cannot be cast (1/3 in. is generally considered a practical minimum).

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bottom=drag нижняя полуформа
top=cope верхняя полуформа
intermediate sections=cheeks щечки (промежуточные секции)
parting line линия разъема
flask опока
sprue стояк
runner литниковый ход (канал)
to conduct *зд.* подводить
riser прибыль
to shrink давать усадку
to float всплывать
to trim обрубать

After-Text Section

Practice 1. Расскажите о литниковой системе и о литейном оборудовании, применяемом при литье в землю, заполнив следующие таблицы.

I

Часть литниковой системы		Назначение	
англ.	русск.	англ.	русск.
1. sprue 2. runner 3. riser			

II

Вид литейного оборудования		Материал		Назначение	
англ.	русск.	англ.	русск.	англ.	русск.
1. mold 2. flask 3. core 4. pattern					

Text 4

Pre-Text Section

Practice 1. Рассмотрите рисунок на с. 285 и предположите, о чем пойдет речь в тексте.

Practice 2. Прочитайте текст и найдите ту часть текста, в которой приводится описание рисунка. Какой поток является наиболее благоприятным?

Practice 3. Обратитесь еще раз к рисунку и определите, при каком методе обработки он получается.

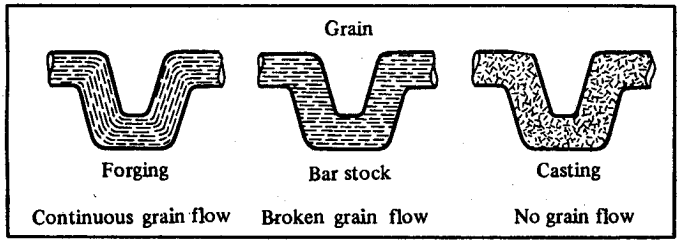
Practice 4. Прочитайте текст еще раз и определите, как влияет непрерывный поток на механические свойства металла и какие именно. Выпишите все механические свойства, упомянутые в тексте, и переведите их с помощью политехнического словаря.

In forging, controlled plastic deformation, whether at elevated temperature or cold (at room temperature) results in greater metallurgical soundness and improved mechanical properties of the metal. Most forging grade metal is pre-worked to remove defects. This pre-working results in directional alignment of grain flow, which when properly forged, produces directional properties in strength, ductility and resistance to impact. The figure below shows the continuous grain flow in a forged crankshaft, the broken grain flow of a crankshaft machined from bar stock, and the complete absence of grain flow in a casting. Continuous grain flow around the part shape is most desirable. Since bar stock and plate have unidirectional grain flow, any change in contour from machining will cut flow lines, exposing grain ends and leaving the metal sensitive to stress corrosion and fatigue failure. Most castings have no grain flow or directional strength.

The increased emphasis on optimizing the efficiency of all kinds of consumer and industrial products has increased the service requirements for mechanical parts. Forging makes metal parts stronger than other metal working methods. Thus forging has become more than just a way of making metal parts, it has become an indispensable method of making high strength metal components. To the designer, the structural integrity of forgings means realistic safety factors based on materials that will respond predictably to the environment without costly special processing.

Since virtually all metals can be forged, the range of physical and mechanical properties available from

forged products spans the entire spectrum of ferrous and non-ferrous metallurgy. Whether a designer is looking for impact strength, corrosion resistance, high tensile strength, or long fatigue life, there is an alloy appropriate to the application that can be forged.



Representation of grain flow in a forging (above left), machined bar stock (above centre) and a casting (above right).

---

to result in приводить к, давать в результате
metallurgical soundness структура металла
improved улучшенные
grain flow направление волокон
cross-section поперечное сечение
absence отсутствие
bar stock заготовка в виде прутка
plate заготовка в виде плиты

After-Text Section

Practice 1. Опираясь на информацию текста, прокомментируйте следующее высказывание из текста.

Forging makes metal parts stronger than other metal-working methods.

Text 5

Pre-Text Section

Practice 1. Прочитайте текст и составьте его план.

Machine-Tools

These are the machines used in engineering to shape metals and other materials.

Before the machine age this work was done with hardened hand tools, in particular, the chisel and hammer.

It took a long time to obtain the necessary quality and accuracy. The metal was first given roughly its right shape by being either hammered when red hot or cast in a mold. Then the final shape was obtained by further hammering and by chiselling.

A great advance was made with the introduction of the file, a hardened steel tool, used to smooth the relatively rough surfaces left by the chisel. Nowadays, these hand tools are normally used only for final fitting and adjustment of parts made on machine-tools.

The various complicated machine-tools now used by engineers are designed to do the same jobs as the hammer, the chisel and the file, but very much more quickly and efficiently, and with much wider range of application. The vastly increased production of modern times would never have been possible without these machines to take the place of hand work, nor could the hand-worker ever produce the precision now needed.

The machine-tools which have replaced the chisel and file and which shape the metal by removing parts of it are shapers, planers, milling machines, drilling and boring machines, grinders and lathes and those which have replaced the hammer and which press the metal into the required shape are steam hammers, forging and pressing machines and sheetmetal work tools.

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chisel зубило, долото
hammer молоток
file напильник
rough грубый
roughly начерно, грубо
range of application диапазон применения
shaper поперечно-строгальный станок
planer продольно-строгальный станок
sheetmetal work tool машина для листовой штамповки

After-Text Section

Practice 1. Скажите, какие станки (машины) заменили а) зубило и напильник, б) молоток. Подтвердите свой ответ ссылкой на текст.

Text 6

Pre-Text Section

Practice 1. Прочитайте текст и определите:

1. в каком абзаце перечисляются основные части (узлы) токарного станка;
2. в каком абзаце идет речь о назначении станка;

3. в каком абзаце сформулирован принцип действия токарных станков (в отличие от других типов металлорежущих станков).

Metal-Cutting Machines. The Lathe

The most useful and versatile machine in the workshop is a turning machine (lathe). As the name shows, it is used for turning different objects and parts. However, besides turning many other operations can be performed on a lathe, such as drilling, reaming, tapping and by employing suitable adapters operations of milling and grinding may be carried out without difficulty.

The lathe consists of the following basic parts: the bed, the headstock, the tailstock, the saddle (or carriage) with the tool-post and the driving and gear mechanism.

The bed is a base for supporting and aligning the components of the machine. At the opposite ends of the bed there is a headstock and a tailstock.

The headstock carries a pair of bearings in which the spindle rotates. The spindle holds the workpiece and rotates with it. The headstock also incorporates the driving and gear mechanism. The parts of this mechanism are the feed shaft and the change gear box. The feed shaft is designed for driving the tool-post, and the change gear box drives the spindle of the lathe at various speeds. Tapered centres in the nose of the spindle and of the tailstock hold the work firmly between them. The tool-post is driven along the saddle either forwards or backwards at a fixed and uniform speed. That is why the operator is capable of making accurate cuts and giving the work a good finish.

There are many types of lathes but all of them operate on the same basic principle: the workpiece is revolved by power and a cutting tool is brought against it, removing metal in the form of chips.

The other principle of operation is that used in milling, grinding and drilling machines. In these machines the tool is fixed and the work is moved to and fro against it in a horizontal plane.

---

to support поддерживать
to align центрировать
feed shaft вал подачи
change gear box коробка перемены скоростей
tapered centre конический центр
to drive (drove, driven) приводить в действие (движение)
to move forwards or backwards/ to and fro двигаться вперед, назад

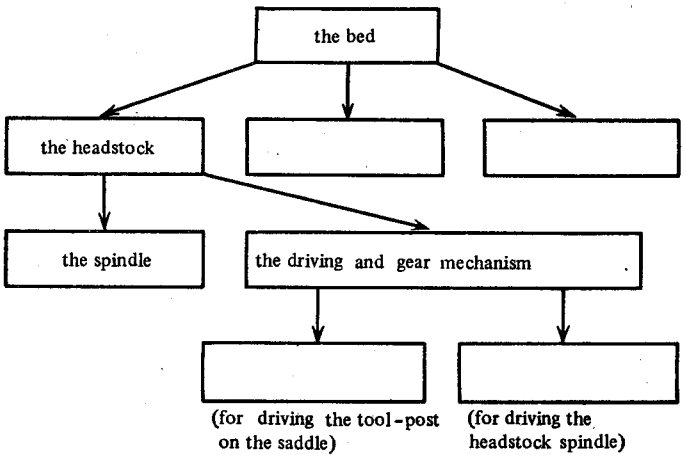
After-Text Section

Practice 1. Выпишите из 2-го абзаца текста слова, обозначающие названия основных частей токарного станка и уточните их значения с помощью политехнического словаря.

Practice 2. Скажите, какие из данных утверждений соответствуют содержанию текста.

1. The main components of the lathe are: the bed, the headstock, the saddle and the driving and gear mechanism. 2. The headstock and the tailstock are located at one end of the bed. 3. The tool-post is mounted on the bed. 4. The tool-post carries the tool. 5. The spindle holds and rotates the work. 6. The function of the change gear box is driving the headstock spindle. 7. The tool-post is driven by the feed-shaft. 8. All lathes operate on the same principle: the tool is fixed and the work is moved to and fro against it in a horizontal plane.

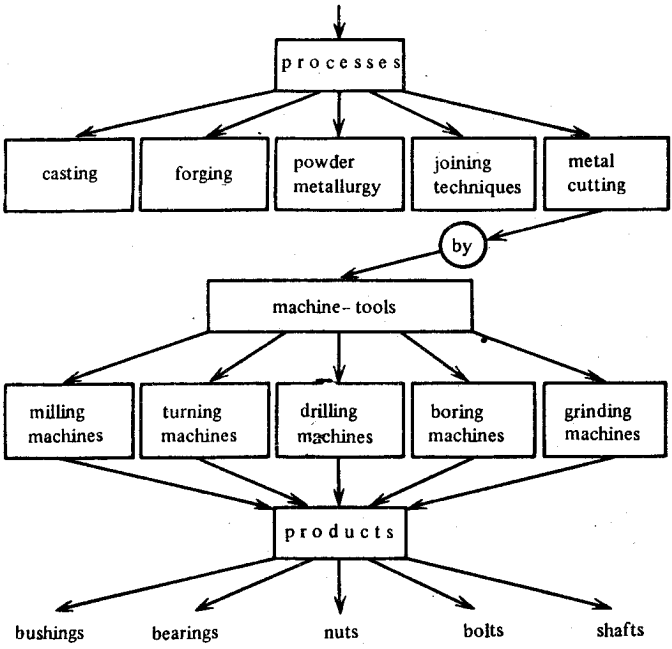
Practice 3. Дополните следующую схему.



Practice 4. Пользуясь информацией текста и схемой Practice 3, расскажите о конструкции токарного станка, назначении основных его частей (узлов) и принципе действия.

ДЕНОТАТНАЯ СХЕМА

MATERIALS TECHNOLOGY



UNIT VII

Machines and Work

Text 1A

READING AND COMPREHENSION

1. Просмотрите текст и выберите для каждого абзаца один из следующих заголовков:

первичные двигатели;
определение «машины»;
взаимосвязь понятий «сила и работа»;
энергия и единицы ее измерения.

2. Не читая текста подробно, напишите по 2—3 предложения по-русски к каждому из этих подзаголовков и список известных вам английских слов, с помощью которых можно передать это содержание.

Machines and Work

Defined in the simplest terms a machine is a device that uses force to accomplish something. More technically, it is a device that transmits and changes force or motion into work. This definition implies that a machine must have moving parts. A machine can be very simple, like a block and tackle to raise a heavy weight, or very com-

plex, like a railroad locomotive or the mechanical systems used for industrial processes.

A machine receives input from an energy source and transforms it into output in the form of mechanical or electrical energy. Machines whose input is a natural source of energy are called prime movers. Natural sources of energy include wind, water, steam, and petroleum. Windmills and waterwheels are prime movers; so are the great turbines driven by water or steam that turn the generators that produce electricity; and so are internal combustion engines that use petroleum products as fuel. Electric motors are not prime movers, since an alternating current of electricity which supplies most electrical energy does not exist in nature.

Terms like work, force, and power are frequently used in mechanical engineering, so it is necessary to define them precisely. Force is an effort that results in motion or physical change. If you use your muscles to lift a box you are exerting force on that box. The water which strikes the blades of a turbine is exerting force on those blades, thereby setting them in motion.

In a technical sense work is the combination of the force and the distance through which it is exerted.

To produce work, a force must act through a distance. If you stand and hold a twenty-pound weight for any length of time, you may get very tired, but you are not doing work in an engineering sense because the force you exerted to hold up the weight was not acting through a distance. However, if you raised the weight, you would be doing work.

Power is another term used in a special technical sense in speaking of machines. It is the rate at which work is performed.

In the English-speaking countries, the rate of doing work is usually given in terms of horsepower, often abbreviated hp. You will remember that this expression resulted from the desire of the inventor James Watt to describe the work his steam engines performed in terms that his customers could easily understand. After much experimentation, he settled on a rate of 33,000 footpounds per minute as one horsepower.

In the metric system power is measured in terms of watts and kilowatts. The kilowatt, a more widely used term, equals a thousand watts or approximately $1^1/_3$ horsepower in the English system.

Language Study

Practice 1.

Общая цель данного текста — дать определение основным понятиям, связанным с «работой» и «машинами». Основные формулы определений:

1) A is B

2) A is B that... which...

3) A, B for smth, V

4) B, which..., is called A

Прочитайте внимательно текст и выберите из него определения понятий: машина — machine (1-й абзац) — 2 определения; первичный двигатель — prime mover (2-й абзац); сила — force (3-й абзац); работа — work (3-й абзац); мощность — power (5-й абзац). Проанализируйте эти определения: подчеркните одной чертой термин, двумя чертами — слова, обозначающие класс, к которому относится понятие, тремя чертами — характеристику понятия.

Model: Machine is a device that uses force to accomplish something.

Переведите каждое определение на русский язык. Сравните их с данными вами определениями в предтекстовых заданиях. В чем разница? Уточните английские слова, выбранные вами в этом упражнении.

Practice 2. Соедините термин с соответствующим ему определением, данным в правой колонке.

Machine	is	the rate at which work is performed.
Prime mover		a device that uses force to accomplish something.

Force	–	an effort that results in motion or physical change.
Work	is	a machine whose input is a natural source of energy.
Power		a combination of the force and the distance through which it is exerted.

Practice 3. Заполните следующую таблицу.

Термин	Класс	Характеристика
prime-mover internal combustion engine turbine		

Practice 4. Прочитайте внимательно два последних абзаца и заполните следующую таблицу, в которой должно быть показано соотношение между единицами мощности в разных системах.

Единицы мощности			Эквивалент
Обозначение	Полное название	Перевод	
hp	horse power	лошадиная сила	33,000 foot-pounds per minute
w	...	...	...
kw	...	...	...

Practice 5. Распределите следующие слова в три группы: а) обозначающие основные понятия физики и механики; б) обозначающие источники энергии; в) механизмы, машины:

wind, power, water, force, work, steam, wind mill, petroleum, turbine, motion, weight, block, device, locomotive, input, output, steam engine, rate, effort, distance, generator, part, weight

Practice 6. Следующие глаголы часто сочетаются с понятиями физики и механики. Составьте с ними глагольные сочетания, использовав материал текста.

Model: to transmit — to transmit motion / force

to produce, to transform, to supply, to result in, to exert, to set, to perform, to result from, to measure ... in

Practice 7. Изучите внимательно 2-й абзац текста еще раз и сгруппируйте следующие существительные в таблицу.

wind mill, wind wheel, steam engine, electric motor, internal combustion engine, turbine

Вид двигателя	Энергия на входе
Prime-mover Non-prime-mover	The input is a natural source of energy. The input is a source of energy that does not exist in nature.

Practice 8.

Сложные предложения с придаточными определительными

S_1 + who / whose / which / that / where / when / why + $S_2 \rightarrow S$

Diesel engines are now mounted on *the lorries.* → *The lorries* are produced by the Minsk, Kremenchug and Byelorussian automobile works. Diesel engines are now mounted on the lorries *which* → are produced by the Minsk, Kremenchug and Byelorussian automobile works.

Найдите в тексте предложения с придаточными определительными и переведите их на русский язык.

Practice 9. Запомните союзы и союзные слова, вводящие придаточные определительные.

Practice 10. Найдите определительные предложения.

1. It took the first Soviet auto-works in Gorky and Moscow a very short time to master the production mainly of lorries which were required at that time. 2. Automobile construction was practically non-existent in prerevolutionary Russia where in 1910 only 10 passenger cars were built. 3. She couldn't believe that he had known nothing about their experiments. 4. That student design bureaus play a big role in developing scientific activity among students is very important. 5. Scientists and research engineers are engaged in work that is intended to provide a scientific approach to many purely industrial problems.

Practice 11. Переведите предложения, обратив внимание на значение which, которое может относиться либо к одному (определяемому) слову в главном предложении и переводиться словом «который», либо ко всему предложению в целом и переводиться словом «что».

1. Every 1972 Volkswagen has a network of sensors leading to one central socket which can report the operating condition of parts in your VW directly to you. 2. The KAMAZ is incorporating six specialized enterprises which are known to the industrialized world. 3. The engineers design, build and test cars, which makes every new car durable and reliable. 4. All its equipment will be checked for operation in a short test run after which the car will return to the plant to undergo finishing operations. 5. Titanium is light, strong and corrosion resistant which makes it one of the most useful structural materials. 6. In testing grounds there are many stretches of roads which are built on the principle "the worse the better". 7. Science Weeks are usually held simultaneously with student scientific and technical conferences during which students are presented diplomas and prizes. 8. An ice-breaker has been invented which is capable of crushing ice fields with hydraulic guns.

Practice 12. Сравните предложения и переведите их на русский язык, обратив внимание на то, что некоторые придаточные определительные могут присоединяться к главному бессоюзно.

1. Modern physics has discovered a complicated array of fundamental particles of which all matter is composed.— Modern physics has discovered a complicated array of fundamental particles all matter is composed of. 2. There are numerous ways in which industry and education can cooperate on problems of common interest.— There are numerous ways industry and education can cooperate in on problems of common interest. 3. Welding is the most universal way of joining parts. Lasers have already been used for some time for obtaining superclean welds that chemists need so badly.— Lasers have already been used for some time for obtaining superclean welds chemists need so badly. 4. The factory which we are speaking about is one of the best in the country.— The factory we are speaking about is one of the best in the country.

Practice 13. Переведите предложения на русский язык.

1. The engine is the source of power that makes the wheels go around and the car move. 2. The Industrial

Engineering Stream is intended for students whose interests lie mainly in the design and production side of mechanical engineering. 3. The Engineering Science Stream is meant for those who are analytically minded and who wish to study in depth the theoretical techniques used by engineers. 4. Friction is a force that tends to retard or to stop motion of one surface over another. 5. Each student design bureau is a self-contained organization which sometimes works on orders of various enterprises and institutions. 6. Today, scientists are making diamonds in laboratories — diamonds that are needed in all kinds of industrial processes in making the machines that will remake nature into a better world for us to live in. 7. The most fantastic possibility of constructing earth-ships that could penetrate the earth's crust and cruise freely across oceans of molten magma would become a reality.

Practice 14. Расширьте высказывание, добавив предложение, определяющее:
а) подлежащее.

Model: This material is very important.
It is widely used in machine-building. → This material which is widely used in machine-building is very important.

1. The changes in material technology are not only quantitative. These changes are taking place at present. 2. Ceramics are gaining an increasing foothold. They are used as tooling materials.

б) дополнение.

Model: I shall describe a new method. It was primarily used not long ago.
I shall describe a new method which was primarily used not long ago.

1. The engineer will be able to design the insides of the components. They will give non-uniform properties. 2. Our industry needs high-strength materials. They will find a wide variety of applications.

Practice 15. Докажите, что в следующих предложениях that присоединяет придаточные определительные. Переведите предложения на русский язык.

1. It is a device *that* transmits motion into work. 2. So are the turbines *that* turn the generators *that* produce electricity. 3. Internal combustion engines *that* use petro-

leum products are also prime-movers. 4. James Watt wanted to describe the work in terms *that* his customers could easily understand. 5. Force is an effort *that* results in physical change.

Practice 16. Определите тип придаточного, вводимого that, в следующих предложениях. Переведите предложения на русский язык.

1. This definition implies *that* a machine must have moving parts. 2. You will remember *that* this expression resulted from the desire of James Watt. 3. James Watt wanted to describe the work *that* his steam engines performed in hp. 4. The force *that* you exerted to hold up the weight was not acting through a distance.

Practice 17.

Условные предложения (Conditional Sentences)

	Изъявительное наклонение	Сослагательное наклонение
Настоящее время Будущее время	**If she is asked** to come she always **comes.** Если ее *просят* прийти, она всегда *приходит.* If this problem **is** less important, it **will not be discussed.** Если эта проблема менее важная, она *не будет обсуждаться.*	If she **were asked** to come she **would** always **come.** Если *бы* ее *попросили* прийти, она всегда *бы пришла.* If this problem **were** less important, it **would not be discussed.** Если *бы* эта проблема *была* менее важной, она *бы не обсуждалась.*
Прошедшее время	If I **had** free time yesterday, I **spent** it on reading. Если у меня *было* вчера свободное время, я *тратил* его на чтение. (в действительности у меня было свободное время)	If I **had had** free time yesterday, I **should have spent** it on reading. Если *бы* у меня *было* свободное время, я *бы потратил* его на чтение. (в действительности у меня не было свободного времени)

Note: В условных придаточных предложениях, относящихся к будущему времени, в английском языке употребляется Present Tense.

Которое из двух предложений каждой пары точнее отражает содержание текста?

a) 1. If a device transmits force into motion it is called a machine. 2. If a device transmitted force into motion it would be called a machine.

b) 1. If you stand and hold weight, you are not doing work in engineering sense. 2. If you stood and held weight, you would be doing work.

c) 1. If you raised the weight, you would be doing work. 2. If you raise the weight, you are not doing work.

Practice 18.

Категория наклонения (The Category of Mood)

Indicative Mood Изъявительное наклонение	Subjunctive Mood Сослагательное наклонение
1. Значение. Изъявительное наклонение выражает действие, отражающее объективную действительность. 2. Форма. (I, we) **shall / can / may** | be... / do... (he, she, it, you, they) **will / may / can** | be... / do... 3. Перевод. I **shall be** only glad to meet him again. Я *буду* только рад встретиться с ним снова.	1. Значение. Сослагательное наклонение выражает предполагаемое, возможное или желательное действие. 2. Форма. (I, we) **should / could / might** | be... / do... (he, she, it, you, they) **would / might / could** | be... / do... 3. Перевод. I **should be** only glad to meet him again. Я *был бы* только рад встретиться с ним снова.

Определите, в каких из следующих предложений употреблено сослагательное наклонение.

1. These castings could not be used because of their defects. 2. If we were pulling a rubber band and then stopped pulling it, the rubber band would quickly return to its original shape and size. 3. I think, if defective castings were brought in for analysis of their defects yesterday, they were tested. 4. If defective castings were brought in for analysis, they would be tested. 5. If there are any changes, the laboratory technician will know. 6. If we expanded a spiral of lead wire a little, it would assume its original shape again afterwards. 7. If there had been no electrical connection between the zinc and the copper but little zinc would have dissolved. 8. I should have been glad if he had come here yesterday. 9. We know that we should return soon. 10. He said that he would do this work himself.

Practice 19. В каких из следующих предложений предположение относится к настоящему или будущему, а в каких к прошедшему времени?

1. They would like to see the world's longest 70-foot bus. It will transport factory workers. 2. If the new equipment had been delivered in time yesterday, there would have been no problem at all. 3. He would be so glad to meet these engineers but unfortunately he won't be able to visit the plant. 4. I should enjoy a drive to the country. It's a pity I cannot come with you. 5. She would have been pleased with the results of her experiment. I'm sorry she didn't ring me up. 6. I should have made the drawing in time. Why didn't you tell me about it yesterday? 7. If you could come back to life two hundred years from now, you would find not only the world and its activities transformed, but also its languages.

Practice 20. Запомните модель образования сослагательного наклонения в условных предложениях. Обратите внимание на союзы, вводящие придаточные предложения условия. Выучите их.

I should do it He would do it	**if** *если* **unless** *если не* **in case** *в случае, если* **provided (that)/providing** *при условии, если/что* **suppose/supposing** *предположим, что, допустим* **on condition (that)** *при условии что*	his friend (I, you, he, she, they)	were came	here.

Practice 21. Переведите следующие предложения на русский язык.

a) 1. Without our professor's help the work would have had many more mistakes. 2. In the entrance exams he missed some questions which a schoolboy could have answered. 3. This is a hypothesis which could be proved only by the discovery of the new chemical element. 4. There are three other designs where this material could be applied. 5. Provided the laboratory continued this experiment, it would take them 3 years to complete it. 6. Unless he worked hard he wouldn't pass the exam. 7. If the conditions were unchanged, the automobile would travel 60 km per hour. 8. If the pulley had been frictionless the effort E would have been exactly equal to the load W. 9. Supposing you accepted this offer, what would you say?

b) 1. If highly durable metal alloys had not been developed, there would be no modern rockets and aviation today. 2. If we could obtain ultrahigh-strength and superrefractory materials having close-packed structures the efficiency of all heat engines would approach 100 percent, as it would be possible for designers to use higher temperatures that today seem unthinkable; the motors could be made far lighter and more compact, since not only their efficiency, but also their specific output would be raised by several times.

Practice 22. Переведите предложения на русский язык, обращая внимание на перевод союзов:

as *в качестве; так же ... как и; поскольку; когда, в то время как;* if *если; ли;* since *так как, поскольку; с тех пор как*

a) 1. At that time the production of lorries was badly required *as* the country was carrying out industrialization and mechanization of agriculture. 2. *As* a building material aluminium is the best. 3. Aluminium is *as* strong *as* steel. 4. The principal work of the engineer is design *as* he has to design products, machines and production systems. 5. *As* he was making his experiments he came to the solution of this problem.

b) 1. A steam turbine designer must take those processes into account *if* he is to step up the efficiency, reliability and erosion resistance of the turbine. 2. *If* parts rubbing on each other are not separated by a film of lubricant, the surface will rub and rapidly wear away. 3. *If* the reinforced plastics will be used in this car depends on the results of the test. 4. The head engineer asked *if* all the engineers of the shop had gathered.

c) 1. Many years have passed *since* the first Moskvitch was put into mass production. 2. *Since* it is a machine that produces power, it is called the engine. 3. *Since* the results were bad the engineer repeated his experiment. 4. *Since* the power station was started it has operated well.

Practice 23. Переделайте предложения по модели, выразив желательность действия. Переведите их на русский язык.

Model: What *shall* we *do* here without this engineer?
What *should* we *do* here without this engineer?

1. Any worker will be glad to accept this offer. 2. Will you go to the experimental laboratory on Tuesday? 3. You can find the answer to your question in any reference

book. 4. Will you repeat it once more? 5. There will be no life without water. 6. It is out of place here. 7. I like to work at the tractor plant. 8. Large and complicated projects of new technologies can well be handled by institute researchers working on practical applications. 9. This often provides the most efficient approach to the solution of processing problems. 10. The engineer is the guiding force behind the machine-tool; without the engineer the machine-tool cannot function.

Practice 24. Ответьте на следующие вопросы, представив соответствующую ситуацию.

1. You meet your professor. What would you say? 2. I don't know how to operate this machine-tool. What would you do? 3. I don't know where the main shop of this plant is. Where could I get the answer? 4. We have broken our car. What would you do in our place? 5. You don't know how to make this drawing. Who would you consult? 6. First I studied at the medical college, but I like engineering best of all. So I dropped my studies at the medical college and went to the auto-mechanical institute. What would you do in my place?

Practice 25. Закончите следующие предложения в сослагательном наклонении, выбрав подходящие словосочетания, данные в списке ниже.

1. None of them... 2. Anyone in his place... 3. The chief engineer... 4. Another student in your place... 5. A mechanical engineer...

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to do the same, to answer this question, to find a way out of this situation, to repair the electric machine, to agree to do it

Practice 26. Раскройте скобки и поставьте глагол в нужную форму сослагательного наклонения.

1. If they (use) another method, the results would have been different. 2. If the complete list of details had been prepared the engineer (buy) everything in time. 3. If the load (increase) the speed would decrease. 4. If all the people of the world (count) the atoms in a drop of water they would not be able to finish their work even in ten thousand years. 5. If one knows the dimensions of the body he (calculate) easily its volume. 6. If every star in the sky were to shine with the same degree of brightness, the distance to any star (can) readily be established. 7. If he (know) the specific heat and the

weight of the substance, he would have calculated its thermal capacity. 8. If you rubbed the stick, it (become) warm.

Practice 27. Преобразуйте следующие предложения в предложения с придаточными условия.

Model: I should have gone to the exhibition of new machine-tools, but I did not know about it.
If I had known about the exhibition of new machine-tools I should have gone there.

1. He would be so glad to meet these engineers but unfortunately he won't be able to visit the plant. 2. I should enjoy a drive to the country. It's a pity I cannot come with you. 3. She would have been pleased with the results of her experiment. I'm sorry she didn't ring me up. 4. I should have made the drawing in time. Why didn't you tell me about it a week ago? 5. He does not have much time, or he would show around the plant himself. 6. There could not be modern science without modern technology. 7. They would have sent us information, but there was none to send.

Practice 28. Преобразуйте следующие предложения, сделав условие сначала менее вероятным, а затем невероятным, нереальным. Переведите предложения на русский язык.

Model: If I *see* our lecturer, I *shall ask* him to explain this difficult material again.
If I *saw* our lecturer, I *should ask* him to explain this difficult material again.
If I *had seen* our lecturer yesterday, I *should have asked* him to explain this difficult material again.

1. If you send us a catalogue of diesel engines, it will help us in our work. 2. If the laboratory gets new equipment, we shall test it. 3. If the circuit is closed, current will flow in it. 4. Unless the armature rotates, no voltage is produced. 5. If there is no water, there is no life. 6. If the wire is thin, much heat will be generated when current flows through it.

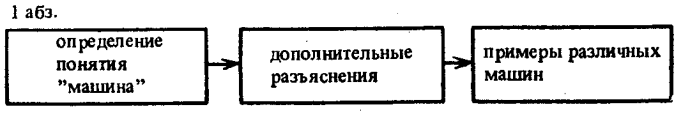
Practice 29. Закончите рассказ в соответствии с Practice 28.

1. If I graduated from the Institute now, I should go to work to KAMAZ. If I went to work to KAMAZ, I should... 2. If I were the chief engineer of the plant, I should... 3. If there were no machine-tools, there wouldn't be... 4. If there were no electricity, there would be... 5. If I worked at the scientific research institute, I should...

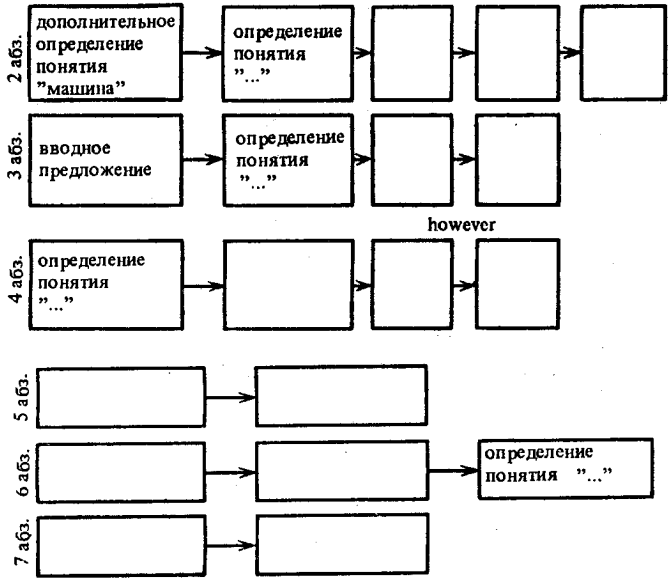
Text Study

Practice 1.

Как следует из содержания текста, все абзацы включают в себя определение какого-либо понятия, разъяснение (более расширенное определение) этого понятия, пример. Например, 1-й абзац можно представить в виде следующей схемы:



Постройте структурную схему каждого абзаца.



AFTER-TEXT SECTION

Text Discussion

Practice 1. Подготовьте развернутые ответы на следующие вопросы.

1. What is a simple definition of a machine? What is a more technical definition? What does this definition imply? 2. Describe some very simple machines. What are

some complex ones? 3. What are the machines called whose input is a natural source of energy? What are some natural sources of energy and the machines that use them? 4. Why aren't electric motors prime-movers? 5. What is force? Give some examples. 6. What is work? How can work be expressed mathematically? Give an example. 7. What is power? 8. How is the rate of doing work usually given in the English-speaking countries? Why was the term invented? 9. In what terms is power measured in the metric system?

Сравните получившиеся ответы с вашими ответами в Practice 2 на с. 292. В чем различие? Совпадение?

Practice 2. Сделайте краткое сообщение на тему "Machine, Work, Power". При подготовке используйте активный словарь.

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глагольные сочетания
виды машин и механизмов	**prime-mover** **windmill** **turbine** **generator** **steam engine** **internal combustion engine** **electric motor**	
источники энергии	**wind** **water** **steam** **petroleum**	
общие понятия физики и механики	**electricity** **effort** **motion** **distance** **rate** **weight** **horsepower** **watt** **kilowatt** **force** **work**	**to produce electricity** **to exert effort** **to set in motion** **to result in motion** **to hold up the weight** **to exert force** **to produce work** **to perform work** **to result from**

Text 1B

PRE-TEXT SECTION

Practice 1. Просмотрите текст и определите, на какие две части его можно разделить. Может ли вторая часть быть понятна без чтения первой (определите по подзаголовку)?

Practice 2. В первых двух абзацах речь идет о развитии электричества в XIX веке. Какой вклад был сделан в развитие электричества Волта в 1800 году и Эдисоном в 1882 году?

Practice 3. Вторая часть текста "The Direct-Current Machines" («Машины постоянного тока») описывает работу и устройство этих машин. Возможно ли понять этот текст, не обращаясь к словарю? Если да, то каким образом? Если нет, как приступить к работе со словарем?

Electrical Energy and Electrical Machines

Volta made his experimental cell in 1800, producing for the first time a steady reliable electric current. During the nineteenth century, the development of practical applications of electrical energy advanced rapidly. The first major uses of electricity were in the field of communications — first for the telegraph and the telephone. They used not only electric current but also electromagnetic effects.

Thomas Edison's invention of the electric light bulb was perhaps the most momentous development of all, but not because it was such a unique invention. It was momentous because it led to the creation of an electric power system which has since reached into nearly every corner of the world. Actually, other people were working simultaneously on the same problem, and Edison's claim to the invention was disputed. Perhaps Edison's most important claim to fame is his pioneering work in engineering, which helped to provide electric service for New York City in 1882.

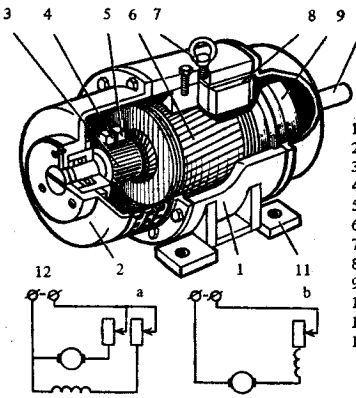
The application of electricity has grown to the point where most of us lead "electrified lives", surrounded by a variety of devices that use electric energy. Less visible, but probably more important, are the thousands of ways industry has put electric energy to work. The direct-current machine is one of the most important ways.

The Direct-Current Machine

Electrical machines are divided into alternating current (a. c.) and direct-current (d. c.) machines. The basic parts of a d. c. machine are the armature and electromagnets (or field coils). Coils wound on the pole cores form the excitation field of the machine. The armature is the rotating part of the machine. In its insulated slots is placed a winding connected to the commutator. Carbon brushes are placed in brushholders and contact the rotating commutator.

There are two electric circuits in the d. c. machine, the armature circuit and the excitation circuit. A d. c. machine is reversible: if the machine is rotated and the magnetic field is excited the machine sends a direct current into the external circuit through the commutator and brushes: the machine operates as a generator. If the armature and excitation winding are joined to a d. c. circuit the armature runs and the machine operates as a motor and converts electrical energy into mechanical energy.

Direct–current machine



1. Steel frame
2. End - shield with ball bearing
3. Commutator
4. Brushholder with brush yoke
5. Carbon current - collecting brushes
6. Armature with main current - carrying winding
7. Lifting eye - bolt
8. Field coil, magnetic field pole
9. Fan
10. Power - transmitting shaft
11. Base with holes for fixing bolts
12. Electrical circuit diagrams for d.c. motors
    a) shunt connection of windings
    b) series connection of windings

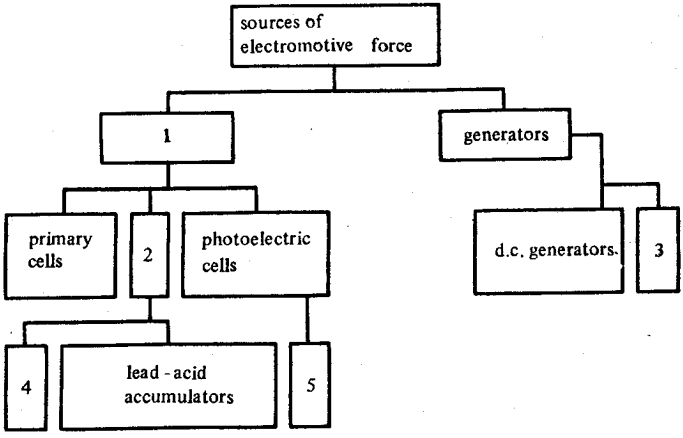
AFTER-TEXT DISCUSSION

Practice 1. Определите значение следующих терминов, не обращаясь к словарю.

alternating current, direct current, armature, electromagnet, field coil, pole, winding, brush, brush holder, commutator, generator, motor

Practice 2. Выделите во второй части текста предложения, описывающие устройство электрической машины и принцип действия электрического мотора.

Practice 3. Заполните следующую диаграмму классификации источников электродвижущей силы, пользуясь приведенным ниже списком слов.



alternators, generators, sources of electromotive force, lead-acid accumulators, cells, solar cells, photoelectric cells, d. c. generators, secondary cells, nickel-cadmium cells

Используя эту диаграмму, можно без труда образовать предложения, классифицирующие различные объекты.

Examples: 1. Sources of electromotive force can be classified as/divided into cells and generators.

2. There are two main sources of electromotive force: cells and generators.

Образуйте предложения, классифицирующие генераторы и генерирующие элементы.

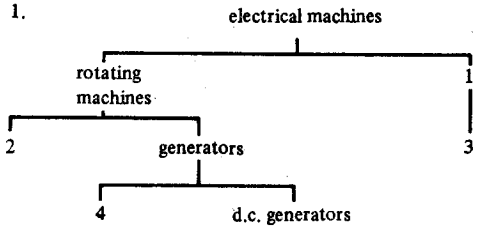
Practice 4.

Классификация часто сопровождается примерами. Например:

There are two main sources of electromotive force: cells and generators. An example of a cell is the lead-acid accumulator. The alternator is an example of a generator.

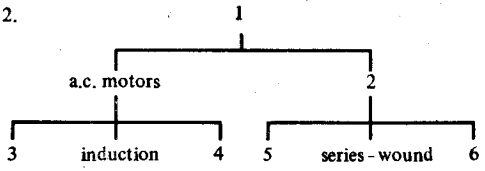
Заполните следующие диаграммы, пользуясь приведенными списками слов. Образуйте как можно больше предложений, классифицирующих различные объекты. Дополните их примерами.

1.



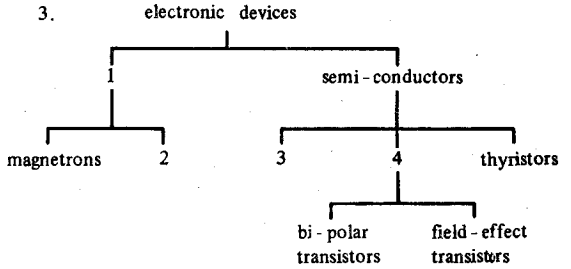
alternators, linear machines, electrical machines, motors, d. c. generators, linear motors, rotating machines, generators

2.



a. c. motors, electric motors, compound-wound, synchronous, variable-speed commutator, d. c. motors, series-wound, induction, shunt-wound

3.



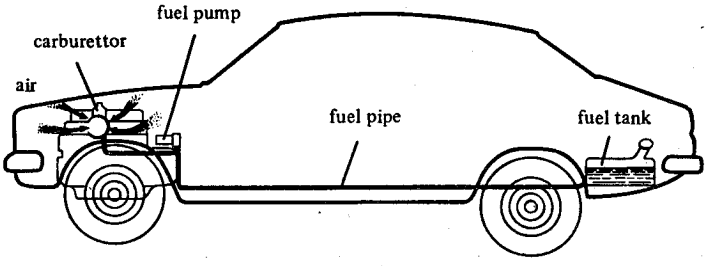
electronic devices, semiconductors, triodes, valves, thyristors, field-effect transistors, silicon diodes, transistors, bi-polar transistor, magnetrons

Text 2A

READING AND COMPREHENSION

Прочитайте текст и определите:

1. какому абзацу текста соответствует рис. урока;
2. в каком абзаце текста дано упрощенное описание работы четырехтактного д. в. с.;
3. сколько рабочих циклов д. в. с. упоминается в тексте; в каком (каких) абзаце (абзацах)?



Engine

An engine produces power by burning air and fuel. The fuel is stored in a fuel tank. The fuel tank is connected to a fuel pipe. The fuel pipe carries the fuel to a fuel pump. The fuel pump is connected to the carburettor. The fuel pump pumps the fuel into the carburettor. In the carburettor the fuel is mixed with air. The fuel and air are drawn into the engine cylinder by the piston. Then the fuel and air are compressed by the piston and ignited by the spark plug. They burn and expand very quickly and push the piston down. Thus the power is produced. The burned fuel and air are expelled from the cylinder by the piston.

The flow of gases into and out of the cylinder is controlled by two valves. There is an inlet valve allowing fresh fuel mixture into the cylinder and an exhaust valve which allows the burnt gases to escape.

There are two basic engine operating cycles:

a) the four-stroke cycle;
b) the two-stroke cycle.

The complete four-stroke cycle comprises:

1. the induction stroke (the piston moves downwards);
2. the compression stroke (the piston moves upwards);
3. the power stroke (the piston moves downwards);
4. the exhaust stroke (the piston moves upwards).

Notes

a stroke: the distance travelled by the piston (upwards or downwards) in the cylinder

t. d. c. (top dead centre): the position of the piston at the top of the stroke

b. d. c. (bottom dead centre): the position of the piston at the bottom of the stroke

WHILE-READING SECTION

Language Study

Practice 1. a) Выпишите из 1-го и 2-го абзацев текста:

1. слова, обозначающие узлы и детали двигателя и топливной системы;
2. глаголы и глагольные сочетания, описывающие рабочие процессы в д. в. с.

b) Уяснив значения слов и сочетаний с помощью рис. урока и, при необходимости, политехнического словаря, дополните следующую таблицу по образцу.

Part (unit)		Its function	
англ.	русск.	англ.	русск.
1. the engine	двигатель	to produce power	производить (вырабатывать) мощность
2. the fuel tank			хранить топливо
3.	топливный насос		
4. The carburettor			
5.		to ignite the charge	
6.	поршень		
7. the inlet valve			
8.			обеспечить выход отработанных газов

Practice 2. Расположите глагольные словосочетания, служащие для описания работы д. в. с., в порядке, соответствующем рабочим процессам д. в. с., о которых вы узнали из текста. Дайте их русские эквиваленты.

to compress the mixture, to store the fuel in the fuel tank, to mix the fuel and air, to ignite the mixture, to pump the fuel into the carburettor, to draw the mixture into the cylinders, to carry the fuel to the fuel pump, to push the piston down, to produce the power

Practice 3.

Глагол to connect используется при описании взаимного расположения деталей (узлов). Как правило, в этом случае он употребляется в формах: N+V/Vs или N+is/are Ved+(by N). Например:

The fuel pipe connects the fuel tank and the fuel pump.
Или:
The fuel tank is connected to the fuel pump (by the fuel pipe).

Используя приведенные выше модели, дайте описание следующих рисунков.

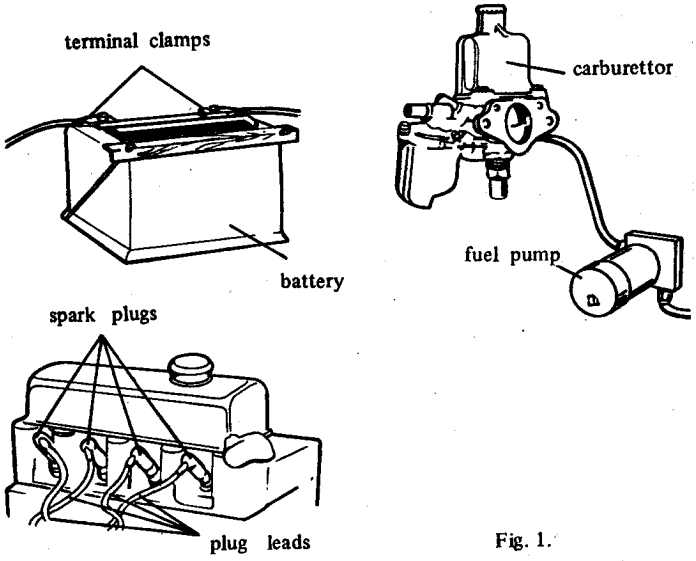


Fig. 1.

Practice 4. a) Переведите Notes к тексту. При необходимости воспользуйтесь словарем.

b) Пользуясь информацией Notes и рис. 2, заполните пропуски в тексте следующими словами (в соответствующей форме).

to compress, to push downwards, to push, to ignite, the cylinder, to close, to start again, to open, to rotate, to return

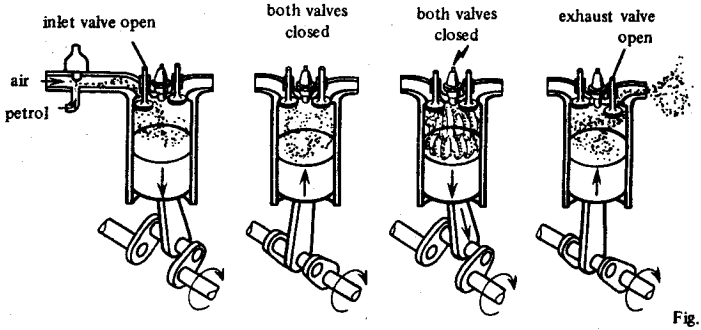


Fig. 2.

The Four-Stroke Operating Cycle

The Induction Stroke

The cycle starts with the piston at t. d. c. As the inlet valve opens, the piston ... ... by the rotating crankshaft. The fuel mixture enters ... . When the piston comes to the top of the stroke, the inlet valve closes.

The Compression Stroke

The rotation of the crankshaft ... the piston upwards again. During the compression stroke, the fuel ... . Both valves are now ... and thus the mixture is prevented from escaping. The compression rapidly heats the mixture before ignition occurs.

The Power Stroke

The spark from the plug ... the heated mixture as the piston comes to the top of its stroke. The burning gases expand and force the piston downwards again. This stroke ... the crankshaft through half a revolution (180°).

The Exhaust Stroke

As the piston comes to b. d. c., the exhaust valve ... . The rotating crankshaft returns the piston to t. d. c. again, expelling the burnt gas through the top of the cylinder. When the piston ... to t. d. c., the cycle ... . In a vehicle engine this cycle is repeated several thousand times a minute.

---

crankshaft коленчатый вал
to expand расширяться
revolution *зд.* оборот
vehicle средство передвижения

Practice 5. Пользуясь информацией Practice 2 и рис. 2, заполните следующую таблицу.

Название такта		Движение поршня		Положение клапанов (впускного, выпускного)	
англ.	русск.	англ.	русск.	англ.	русск.
1. 2. 3. 4.					

Practice 6.

Союзы when, as *когда*? служат для обозначения времени действия. Кроме того, союз as *так как* служит для объяснения причины действия.

a) Найдите в тексте Practice 4 предложения с этими союзами и переведите их на русский язык.

b) Прочитайте предложения, в которых использованы данные союзы, и скажите, соответствуют ли они содержанию текста "Engine" и Practice 4 "The Four-Stroke Operating Cycle".

1. The operating cycle starts when the piston is at b. d. c. 2. The compression stroke takes place when both valves are closed. 3. The compression stroke got its name because during this stroke the mixture is compressed by the piston. 4. As the mixture is compressed it is ignited by the spark plug. 5. As during the third stroke in the four-stroke cycle power is produced this stroke is called the power stroke. 6. When the piston comes to b. d. c. the inlet valve and the exhaust valve open and the burnt gases are expelled from the cylinder by the piston.

Practice 7. a) Следующие модели рекомендуется использовать, когда речь идет о функции или назначении. Прочтите их и переведите на русский язык.

Function, Duty

1. The function The duty	of	the superheater the governor the spring	is to	raise the t° of the steam. control the engine speed. keep the weights depressed.

2. The superheater	has	the function		raising the steam t°.
The governor	performs	the duty	of	controlling the engine speed.
The spring				keeping the weights depressed.

3. The superheater	serves to	raise the temperature of the steam.
The governor		control the speed of the engine.
The spring		keep the weights depressed.

4. The superheater	serves as acts as	a means of raising the steam t°.
The governor	is used as	a method of controlling the engine speed.
The spring		a way of keeping the weights depressed.

b) Заполните пропуски словами, выражающими цель или назначение. Воспользуйтесь таблицей. Переведите полученные предложения.

1. A thermometre ... (to measure) the t° of a body. 2. A distributor ... (to provide) a spark in each of the cylinders. 3. A chuck ... (to hold) the work firmly on the lathe. 4. The safety valve ... (to clamp) the work on to the drilling machine. 5. The examination ... (to test) the students' knowledge.

Practice 8.

Группа сказуемого (Verb Phrase — VP) в английском предложении может быть выражена следующими моделями: V + Adv + Adv, V + N + Adv, V + N_1 to/into + N_2.

a) Переведите следующие отрывки, образованные по вышеуказанным моделям.

1. ...burn very quickly. 2. ...expand very quickly. 3. ...push the piston down. 4. ...carries the fuel to a fuel pump. 5. ...pumps the fuel into the carburettor.

b) Найдите в 1-м абзаце текста предложения с приведенными выше отрывками и переведите их на русский язык.

c) Просмотрите текст еще раз и распределите встретившиеся вам при чтении текста предлоги в следующую таблицу.

Предлоги способа действия	Предлоги местонахождения	Предлоги движения

Сколько раз в тексте употребляется предлог способа действия by?

Text Study

Practice 1. Пользуясь информацией текста "Engine", составьте схему пути следования топлива в топливной системе двигателя.

Practice 2. Пользуясь информацией текста "Engine" и Practice 4 "The Four-Stroke Operating Cycle", составьте схему, описывающую рабочие процессы в цилиндре двигателя, в результате которых вырабатывается мощность.

Practice 3. Завершите предложения, подобрав соответствующие окончания в правом столбце.

1. Most automotive engines operate...	...through 180°.
2. This cycle comprises:...	...the inlet valve and the exhaust valve.
3. The first stroke starts with the piston...	...from the cylinder.
4. The fuel mixture in the cylinder is compressed and ignited...	...on the four-stroke cycle.
5. The piston is pushed downwards...	...is produced.
6. The crankshaft rotates...	...at t. d. c.
7. Thus power...	...by the burnt gases.
8. The burnt gases are expelled...	...by the spark plug.
9. The flow of gases into and out of the cylinder is controlled by two valves: ...	...the induction stroke, the compression stroke, the power stroke and the exhaust stroke.

AFTER-TEXT SECTION

Text Discussion

Подготовьте краткие сообщения на следующие темы:

1. Путь следования топлива в топливной системе д. в. с.

При составлении воспользуйтесь схемой Practice 1 на с. 315.

2. Рабочие процессы, происходящие в цилиндре двигателя, во время рабочего хода.

Воспользуйтесь составленной вами схемой Practice 2 раздела "Text Study" и активным словарем.

3. Четырехтактный цикл.

Воспользуйтесь рис. 2 к Practice 4 раздела "Language Study", Practice 5 того же раздела и активным словарем.

Active Vocabulary

Область применения	Существительные и сочетания сущ.+сущ.	Глаголы и глагольные сочетания
узлы и детали двигателя и топливной системы	**carburettor** **fuel pipe** **fuel pump** **fuel tank** **spark plug** **piston** **cylinder** **inlet valve** **crankshaft**	
описание, характеристика работы д.в.с. по четырехтактному циклу	**t.d.c.** **b.d.c.** **piston stroke** **induction stroke** **compression stroke** **power stroke** **exhaust stroke** **two-stroke cycle** **four-stroke cycle**	**to produce power** **to store fuel** **to pump** **to mix** **to draw** **to burn** **to compress** **to ignite** **to expand** **to push the piston down** **to expel** **to control** **to rotate** **to enter the cylinder gas flow** **to move upwards (downwards)**

Продолжение

Область применения	Существительные и сочетания сущ.+сущ.	Глаголы и глагольные сочетания
описание конструкции и взаимного расположения деталей		**to connect**

Text 2B

PRE-TEXT SECTION

Прочитайте текст "The Wankel Engine" и выполните следующие задания.

1. **Найдите в 1-м абзаце текста фразу, объясняющую, почему данный тип двигателя называют «роторным».**
2. **Скажите, можно ли каждый из трех отдельных абзацев текста рассматривать как законченный смысловой отрывок.**
3. **Найдите абзац (абзацы), в котором (которых) проводится сравнение между двигателем Ванкеля и традиционным двигателем.**
4. **Какому абзацу текста соответствует прилагаемый рисунок?**

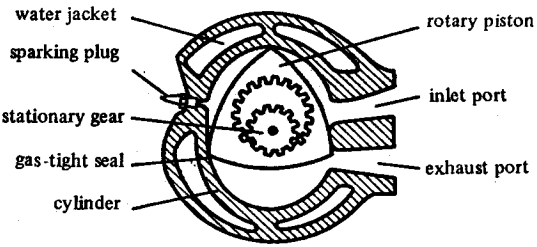
The Wankel Engine

The Wankel engine is a form of heat engine which has a rotary piston. In other words, instead of going up and down the Wankel piston rotates in the cylinder. Both cylinder and piston are quite different in shape from those of conventional engines. The Wankel piston is triangular with curved sides and the cylinder is roughly oval in shape. The piston has an inner bore which is linked through an eccentric gear to the output shaft. The other end of the bore is toothed and engaged with a stationary gear fixed to the cylinder end. This arrangement ensures that the piston follows an elliptical path round the cylinder so that the apexes of the piston, which carry gastight seals, are always in contact with the inside surface of the cylinder.

The piston thus forms three crescent-shaped spaces between itself and the cylinder wall, which vary in size as the piston rotates. Fuel enters the cylinder through the inlet port when one of these spaces is increasing in size. The fuel trapped in this section is then compressed by the turning piston and ignited by the sparking plug. The

expanding gases subject the piston to a twisting moment which makes the piston revolve further until the exhaust gases escape through the exhaust port. A fresh charge is then induced into the cylinder. Meanwhile the same process is being repeated in the other two spaces between the piston and the cylinder.

The Wankel engine has many advantages over the reciprocating piston engine. Fewer moving parts are necessary because it produces a rotary movement without using a connecting rod and a crankshaft. Because of this rotary movement it has no vibration. In addition it has no valves, it is smaller and lighter than conventional engines of the same power, and it runs economically on diesel and several other fuels.



up and down movement=reciprocating movement возвратно-поступательное движение
triangular треугольный
inner bore внутреннее отверстие
gear шестерня, зубчатое колесо
apex вершина
gastight seal газонепроницаемая прокладка
crescent-shaped серпообразный, серповидный
to trap улавливать
connecting rod шатун

AFTER-TEXT DISCUSSION

Practice 1. Догадайтесь о значении следующих интернациональных слов.

oval, eccentric, stationary, elliptical, vibration, economically, diesel

Practice 2. Прочитайте еще раз 1-й абзац текста и найдите в нем следующие сведения:

1. форма поршня роторного двигателя;
2. форма цилиндра;
3. траектория движения поршня в цилиндре;
4. расположение (установка) поршня в цилиндре.

Practice 3. Расположите следующие предложения, служащие для описания работы роторного двигателя, в порядке, соответствующем рабочим процессам данного двигателя.

1. The expanding gases make the piston revolve further. 2. The fuel is ignited by the spark plug. 3. Fuel enters the cylinder through the inlet port. 4. The exhaust gases are expelled through the exhaust port. 5. The fuel is compressed by the rotating piston.

Practice 4. Сравните характеристики и конструктивные особенности традиционного и роторного двигателей, заполнив следующую таблицу.

Type	Size	Weight	Design features	Fuel used	Operation
Conventional Engine					
Rotary Engine					

Note: В графе "Design features" следует указать:

1. the shape of the cylinder;
2. the shape of the piston;
3. the manner of the piston movement;
4. the availability of valves;
5. the number of moving parts.

Practice 5. Пользуясь материалом Practices 2-4 и рисунком, расскажите о роторном двигателе Ванкеля по следующему плану:

1. The design features.
2. The principle of operation.
3. Advantages (and disadvantages).

Text 3A

READING AND COMPREHENSION

1. Прочитайте текст на русском языке о технологических процессах свободной ковки и объемной штамповки. После этого в английском тексте найдите предложения и словосочетания, отражающие выделенные в русском тексте моменты.

1. Машинная ковка

Ковка — процесс горячей обработки металлов давлением, при котором с помощью многократного действия усилий, передаваемых непосредственно *бойками, нагретая заготовка пластически деформируется, посте-*

пенно приобретая заданную форму, размеры и свойства. При этом металл заготовки свободно течет в направлениях, не ограниченных рабочими поверхностями инструмента.

Кузнечный инструмент, применяемый для ковки, подразделяется на основной технологический, поддерживающий и контрольно-измерительный.

Бойки для паровоздушных молотов имеют различные формы рабочих поверхностей. Различают *плоские, вырезные полукруглые* и *ромбические* бойки.

2. Основные разновидности горячей штамповки

Метод *горячей объемной штамповки* отличается высокой производительностью, меньшими по сравнению с коваными поковками припусками на обработку резанием и суженными допусками на размеры. Метод заключается в деформировании нагретого металла в штампе.

В процессе *деформирования штампа,* происходящем в ограниченной *стенками штампа полости,* называемой *ручьем штампа,* заготовка приобретает *форму и размеры ручья штампа.*

Соответственно типу окончательного ручья штамп называют *открытым* или *закрытым. Штамповка в открытых штампах* сопровождается образованием вокруг поковки предусмотренного *облоя,* удаляемого обычно на обрезных прессах. Для поковок, получаемых в закрытых штампах, *облой не предусматривается.*

2. Изучите рисунки, сопровождающие английские тексты, и составьте к ним надписи на русском языке, исходя из содержания русского текста и английских надписей.

Forging Processes and Equipment

Open die forging with modern hammers and presses is a technological extension of the pre-industrial blacksmith working with a hammer and anvil. Open die forgings are produced on flat dies, round swaging dies and V-dies, either in pairs or in combination with a flat die. The upper die is attached to the ram, and lower die to the hammer anvil or press bed. The open die process is usually associated with large parts such as shafts, sleeves and disks, weighing up to 1,000,000 lb.

As the workpiece is formed during open die forging, it is moved via a manipulator in small increments until hot

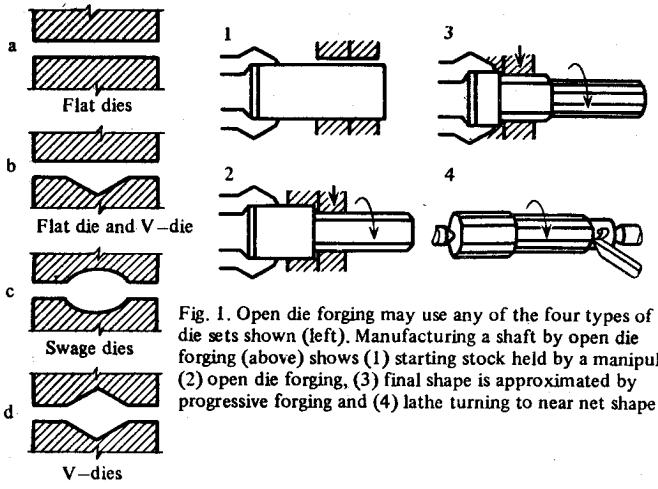
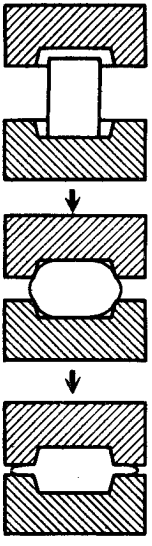


Fig. 1. Open die forging may use any of the four types of die sets shown (left). Manufacturing a shaft by open die forging (above) shows (1) starting stock held by a manipulator, (2) open die forging, (3) final shape is approximated by progressive forging and (4) lathe turning to near net shape.

working forces the metal into the desired dimensions. After forging the part is rough, then finish machined to net dimensions. Heat treatment is often performed either prior to or between machining operations. Materials for open die forging vary from carbon alloy, stainless and tool steels to aluminium, titanium and nickel-based alloys for high temperature applications. Metals are worked above their recrystallization temperature (Fig. 1).



Impression die forging comprises the majority of commercial forging production. It is carried out in two cavities that are brought together in a hammer or press. The workpiece undergoes plastic deformation until its enlarged sides contact the side walls of the die, as shown in Fig. 2. Once the die cavity is nearly filled, a small amount of material flows outside the die, forming flash. The flash cools rapidly and presents increased resistance to further metal flow. This increases the pressure in the workpiece, assuring complete die filling.

Fig. 2. A simple example of impression die forging. Flash cools rapidly, closing off the die to further metal flow. Pressure inside the workpiece then increases to fill the die cavity.

Closed die forging, a variation of impression die forging, does not depend on the formation of flash to complete die filling. In true closed die forging, the metal is deformed in a cavity that allows little or no escape of excess metal (Fig. 3).

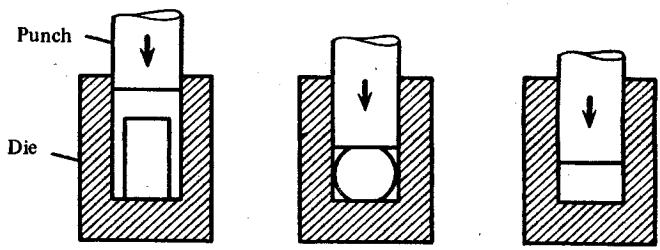


Fig. 3. Closed die forging is a special form of impression die forging that does not depend on flash formation to complete die filling. As shown here, the die impression is completely closed to external metal flow.

WHILE-READING SECTION

Language Study

Practice 1. Сгруппируйте следующие словосочетания в 4 группы, обозначающие:

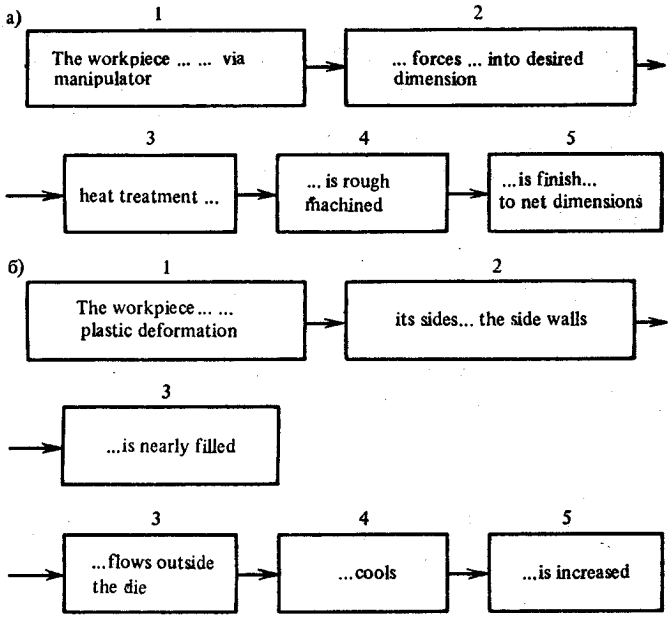
1. оборудование и детали, необходимые для ковки и горячей штамповки;
2. процессы и действия, связанные с ковкой и горячей штамповкой;
3. материалы;
4. условия и показатели протекания процесса.

Переведите эти словосочетания на русский язык.

open die forging, tool steel, anvil, to form, hammer, press, die, flat die, to machine, weight, V-die, to move, swaging die, to force, heat treatment, alloy, carbon, stainless steel, titanium, to work, flash, closed die forging, to deform, cavity, to contact, to cool, resistance, pressure, die filling, impression die forging, recrystallization temperature, net dimension

Practice 2. Заполните блок-схемы протекания процесса а) свободной ковки, б) объемной горячей штамповки.

Model 1: N + is/are + V ed
Model 2: N + V s



Practice 3. Прочитайте внимательно об отличии в процессах протекания объемной штамповки в открытых и закрытых штампах и постройте блок-схему для процесса объемной штамповки в закрытых штампах, ориентируясь на схему (б) Practice 2.

Practice 4.

Союзы as, once, until типичны для придаточных предложений времени.

Найдите в тексте предложения с этими союзами и переведите их на русский язык.

Practice 5.

Слово after многозначно: оно может быть союзом или предлогом.

Model 1: After + N_1 + N_2 + V

↓

предлог → «после N»

Model 2: After + N_1 + V + N_2

↓

союз → «после того, как N ... »

Найдите во 2-м абзаце текста предложение с after, определите его функцию; переведите предложение на русский язык.

Practice 6.

Очень часто определительное придаточное предложение может быть трансформировано в причастный оборот с Participle I или Participle II.

a) Переделайте следующие предложения по данным моделям и переведите их на русский язык.

Model 1: Many commercial vehicles have a different engine *which is called* a diesel engine.
Many commercial vehicles have a different engine *called* a diesel engine.

1. A stroke is the distance which is travelled by the piston in its cylinder. 2. In many engines, the gas which is used is a mixture of petrol and air. 3. Devices that are designed and built by engineers are used in the search for basic information. 4. More and more engineers are members of scientific teams that are involved not only in the development of workable machines and systems but in all research. 5. The scientific method is the method which is used by scientists in making scientific discoveries.

Model 2: There is an inlet valve *which allows* fuel mixture into the cylinder.
There is an inlet valve *allowing* fuel mixture into the cylinder.

1. The two valves which control the gas flow are at the top of the cylinder. 2. Rings which prevent oil from entering the top of the cylinder are fitted round the piston. 3. Mechanical engineering is a very wide field which includes a great variety of specialists. 4. Mechanical engineering is the branch of engineering that deals with machines and their uses. 5. The science that deals with problems of control is known as cybernetics.

b) Найдите в двух последних абзацах текста предложения с описанной выше структурой и замените их предложениями с причастными оборотами.

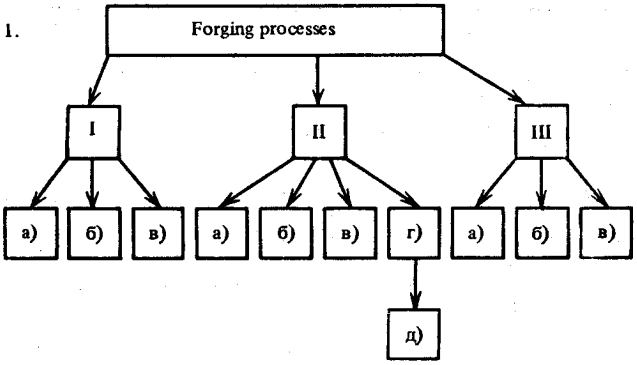
Practice 7. В тексте 1A "Machines and Work" вы проработали способы выражения «определения» в английском техническом тексте. Основываясь на изученных вами моделях, дайте определения для нижеприведенных терминов. Постарайтесь при этом использовать все изученные вами структурные модели.

open die forging, impression die forging, closed die forging

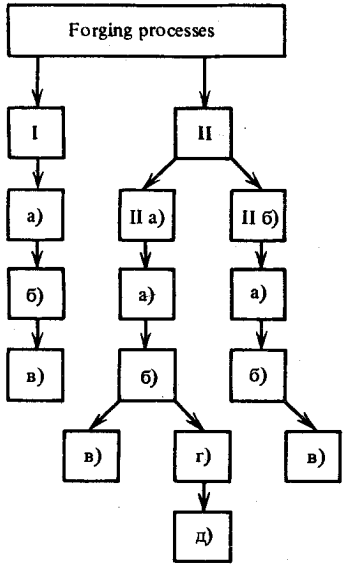
Text Study

Practice 1. Какая из приведенных ниже схем точнее отражает логику текста? Заполните выбранную схему предложениями или словосочетаниями из текста.

1.



2.



AFTER-TEXT SECTION

Text Discussion

Practice 1. Расскажите об отличиях в процессах ковки и горячей штамповки, ориентируясь на выбранную вами схему и активный словарь на с. 326.

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы	Коннекторы
оборудование и детали машин	**anvil, cavity** **hammer** **press** **die, flat die** **swaging die**		**either ... or** **as** **once** **such as** **until**
технологические процессы	**open die forging** **closed die forging** **heat treatment** **impression die forging**	**to form, to deform** **to machine** **to move** **to force** **to work** **to contact** **to cool**	
материалы	**alloy** **carbon** **stainless steel** **titanium** **tool steel**		
условные показатели и результаты протекания процесса	**weight** **dimension** **net dimension** **recrystallization temperature** **flash** **pressure** **die filling**		

Text 3B

PRE-TEXT SECTION

Прочитайте текст и определите:

1. сколько типов плавильных печей упоминается в тексте;
2. в каких абзацах говорится о конструкции и работе вагранки;
3. в каком абзаце в обобщенном виде говорится о принципе действия электропечей;
4. сколько типов электропечей упоминается в тексте, в каких абзацах.

Melting Furnaces

The metals used in various kinds of castings are melted in several types of furnaces. They are: cupolas, electric furnaces, open-hearth furnaces, crucible furnaces and some others.

A cupola furnace is a vertical type, cylindrical or shaft furnace designed to melt ferrous metals in the production of cast iron castings. The cupola consists of a refractory-lined steel stack resting on a cast iron base plate which is supported by four steel legs. The bottom of the cupola consists of two doors which are supported in closed position by a centre prop.

Iron, coke and flux are charged onto a coke bed and are held above the tuyere openings where the maximum temperature is maintained. Molten metal is tapped through a tap hole at the base of the cupola.

Although the first cupola was built about 1720 cupola melting is still recognized as the most economical melting process and most of the grey cast iron produced is melted by this method.

Electric furnaces are used for producing high quality castings. The principle of the electric furnace operation is based on the heating effect obtainable from the passing of electricity. There are three general types: arc, induction and resistance.

Arc furnaces are used for melting or refining ferrous metals. Two types of arc furnaces are in use: direct-arc and indirect-arc.

In the direct-arc furnace the arc comes in direct contact with the metal charge. Indirect-arc furnaces are the type in which the arc is maintained between two electrodes above the charge.

In the induction furnace electric currents are induced in the charge and their circulation through the charge produces heat. This type of furnace is used for producing exact alloys.

In the resistance furnace the electrodes are placed in the charge and the flow of electric current through the charge produces heat. These furnaces are generally used for non-ferrous metals production.

---

cupola вагранка
refractory-lined stack шахта, облицованная огнеупорным материалом
to rest опираться
prop подпорка
tuyere opening фурменное отверстие (для подачи в печь воздуха)

to maintain поддерживать
to tap (metal) выпускать (металл)
arc furnace электродуговая печь
direct-arc/indirect-arc furnace электродуговая печь прямого/непрямого нагрева
resistance furnace печь сопротивления
metal charge металлическая шихта

AFTER-TEXT DISCUSSION

Practice 1. a) Догадайтесь о значении следующих интернациональных слов.

base, plate, coke, flux, induction, to refine, contact, electrode, to induce, circulation

b) Найдите в тексте предложения с данными словами и проверьте по контексту правильность выбранных вами значений.

Practice 2. Скажите, какие из данных утверждений соответствуют содержанию текста.

1. The cupola is designed to melt non-ferrous metals. 2. Cupola melting is the most economical melting process. 3. The cupola is a horizontal type furnace. 4. Iron, coke and flux are charged onto a coke bed at the bottom of the furnace. 5. The maximum temperature is maintained under the tuyere openings. 6. Molten metal is tapped through a tap hole.

Practice 3. Завершите предложения, подобрав соответствующие окончания в правом столбце.

1. Electric furnaces are used for...	...comes in direct contact with the metal charge.
2. There are three general types of electric furnaces...	...direct-arc and indirect-arc.
3. Two types of arc furnaces are in use...	...produces heat.
4. In the direct-arc furnace the arc...	...production of high-quality castings.
5. In the indirect-arc furnace the arc...	...for non-ferrous metals production.
6. In the induction furnace current circulation through the charge...	...arc, induction and resistance furnaces.
7. The resistance furnace is generally used for...	...is maintained between two electrodes above the charge.

Practice 4. Суммируйте информацию текста, заполнив следующую таблицу.

Тип печи		Применение	
англ.	русск.	англ.	русск.
1. Cupola 2. Arc furnace a) direct-arc furnace b) indirect arc-furnace 3. Induction furnace 4. Resistance furnace			

SELF-TRAINING PRACTICE: SUPPLEMENTARY TEXTS

Text 1

Pre-Text-Section

Practice 1. Прочитайте текст и определите его тематику.

The fundamental component in all machines is the wheel. Machines were only made possible by its invention. It is a device which can only go round and round, so that a wheel can only do what it has done in the past, it can only repeat a fixed pattern of actions. This is obvious in simple applications of the wheel in electric motors, motor car engines, pumps, lathes, and spinning machines, in which the circular action is plainly visible. Quite surely, a glance will show the basic wheel, or its distortion in a crankshaft, involved and at work.

Every machine ever made is bound by the laws of cyclic mechanical process, because it must have an operational starting-point, at which the starting-button is pressed, and it must have a finishing-point so that it is ready to start again. Although what happens in sum may be very complicated, the cyclic nature of all machines founded on the principle of the wheel is basic.

---

to go round вращаться
a fixed pattern of actions определенная модель движения
to be obvious быть очевидным
to be plainly visible быть ясно видимым
to be bound быть связанным, ограниченным
in sum в общем; короче говоря

After-Text Section

Practice 1. Опираясь на информацию текста, расскажите об основном компоненте всех машин — колесе.

Text 2

Pre-Text-Section

Practice 1. Прочитайте текст и озаглавьте его.

Nearly a century and a half ago, a Danish physicist, Oersted, was demonstrating current electricity to a class, using a copper wire which was joined to a voltage cell. Amongst the apparatus on his demonstration table there happened to be a magnetic needle, and Oersted noticed that when the hand holding the wire moved near the needle, the latter was occasionally deflected. He immediately investigated the phenomenon systematically and found that the strongest deflection occurred when he held the wire horizontally and parallel to the needle. With a quick jump of imagination he then disconnected the ends of the wire and reconnected them to the opposite poles of the cell — thus reversing the current — and found that the needle was deflected in the opposite direction. This chance discovery of the relationship between electricity and magnetism not only led quickly to the invention of the electric dynamo and hence to the large scale utilization of electric energy, but forms the basis for modern electromagnetic field theory, which is now an extremely valuable tool in both macro- and micro-physics.

---

needle игла
the latter последний (из двух названных)
to deflect отклоняться
with a quick jump of imagination *зд.* по наитию

After-Text Section

Practice 1. Опираясь на информацию текста, ответьте на следующие вопросы.

1. What was the accidental phenomenon which Oersted noticed and investigated? 2. How did he make the needle deflect to the opposite direction to that of its original deflection? 3. What forms the basis of modern field theory?

Text 3

Pre-Text Section

Practice 1. Прочитайте текст и определите его тематику.

Practice 2. Прочитайте текст еще раз и скажите:

— по каким двум направлениям ведутся исследования в этой области;

— какой новый источник энергии назван в тексте;

— над какими уже известными моделями производства электричества ведется работа.

Researchers are also trying to develop new systems of generating electricity, some of which involve new sources of energy. One part of this research has concentrated on finding a new source of power to drive the turbine such as the kinetic energy (energy that comes from motion) of the wind and tides. Another line of research attempts to develop other known but so far impracticable methods for generating electricity. These include piezoelectricity — electricity that comes from pressure or weight applied to certain kinds of crystals. More promising is thermoelectricity, or the generation of electricity through heat. When the joint between two different metals is heated, a weak electromotive force is created. The joint is called a thermocouple, and several thermocouples joined in a series, like cells in a battery, increase the electromotive force. Thermoelectric generators, with heat supplied from radioactive materials, have been used in equipment for the space program. The action of light on some substances can also produce a release of electrons with an electromotive force. This effect is known as photoelectricity. It is familiar to most of us in the photoelectric cells that open and close automatic doors when a beam of light is broken.

Finally, attempts are being made to improve the means of producing electricity from chemical reactions in cells and batteries. Although electric cars powered by batteries have existed for a long time, they still cannot compete with cars powered by internal combustion engines, which burn increasingly scarce and expensive gasoline. There have been some promising discoveries in battery research, which may hasten the development of a practical battery-powered car. An electric car produced at a low enough price

and with a long enough operation time would offer two advantages over the internal combustion engine: it would save fuel and avoid further pollution of the atmosphere.

to join соединять
weak слабый
thermocouple термопара
to produce a release of electrons освобождать электроны
beam луч
to compete состязаться, соревноваться
to hasten ускорять
to save экономить
pollution загрязнение

After-Text Section

Practice 1. Используя информацию текста, ответьте на следующие вопросы.

1. What new sources of power could be used to drive the turbine? 2. What is the name for electricity that comes from pressure applied to certain crystals? 3. Does thermoelectricity create a strong or weak electromotive force? How can the force be strengthened? 4. Where have thermoelectric generators been used? 5. How is photoelectricity produced? 6. What is a familiar example of the use of photoelectricity? 7. What is being done to improve electric cars? 8. What advantages would electric cars have over those with internal combustion engines?

Text 4

Pre-Text Section

Practice 1. Прочитайте текст и составьте план.

There are three types of internal combustion engines which are of great importance to us and our industrial life. These three are the petrol engine, the diesel engine and the gas turbine.

They all three breathe air. They burn a liquid hydrocarbon fuel. They produce mechanical work and also, a great disadvantage, exhaust gases.

However, there are differences in the principles of their construction and operation. The first two, the petrol engine and the diesel engine, are reciprocating engines, that is, they are based on a piston moving within a cylinder. The third engine, the one we are most interested in today, the gas turbine, is a rotary engine.

There are two basic types of rotary engine: the turbo-jet and the turbo-prop. The turbo-jet is a very good, very

reliable engine. It consists of a main shaft, at one end of which there is an axial compressor and at the other end is a turbine. The purpose of this turbine is to drive the compressor. Between the compressor and the turbine are combustion chambers into which the fuel is injected. The fuel is in fact kerosene.

Air enters the compressor; the compressor is turning. As it passes through the compressor it increases both in pressure and in temperature. Then it flows into the combustion chambers, mixes with the fuel and at constant pressure the temperature goes up to a very high level. The gases then expand through the turbine. The turbine extracts work from those gases and turns the compressor. So, the turbine has no part in propelling the aircraft to which this engine is attached. The propulsion of the aircraft is due to the reaction of the exhaust gases. A jet engine is a reaction engine.

The second type is the turbo-prop. The two engines are fundamentally the same: a turbine, a compressor and combustion chambers between the two of them. But here instead of an axial compressor, we have a centrifugal compressor. In this engine, the turbine has two functions. It not only has to run the compressor, it also turns the propellor because it is a propellor engine.

Both of these engines have certain advantages over a reciprocating engine. The first and the most important is that these engines have a high power-weight ratio. In other words, for a given weight of engine the power they produce is much larger than that of a piston engine. The second characteristic is that they are very simple and have a very small number of moving parts. The third one is that they are able to run independent of water supply. Of great importance is their rapid starting. From the time you start the run-up procedure to the time full power is developed is about 30 seconds compared to some minutes with a reciprocating engine.

The major use of these engines is in aviation. Because of the high power-weight ratio, it has made aviation faster, it's made it softer. There are other uses, one of them being in electricity generation.

---

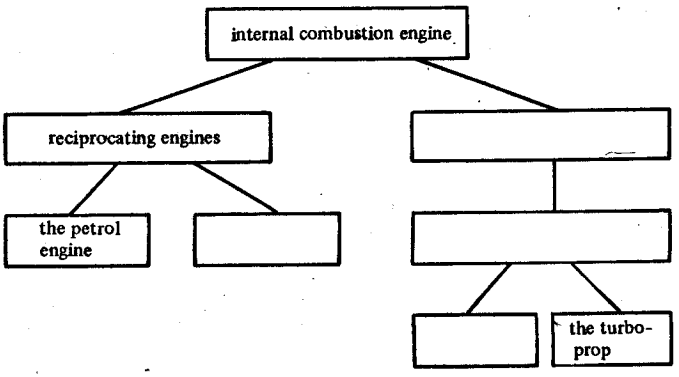
main shaft промежуточный вал
to inject впрыскивать
to expand расширять
to extract извлекать
ratio соотношение
independently независимо
supply источник
rapid быстрый

After-Text Section

Practice 1. Вы ознакомились с содержанием текста. Как вы поняли следующие словосочетания?

reciprocating rotary reaction turbo-jet turbo-prop jet propellor piston	engine
axial centrifugal	compressor

Practice 2. Опираясь на информацию текста, заполните следующую схему.



Practice 3. Сравните следующие типы двигателей.

1. reciprocating engines and rotary engines;
2. turbo-jets and turbo-props.

Подтвердите свой ответ ссылкой на текст.

Text 5

Pre-Text Section

Practice 1. В тексте рассказывается о процессе прецизионной ковки. Прочитайте текст и скажите, какой сплав наиболее легко обрабатывается этим методом и почему.

Precision forging is not a special technology, but a refinement of existing technology. Precision forgings are held to tolerances of $\pm$0.015 in., and can be used with

little or no secondary machining. Precision forging of aluminum alloys is practical because of several factors: 1. Forging and die temperatures are essentially the same; 2. Aluminum does not oxidize significantly; 3. Forging pressure requirements are relatively low; 4. Thermal shrinkage is predictable; and 5. Aluminum alloys possess excellent forgeability. Except for magnesium alloys, no other structural metal has these advantages.

It is important to remember that inherent metal properties determine the capability of forging to small, precise dimensions. While aluminum and magnesium alloys can be readily forged to close dimensional tolerances, it is much more difficult to precision forge steels, titanium alloys and other less forgeable metals that require higher forging temperatures and pressures. Similarly, the more complex a shape, the more difficult it is to forge to small, highly accurate dimensions. Precision forgings are used extensively in the aircraft and aerospace industries.

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refinement улучшение
tolerance допуск на размер
die матрица
shrinkage усадка

After-Text-Section

Practice 1. Опираясь на информацию текста, закончите следующие предложения.

1. Precision forging is a ... of existing... . 2. It is easy to precision forge ... and ... alloys. 3. Forgeability of any material to close ... tolerances is determined by ... ... properties. 4. The complexity of a ... also influences the process of ... . 5. Fields of application of precision forgings are ... and ... industries.

Text 6

Pre-Text Section

Practice 1. Прочитайте текст и скажите, о каком процессе идет речь.

Practice 2. Рассмотрите рисунок на с. 336. Что на нем изображено?

Practice 3. Найдите в тексте описание рисунка.

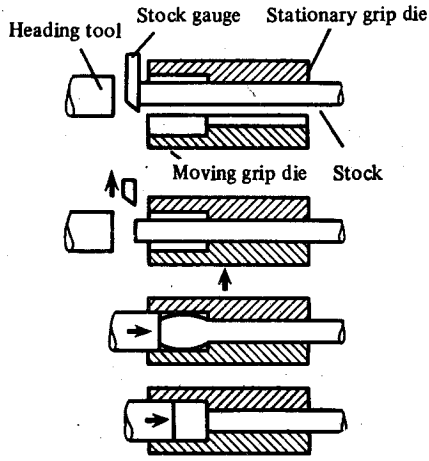
Practice 4. Определите тематику 2-го абзаца.

Upsetting comprises a substantial part of forging production. The sequence of upsetting on a forging machine is shown in Figure 1 below. The end of the bar (which may be hot or cold) is placed against a stationary stock gauge. The moving grip die then closes, the heading tool com-

presses the metal until the cavity is filled. The heading tool is then retracted and the part ejected.

The limits of maximum length that can be upset in a single stroke are determined by the tendency of the unsupported workpiece to buckle. The unsupported length should not be more than three times the diameter (or square) of the bar. This maximum length is further reduced if the end of the bar is sheared non-perpendicular to its axis, or if an impression is to be formed by the heading tool.

A Typical Operating Sequence of Upsetting on a Forging Machine



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upsetting высадка
sequence последовательность операций
grip die захватывающая (удерживающая) матрица
stock gauge указатель, зонд, шомпол
heading tool подвижная матрица для высадки
to eject выбрасывать
in a single stroke за один ход инструмента
tendency to buckle тенденция к деформации, короблению
to shear резать ножницами
impression ручей прямого штампа

After-Text Section

Practice 1. Используя рисунок и его описание в тексте, расположите следующие предложения в порядке следования операций.

1. The stock is advanced to the stock gauge. 2. The heading tool forms the stock. 3. The gauge retracts. 4. The moving grip die holds the stock.

Text 7

Pre-Text Section

Practice 1. Прочитайте текст и найдите в нем сведения, описывающие некоторые свойства твердого и жидкого магния.

Technology For Casting Large-Size Magnesium Products

M.C.L. Co., Ltd (Japan) has developed a technology for very accurate casting of large-size magnesium products by the investment casting process.

With a specific gravity of 1.74, magnesium is far lighter than aluminium (specific gravity: 2.70) though its strength is almost the same. However, the metal has the disadvantage of being difficult to process, and it is liable to burst into flames if not treated properly.

The company has been processing magnesium by the investment casting method using gypsum casting molds, but various problems have been encountered in this method, such as high production costs, the long period required for baking gypsum casting molds, and the limited size of products (maximum length or width is 30 cm, and it is difficult to obtain thickness under 1.5 mm).

With the newly developed technology, magnesium is cast with ceramic casting molds using almost the same method as for aluminium casting. It involves improved ceramic composition, suppression of the chemical reaction of molten magnesium and a method of pouring molten magnesium, whose flowability is normally poor, into the molds very smoothly.

As a result, it is now possible to manufacture magnesium products having a maximum length or width of 70 cm and a thickness of only 0.8—1 mm. Moreover, existing aluminium casting facilities can be utilized for this purpose.

This new technology is applicable to the manufacture of a wide range of lightweight products such as aircraft parts, handy TV cameras for broadcasting and computer components.

---

investment casting литье по выплавляемым моделям
specific gravity удельный вес
to be liable to burst into flames быть склонным к воспламенению
gypsum гипс
suppression подавление (снижение активности)
flowability текучесть

After-Text Section

Practice 1. Суммируйте информацию текста, заполнив следующую таблицу.

Недостатки технологии производства в гипсовых литейных формах		Преимущества, полученные в результате изменения технологии		Применение продукции, полученной с помощью новой технологии	
англ.	русск.	англ.	русск.	англ.	русск.
1. 2. 3.		1. 2. 3. 4. 5.		1. 2. 3.	

Text 8

Pre-Text Section

Practice 1. Прочитайте текст и скажите, что нового будет:

1. в управлении печами;
2. в проекте литейного цеха;
3. в методах плавления и транспортировки жидкого металла.

Подтвердите свои ответы соответствующими положениями текста.

Melting Plant of 1999

It is possible to forecast some specific features of a foundry melting system for 1999. For health and safety reasons there will be no operators near the furnaces. The process must be automatically controlled. The unit will be designed as a totally enclosed system to avoid oxidation when not needed, minimize heat losses and emissions. Protective gas barriers will become more common.

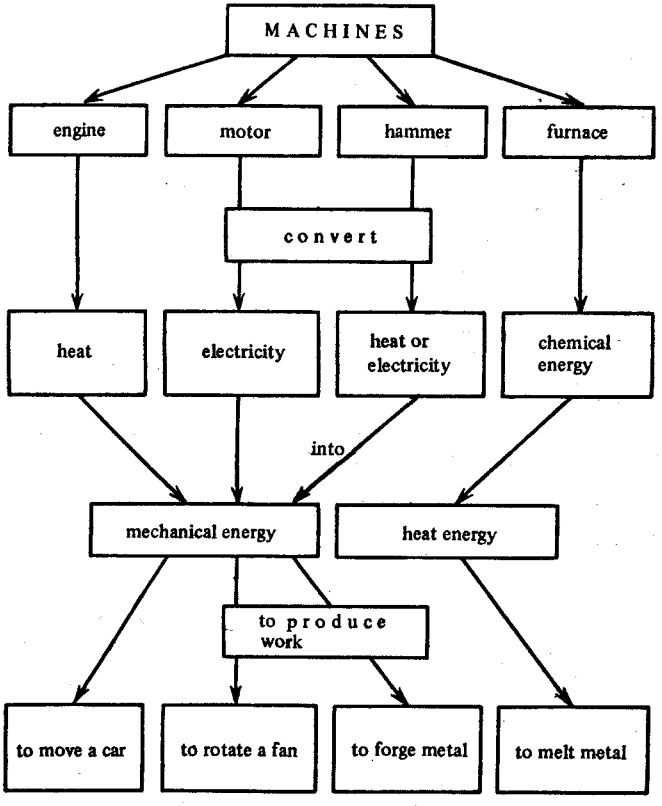
Melting will be in two stages. Primarily melting will produce standard base iron or other metal, which then will be refined further in secondary furnaces to produce the required alloys. Electricity is likely to be the standard fuel.

When the metal is ready it will be poured either directly from the furnace as at present or will be moved in an induction trough.

---

to avoid oxidation избегать окисления
heat losses потери тепла
to refine очищать
fuel топливо
trough желоб

ДЕНОТАТНАЯ СХЕМА



UNIT VIII

Robots and Computers

Text 1A

READING AND COMPREHENSION

1. **Переведите заголовок. О каких направлениях пойдет речь в тексте? Как они взаимосвязаны?**
2. **Просмотрите 1-й абзац текста. В нем названы процессы, характерные для перестройки, происходящей в промышленности в настоящее время. Какие это процессы? Ответьте, не прибегая к помощи словаря.**
3. **Следующие абзацы (кроме последнего) затрагивают проблемы роботизации производства. В каких предложениях идет речь о:**
   1) сотрудничестве с социалистическими странами в этой области;
   2) сотрудничестве с капиталистическими странами;
   3) различных видах роботов.
4. **В последнем абзаце идет речь о взаимосвязи гибких производственных систем и обычных производственных линий. Какие процессы заготовительной стадии производства при этом упомянуты?**

Flexible Production and Industrial Robots

This country's machine-building industry is now facing the task of restructing on a large scale engineering production, and developing new methods of organization, new equipment and new technologies. This is a global process. Swift production automation, the introduction of microprocessors, robotics, rotary and

rotary-conveyer lines, flexible readjustable production is vital for today's industry.

Industrial robots play an important part in the process. Many institutes are currently engaged in developing them. The concept of designing robot modules is making successful headway.

The task today is to raise their reliability, speed and failure-free operation. An international scientific-production association, Interrobot, has been set up to pool the efforts of scientists within the framework of the socialist community. Scientific institutions and production enterprises of the USSR, Bulgaria, Hungary, Poland and Czechoslovakia are involved in its work.

Soviet engineers cooperate in the development of flexible production systems with experts from capitalist countries. Jointly with the Finnish company Valmet, flexible systems are being developed on the basis of machining centres of the Ivanovo plant, as well as transport robots and automated storehouses in the Valmet company.

Also needed for the operation of flexible systems are robots which will transport billets and parts between machine tools, i. e. transport robots, robot trailers, as well as measuring robots. Experts from the Institute of Machine Studies are developing measuring manipulators and coordinate-measuring machines.

It is hard to enumerate all the problems facing our engineers and designers in the development of flexible productions. Automated systems of adjusting, controlling instruments, machined parts and many other things are needed.

The combination of flexible systems with the general system of programmed production, the spreading of flexibility to the processes of preparatory productions — foundry, forging and welding — are also very complicated problems. The flexible system must embrace all the stages of machine building, all its processes.

WHILE-READING SECTION

Language Study

Practice 1. В следующем списке слов найдите интернациональные слова, догадайтесь об их значении. Значения остальных словосочетаний определите с помощью словаря. Не забудьте о порядке перевода многочленных именных сочетаний.

production system, flexible production system; production automation; preparatory production; rotary line, rotary-conveyer line; robot, robotics, robot module, transport robot, trailer measuring robot; operation, failure-free operation; enterprise, production enterprise; machining centre; storehouse, automated storehouse; measuring manipulator; foundry, forging, welding; flexibility; reliability

Уточните значение сочетаний, опираясь на контекст.

Practice 2. Распределите сочетания из Practice 1 на три тематические группы:

а) характеристика машиностроения;
б) оборудование, станки, инструменты;
в) автоматизация производства.

Practice 3. Образуйте глагольные сочетания, соединив глаголы с существительными, ориентируясь на содержание текста. Переведите их. Распределите их по тем же тематическим группам (см. Practice 2).

to design	reliability
to embrace	problems
to restruct	production
to introduce	association
to develop	new methods
to raise	speed
to enumerate	robot modules
to transport	the stages of production
to set up	

Practice 4. На какие вопросы отвечают выделенные слова? Отметьте формальные признаки, которые определяют значение этих форм. Проверьте перевод этих форм в предложениях текста. Какие из них совпадают?

1. ...is *facing* the task... (что? что делает? какой? что делать?) 2. ...industry *facing* the task... (что делает? какой? что?) 3. ...robots *play* the... (что делают? что?) 4. ...robots *play* is... (что делают? какой? что?) 5. ...the task is *to raise*... (что должна делать? в чем заключается она?) 6. ...the engineer is *to raise*... (что должен делать? что делать?) 7. ...of *programmed* production... (какие? что делали?) 8. ...they *programmed* production... (что делали? какие?)

Practice 5. Какие из выделенных действий происходят: 1) в течение длительного времени в настоящее время; 2) регулярно; 3) должны произойти?

1. The task *is to raise* the reliability of robots. 2. Flexible systems *are being developed* in many automobile

plants. 3. This engineer *is developing* a new measuring manipulator. 4. Flexible systems *embrace* all stages of machine building. 5. Robots *play* an important part in the process.

Practice 6. Найдите в тексте предложения, в которых обозначено действие в его протекании в настоящий момент, и переведите их на русский язык.

Practice 7. Найдите в тексте предложения, в которых подчеркивается завершенность и результативность действия, и переведите их на русский язык.

Practice 8.

Инфинитив (The Infinitive)

Значение	Формы	
	Active	Passive
одновременность	**to make**	**to be made**
предшествование	**to have made**	**to have been made**
длительность	**to be making**	
длительность и предшествование одновременно	**to have been making**	

Найдите в тексте предложения с инфинитивными оборотами и переведите их на русский язык.

Practice 9. Сравните нижеприведенные предложения с инфинитивными оборотами и покажите разницу их структурных моделей через перевод.

Model 1: To obtain a steel of the desired quality is the main subject of the experiments carried out in the research laboratory of the plant. Получение стали желаемого качества является основной целью опытов, проводимых экспериментальной лабораторией завода.

Model 2: To obtain a steel of the desired quality the research laboratory of the plant carried out a lot of experiments. Для того чтобы получить сталь желаемого качества, экспериментальная лаборатория завода провела много экспериментов.

1. To develop a new method of cutting metals was necessary. To develop a new method of cutting metals

the engineers made some interesting experiments. 2. To make good castings, it is necessary to use large and properly placed risers to feed heavy sections. To make good castings is impossible without using large and properly placed risers to feed heavy sections. 3. To discover the stresses occurring requires careful figuring. To discover the stresses occurring, we require careful figuring. 4. To use an aluminium paint spray was the only really promising mould-treatment developed in the test work. To use an aluminium paint spray the engineers developed the only really promising mould-treatment during the test work. 5. To design new machine-tools is the task of a mechanical engineer. To design new machine-tools a mechanical engineer must study much. 6. To be an ideal engineer means to have knowledge, to improve one's ability to analyze, synthesize and develop insight into one's field. To be an ideal engineer one is to have knowledge, to improve one's ability to analyze, synthesize and develop insight into one's field.

Practice 10.

Очень часто инфинитив употребляется в качестве определения в модели N+to V, при переводе которой на русский язык вводится значение будущности или долженствования. Например:

A casting to be made in a metal mould must be comparatively short. Отливка, которая будет изготовляться в металлической форме, должна быть сравнительно небольшой.

Переведите следующие предложения с инфинитивным оборотом в функции определения на русский язык.

1. Engineers must know the best and most economical materials to use, understand the properties of these materials and how they can be worked. 2. Another factor for the industrial engineer to consider is whether each manufacturing process can be automated in whole or in part. 3. Industrial robots to be built now perform certain tasks even better than a human being. 4. There are few written instructions to help a melter in determining alloying additions to be made to a heat of steel melted in an induction furnace. 5. Heating temperatures, methods of quenching and shape of the part to be treated are the factors which particularly affect the amounts of distortion. 6. The tube to be drawn is mounted on the

rollers on the turn-table bed-piece, and the left-hand end of the tube is brought in contact with the stripper plate incorporated in the head.

Practice 11. Обратите внимание на разнообразие способов выражения различной степени вероятности совершения действия.

Степень вероятности	Способы выражения
certainly	I am **sure/certain/positive** that the ideal engineer will need much more technical knowledge. The ideal engineer **is certain/bound** to need much more technical knowledge. The ideal engineer **will certainly/definitely** need much more technical knowledge.
probably	It is **likely** that the ideal engineer will need much more technical knowledge. The ideal engineer is **likely** to need much more technical knowledge.
possibly	The ideal engineer **may/might** need much more technical knowledge.
probably not	It is **unlikely** that the ideal engineer will need some teaching skills. The ideal engineer is **unlikely** to need some teaching skills.
certainly not	The ideal engineer **definitely/certainly won't** need any artistic skills. I am **sure/certain/positive** that the ideal engineer won't need any artistic skills.

Изучите информацию, данную в нижеприведенной таблице, и сформулируйте на ее основе предложения. Знаком плюс отмечены разные степени вероятности совершения действия. (См. образец ниже.)

	certainly	probably	possibly	probably not	certainly not
1. The ideal engineer has technical competence.	+				
2. The ideal engineer possesses social skills, such as cooperativeness.		+			

Продолжение

	certainly	probably	possibly	probably not	certainly not
3. The ideal engineer doesn't do what interests him most without regard to the needs of the organization.					+
4. The ideal engineer doesn't approach his job with unrealistically high expectations.					+
5. The ideal engineer is interested in some kind of promotion.			+		
6. The ideal engineer doesn't expect work privileges, without having to prove that he is worth it.				+	
7. The ideal engineer is practical and realistic.	+				
8. The ideal engineer has initiative.					
9. The ideal engineer won't learn the organizational system slowly.					
10. The ideal engineer knows how to report results orally and in writing.					
11. The ideal engineer has some scientific abilities.					
12. The ideal engineer keeps up with technological progress and grows professionally.					

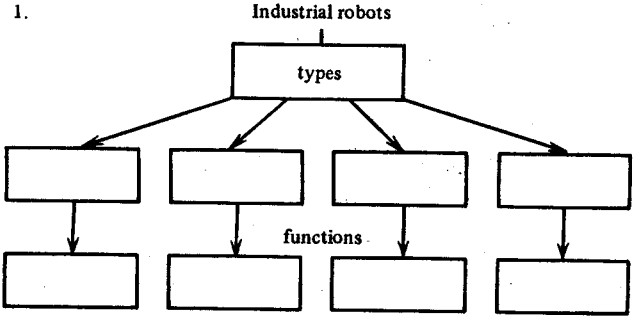
Model: I am sure that the ideal engineer has technical competence.
The ideal engineer is certain to have technical competence.

Text Study

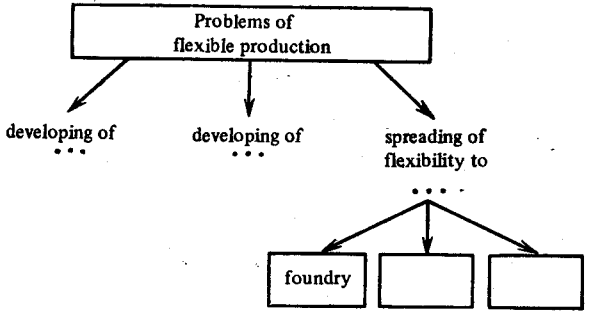
Practice 1. Заполните следующую диаграмму, отражающую логику данного текста. В схему должны быть внесены номера предложений текста, отражающие указанную мысль.

Practice 2. Заполните следующие диаграммы, отражающие связь между понятиями в тексте.

1.



2.



AFTER-TEXT SECTION

Text Discussion

Practice 1. Расскажите о: 1) развитии промышленных роботов, 2) проблемах гибкого производства. Воспользуйтесь при этом Practice 2 на с. 351 и активной лексикой.

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глагольные сочетания	Прилагательные	Коннекторы
Автоматизация, роботизация производства	flexible production production automation microprocessor robotics rotary-conveyer line robot robot module automated storehouse transport robot robot trailer measuring robot measuring manipulator	to restruct production to develop new methods, flexible systems to introduce new methods to design robot modules	adjustable readjustable	also i.e. as well as
завод, цех, участок, станок, инструмент	engineering production equipment technology enterprise machining centre billet foundry forging welding machine-tool adjusting instruments controlling instruments preparatory production	to transport		

Продолжение

Область применения	Существительные и сочетания с существительными	Глагольные сочетания	Прилагательные	Коннекторы
характеристика производства	**reliability** **failure-free operation** **flexibility**	**to raise reliability, speed**		

Text 1B

PRE-TEXT SECTION

Practice 1. Найдите в тексте абзацы, содержащие информацию:

1) об истории появления слова «робот»;
2) о типах промышленных роботов;
3) о применении роботов.

Practice 2. Изучите нижеприведенную таблицу и определите, какие из граф таблицы имеют непосредственное отношение к вашей будущей специальности.

What Can Robots Do?

The word "robot" was first used by Czech playwright Karel Čapek, who in 1920 wrote a drama about machines that could move like human beings — and do their work. Today this idea has become a reality. Industrial robots now being manufactured perform certain tasks even better than a human being. We are thus at the threshold of the era of robots — what might be called a "robolution".

An industrial robot is a unit "which has movement functions with a high degree of freedom similar to human arms and hands and is able to move autonomously on the basis of sense and perceptions".

There are six categories of robots: (1) the manual manipulator, remotely controlled by a person, which carries out hand-and-arm functions to hold and move objects; (2) the fixed-sequence robot, which performs a series of operations in a preset order, always in the same series of locations in space; (3) the variable-sequence robot, which operates in the same manner as a fixed-sequence robot but can easily be reprogrammed for a different sequence of operations; (4) the playback robot, which repeats a sequence of movements and opera-

tions that are first "taught" by manual movement of a manipulator and stored in the robot's memory unit; (5) the numerically-controlled robot, which moves from one position to another according to numerical instructions in such forms as punched paper tapes or cards; and (6) the intelligent robot, an advanced type that can decide its course of action on the basis of its sensing devices and analytical capability.

Today robots play a major role in welding, press-forming, coating and other operations, particularly in the automotive industry.

Development of Major Application Fields of Industrial Robots in 1980s

Application field	Jobs and tasks of robots
Manufacturing industries: (use of intelligent robots and unmanned plant)	Dangerous, unpleasant and monotonous tasks on assembly line, unmanned plant and automated line in welding, pressing and painting operations in automobile and other manufacturing industries
Construction, civil engineering and mining	Work on high elevations in building construction Blasting and drilling in construction Pit face work in mining
Social welfare	Guiding robot for the blind Artificial limbs Nursing robot for the elderly Cleaning robot
Agriculture and fishery	Pesticide spraying, irrigation, field cultivation Milking, feeding and waste treatment in dairy farming Fertilization, irrigation, afforestation, lumbering and loading in forestry industry Observation and search in fishery
Transportation, distribution and service	Loading and unloading Railway maintenance Ship bottom cleaning Electric insulator cleaning Measuring, construction and dismantling in nuclear reactor

Продолжение

Application field	Jobs and tasks of robots
Environmental control	Measuring, control and observation Waste treatment Fire fighting
Offshore development	Submarine work, offshore observation
Space development	Assembly robot in space construction, remote sensing robot

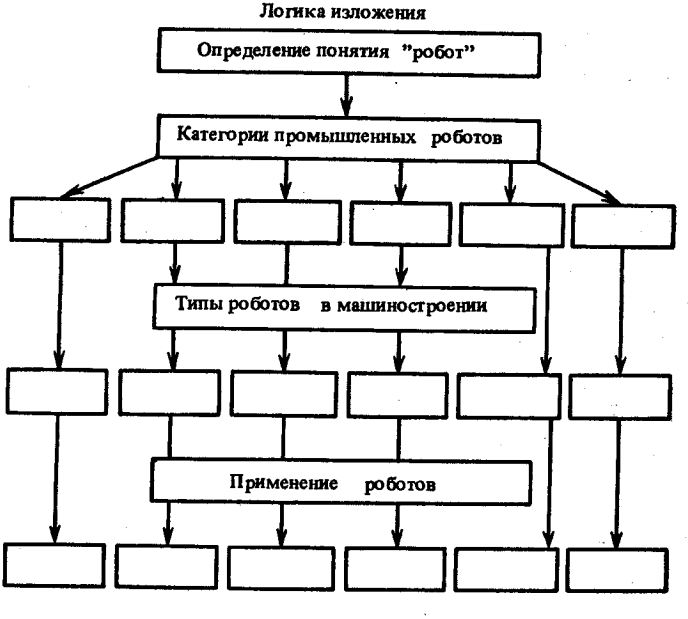
AFTER-TEXT DISCUSSION

Practice 1. Прочитайте 1-й абзац и определите, в связи с чем Карел Чапек впервые упомянул слово «робот».

Practice 2. Из 2-го и 3-го абзацев выпишите определения всех категорий промышленных роботов, отметив: 1) термин; 2) класс; 3) характеристику. Переведите получившиеся определения на русский язык.

Practice 3. Переведите графы таблицы, имеющие отношение к вашей специальности.

Practice 4. Дополните сообщение, приготовленное по содержанию текста 1A, информацией текста 1B. (Воспользуйтесь нижеприведенной схемой.)



Text 2A

READING AND COMPREHENSION

1. Просмотрите текст и сделайте вывод о 1) характере текста: а) учебный, б) научный, в) текст-инструкция, г) патентное описание); 2) о его функциональной направленности: а) дать классификацию компьютеров; б) дать определение основных узлов компьютера; в) дать описание программной части компьютера.

2. Определите, какому абзацу текста соответствует таблица на с. 353.

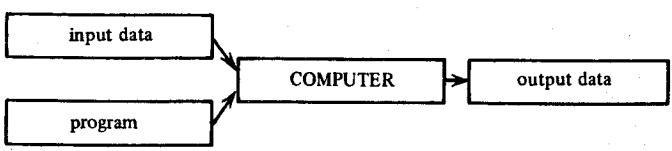
Computer

One of the most important developments of this century is the computer. As a consequence, there is now at the service of man an inanimate power of over 200 billion calculating operations per second, supplementing the thinking and the memory of man.

Computers are used nowadays for many different kinds of work, e. g. in offices, banks, factories, hospitals, universities and schools. Their use is becoming more widespread as cheaper and smaller computers become available. People can now buy small personal computers.

What are computers? And what can they be used for? Computers are electronic systems. They are used for handling, or processing, facts and figures. The facts and figures processed by a computer are usually known as data. Computers can process large amounts of data very quickly.

The data fed, or put, into a computer is input data. Input data is processed according to a set of instructions called a program. Both input data and programs are needed for processing. The results of processing are output data. Very often, the output data is new and useful information. "Information" here means output data useful for making decisions.



A computer can be used to process many different types of data. For example, a scientist can use a computer to do numerical calculations. A businessman can use a computer to analyse a list of customers or stock

(stores held by the business). An engineer can use a computer to produce diagrams or plans. The table below shows some different types of process and data for different users:

User	Process	Data
scientist	calculating	numbers (i.e. numerical data)
businessman	analysing	names, addresses (i.e. non-numerical data)
engineer	designing	colours, patterns
manufacturer	controlling	measurement (volume, time, temperature, speed)
hospital	analysing plotting	electrical signals
library/shop	information retrieval	stock details

WHILE-READING SECTION

Language Study

Practice 1. Догадайтесь о значении следующих интернациональных слов. Уточните по словарю их произношение.

computer, service, billion, calculate, operation, office, bank, factory, university, personal computer, electronic system, fact, instruction, program, result, information, businessman, list, diagram, plan

Practice 2. Следующие слова — «ложные друзья переводчика». 1) Напишите предполагаемые значения. 2) Выпишите все значения из словаря. 3) Уточните по контексту их значение в данном тексте.

process, processing, data, table, designing, controlling, hospital

Practice 3. Найдите приложение I на с. 408 учебника, изучите таблицы наиболее частотных суффиксов, переведите приведенные в таблицах примеры, воспользовавшись словарем при необходимости.

Practice 4. Прочитайте следующие предложения и по суффиксам определите принадлежность выделенных слов к разным классам слов: N, V, Adv, Adj.

1. The system *analyst* provides the *programmer* with the details of the data processing problems. 2. These terminals are very *useful interactive* devices for use in offices because of their speed and *quietness*. 3. The new

microcomputer we purchased does not have a Fortran *compiler*. It is *programmable* in Basic only. 4. A computer is a machine with an intricate network of electronic circuits that operate switches or *magnetize* tiny metal cores. 5. In very large and modern *installations*, the computer *operator* sits in front of a screen that shows an up-to-date *summary* of the computer jobs as they are being processed. 6. The *introduction* of terminals and screens has *partly* replaced the use of punched cards. 7. *Binary arithmetic* is based on two digits: 0 and 1. 8. Multiplexing is when many *electrical* signals are combined and carried on only one *optical* link. 9. Computers are machines designed to process *electronically specially* prepared pieces of *information*. 10. The *computed* results were printed in tables.

Practice 5. Заполните пропуски соответствующим смыслу предложения словом из предложенного списка.

a) operation, operate, operator, operational, operationally, operating: 1. A computer can perform mathematical ... very quickly. 2. One of the first persons to note that the computer is malfunctioning is the computer... . 3. The job of a computer is to ... the various machines in a computer installation. 4. The new machines in the computer installation are not yet ... .

b) acceptance, accept, accepted, acceptable, acceptably: 1. A computer is a device which ... processes and gives out information. 2. The students are still waiting for their ... into the Computer Science program. 3. It is ... to work without a template if the flowcharts are not kept on file.

c) solution, solve, solvable, solver: 1. It may take a lot of time to find a ... to a complex problem in programming. 2. A computer can ... a problem faster than any human being. 3. A computer has often been referred to as a problem ... .

d) remark, remarkable, remarkably: 1. Today's computers are ... faster than their predecessors. 2. Systems analysts will often make ... about existing programs so as to help make the operations more efficient. 3. There have been ... developments in the field of computer science in the last decade.

e) communication, communicate, communicable, communicative, communicably: 1. A computer must be able to ... with the user. 2. Fibre optics is a new develop-

ment in the field of ... . 3. Some people working in computer installations aren't very ... because they are shy.

f) calculation, calculate, calculating, calculated, calculator, calculable, calculus: 1. A computer can do many kinds of ... quickly and accurately. 2. ... is a branch of mathematics for making ... without the use of a ... machine. 3. A computer can ... numbers much faster than a manual ... . 4. Some problems aren't ... without logarithm tables.

g) mechanic, mechanism, mechanize, mechanical, mechanically, mechanistic, mechanics, mechanization, mechanized: 1. Today's computers are less ... than they used to be. 2. The ... devices in a computer system operate more slowly than the electromagnetic devices. 3. The ... of the brain is very complicated but unlike a computer it isn't ... .

h) necessity, necessitate, necessary, necessarily, necessities, need, needed: 1. Because it is expensive to set up a computer department it is ... to budget well for the basic ... of the installations. 2. A good programmer isn't ... going to be a good systems analyst. 3. Students' lack of understanding of the basic concepts in computer science may ... the instructor to restructure the course.

i) dependence, depend on, dependable, dependably, dependent, dependency, depending: 1. The length of time a programmer takes to make a program will vary ... on the complexity of the problem and his ability and experience. 2. One can always ... a computer to obtain accurate answers because it's probably the most ... machine in the world today.

j) technology, technological, technologically, technologist: 1. Computer ... is a fast growing discipline. 2. The ... improvements of computers are reducing man's workload.

Practice 6. Заполните следующую таблицу.

Term	Class	Characteristics
a computer data program information input data output data	electronic machine	that processes data

Practice 7. Какие части следующих слов (подчеркните их) указывают на 1) деятеля (1 черта), 2) на процесс (2 черты), 3) на результат процесса (3 черты).

computer — computation
processor — processing
programmer — programming — program
calculator — calculating — calculation

Practice 8. Соедините слова левой и правой колонок так, чтобы получить терминологическое сочетание.

data	machine
electronic	input
numerical	output
device	data

Practice 9. Напишите определения следующих терминов. Для каждого термина напишите разные варианты определения. Уточните перевод терминов по политехническому словарю.

computer, data, input data, program, output data, information

Practice 10. Найдите в 4-м абзаце текста предложения, иллюстрирующие таблицу на с. 353, составьте дополнительные предложения, отражающие потребности пользователя ("User") компьютера.

Model:

$N_1+V+N_2+$to $V+N_3$
user computer

Practice 11.

Слова — организаторы научной и технической мысли (коннекторы) помогают отделить главное от вспомогательного, действие от его последствий, основную мысль от информации, иллюстрирующей ее.

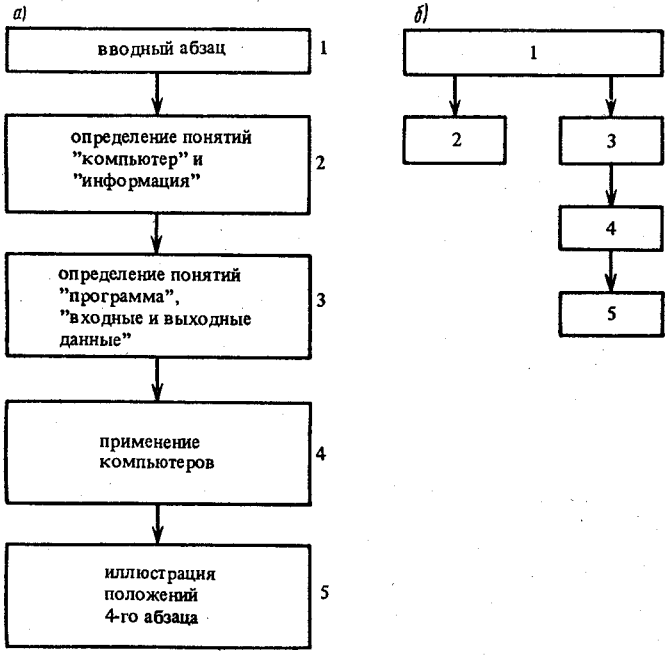
Выпишите из 1-го абзаца словосочетания, указывающие на «следствие», из 2-го абзаца и последнего абзаца — коннектор, указывающий на то, что дается пример, пояснение. После этого сократите эти абзацы так, чтобы оставшиеся предложения представляли только основную информацию.

Text Study

Practice 1. Какое предложение передает основное содержание текста?

1. Input data is fed into a computer. 2. Computers are used by different users. 3. The program tells computer what to do. 4. Computers are machines used for processing facts and figures at great speed and with high reliability.

Practice 2. Какая из схем точнее отражает логику всего текста?



AFTER-TEXT SECTION

Text Discussion

Practice 1. Воспользовавшись выбранной вами схемой в Practice 2, расскажите об основных узлах компьютера, их назначении, применении компьютеров в различных сферах деятельности. При подготовке сообщений воспользуйтесь активным словарем.

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы и глагольные сочетания	Прилагательные	Коннекторы
понятия, связанные с работой компьютера	**data** **input data** **output data** **program** **information** **instruction**	**to process** **to handle** **to put into**		**as a consequence** **for example** **i.e.**

Продолжение

Область применения	Существительные и сочетания с существительными	Глаголы и глагольные сочетания	Прилагательные	Коннекторы
сфера использования компьютера		**to do calculations** **to analyse a list of** **to produce diagrams** **to control measurements**	**numerical**	

Text 2B

PRE-TEXT SECTION

Practice 1. Прочитайте текст и заполните следующую таблицу на русском языке.

Вид компьютера	Его характеристики
Компьютеры I поколения Компьютеры II поколения Компьютеры III поколения Компьютеры IV поколения	

The Development of Computers

The first computers used thousands of separate electrical components connected together with wires. In the late 1940s, computers were made using vacuum tubes, resistors, and diodes. These computers were called first generation computers.

In 1956, transistors were invented. Transistors are made from materials called semiconductors. Computers using transistors were called second generation computers. Second generation computers were smaller than first generation computers. Second generation computers also used less electrical power. Both first and second generation computers were very expensive.

Computer components (such as transistors, diodes, resistors) can now be made from semiconductor materials of different shapes. Nowadays, complete circuits

can be made from a single piece of semiconductor, called a chip. Such circuits are called integrated circuits (IC's). Computers using integrated circuits were first produced in the 1960s. They were known as third generation computers. Their integrated circuits had about 200 components on a single chip. Today, we can produce more than 100,000 components on a single chip. A chip can be as small as 0.5 cm square.

With the invention of chips, computer manufacture has become much simpler. The manufacturer does not have to connect thousands of components together. Most of the connections are made inside the chip. It is even possible to build a complete processor in a single chip. A processor on a single chip is called a microprocessor.

AFTER-TEXT DISCUSSION

Practice 1. Прочитайте текст внимательно и выберите из него предложения, характеризующие размеры, конструкцию, скорость обработки данных в компьютерах различных поколений. Составьте таблицу на английском языке, аналогичную таблице в предтекстовом заданин. Сравните обе таблицы. Внесите в таблицу на русском языке дополнительные данные.

Practice 2. Опишите каждую иллюстрацию, воспользовавшись следующими моделями.

This computer is called... . It used (uses)... . It consists of... . ... were (are) small (large). ... ... cheap (expensive). It was first ...ed in... .

Text 3A

READING AND COMPREHENSION

Просмотрите текст и разбейте его на 2 части, которые могли бы быть помещены под заголовками: 1) Computer hardware. 2) Computer software. Отметьте предложения, которые обобщают содержание а) первой части; б) второй части.

The Parts of a Computer System

In order to use computers effectively to solve problems in our environment, computer systems are devised. Computer systems may be discussed in two parts.

The first part is hardware — the physical, electronic, and electro-mechanical devices that are thought of and

recognized as "computers". The hardware consists of Central Processing Unit (CPU), input devices and output devices. The CPU is made up of a processor and a main memory, or main store. The processor carries out, or executes, instructions in the program. The main memory stores input data and the program needed by the processor. The main memory also holds output data, or the results of processing.

Input devices are used to provide data for the CPU. The keyboard is a common data input device. By using a keyboard, a user can enter data directly into the computer system. Data is sometimes entered on cards. The cards are read by an input device called a card reader. Data is often input from a mass storage device, such as magnetic tape or magnetic disc. A mass storage device has a much larger capacity than main memory. That is, it can store more data. The tapes or discs are read by an input device called a tape drive or a disc drive.

Output devices receive data from the CPU. The Visual Display Unit (VDU) and printer are common output devices. The VDU is similar to a television screen. The printer produces printed output on paper. Both the VDU and printer present output data for immediate use. Sometimes, the output data is transmitted along a telephone line to another computer. Output data can also be stored for future use on a mass storage device, such as magnetic tape or magnetic disc.

Input devices, output devices and mass storage devices are collectively called Input-Output Devices (I-O Devices), or peripherals.

The second part is software — the programs that control and coordinate the activities of the computer hardware and that direct the processing of data.

For the computer system to operate, computer programs are required. A computer program is a set of instructions for the CPU. These instructions tell the CPU where to find the input data in the system. The CPU is also instructed how to process the data and where to put the results. Programs are not hardware, as they have no electrical or mechanical components. They can be easily changed according to the needs of the user.

Computer software can be divided into two very broad categories — systems software and application software.

WHILE-READING SECTION

Language Study

Practice 1. Прочитайте внимательно 1-ю часть текста (см. предтекстовые задания) и сгруппируйте данные ниже словосочетания в две колонки под рубриками 1) hardware; 2) software; найдите по словарю перевод этих сочетаний. При поиске значения многочленного словосочетания в словаре не забудьте, что «основным» является последнее слово в цепочке.

Model: input device устройство (чего?) ввода

CPU, VDU, programs; main memory; input device; printer; magnetic tape; magnetic disc; tape drive; disc drive; instruction; card reader

Practice 2. Подберите к терминам левой колонки соответствующие определения из правой.

1. hardware	a set of instructions for the CPU
2. software	devices used to provide data for the CPU
3. CPU	devices which receive data from CPU
4. input devices	parts of hardware in which instructions are carried out and data is stored
5. output devices	physical, electronic and electromechanical devices

Practice 3. Составьте глагольные сочетания, соединив глаголы левой колонки с соответствующими существительными. Переведите получившиеся сочетания на русский язык, ориентируясь на содержание текста. Проверьте правильность перевода по словарю.

1. to be made up of	a processor and a main memory
2. to carry out	data
3. to store	card reader
4. to hold	instructions
5. to enter	output data
6. to be read by	input data
7. to input	printed output
8. to receive	CPU
9. to transmit	a Central Processing Unit
10. to instruct	input devices
11. to process	output devices
12. to consist of	

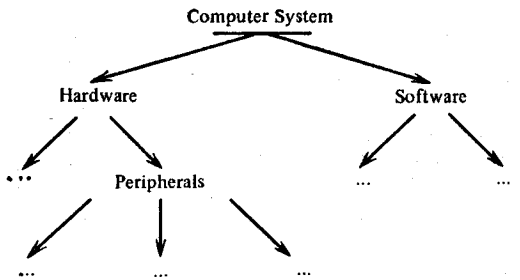
Объедините получившиеся сочетания в синонимичные пары.

Practice 4.

При классификации и группировке объектов по тем или иным признакам часто используются следующие сочетания: (they) fall into / are classified into / are divided into / are grouped into (certain categories). Например:

Computer software can be divided into two categories.

Заполните следующую диаграмму. После этого составьте предложения, отражающие группировку систем, входящих в систему компьютера.

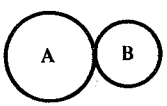


Practice 5.

«Проблема» и «ее решение» могут быть представлены различными способами:

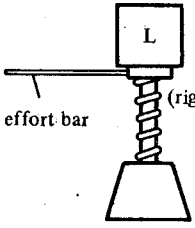
1. To enter data directly into the computer system, a user uses a keyboard.
2. A user can enter data directly into a computer system by using a keyboard.
3. Data is entered directly into a computer system by a user using a keyboard.

Напишите решение для каждой из изображенных ситуаций. После этого соедините «проблему» и «ее решение» в соответствии с приведенными примерами.

1. 

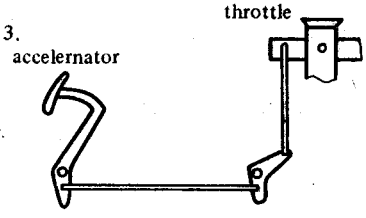
Rotate gear B clockwise.

2.



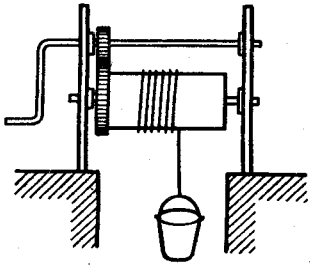
Lower the load.

3.



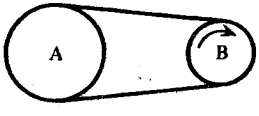
Open the throttle.

4.



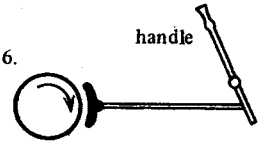
Raise the bucket in the well.

5.



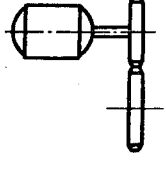
Reverse the direction of rotation of pulley B.

6.



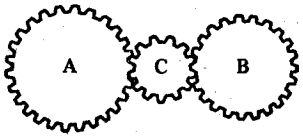
Apply the brake.

7.



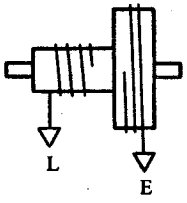
Rotate gear B at 40 rev/min.

8.



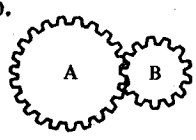
Rotate gear B clockwise.

9.



Raise load L.

10.



100 teeth 50 teeth

Rotate gear B at 50 rev/min anti-clockwise.

Practice 6. Найдите приложение I в конце учебника, изучите таблицы наиболее частотных префиксов, переведите приведенные в таблицах примеры, воспользовавшись словарем при необходимости.

Practice 7. Заполните пропуски нужным по смыслу префиксом из числа приведенных ниже.

multi-, semi-, mini-, deci-, mono-, de-, sub-, mega-, inter-, auto-, prime-

1. ...byte means one million bytes. 2. ...plexing is when many electrical signals are combined and carried on only one optical link. 3. Blocks are separated from each other by marks called ...block gaps. 4. The number system we use in everyday life is the ...mal system, which has a base of 10. 5. Some screens are ...chromatic whereas others produce multicolour pictorial graphics. 6. The complete description of the logical structure of data is called the schema and the description of the parts, the ...schema. 7. The main storage locations of a computer are called its ...ary storage. 8. The small ferrite rings called cores have two states: they can be either magnetized or ...magnetized. 9. The introduction of chips or ...conductor memories made it possible to reduce the size of the computer.

Practice 7. Прочитайте следующий отрывок; в процессе чтения выберите слова с префиксами и заполните ими нижеприведенную таблицу.

Computers may have a short history but prior to their development, there were many other ways of doing calculations. These calculations were done using devices that are still used today; the slide rule being a perfect example, not to mention the ten fingers of the hands. These machines, unlike computers, are non-electronic and were replaced by faster calculating devices. It wasn't until the mid-1940s that the first digital computer was built. The post-war industrial boom saw the development of computers take shape. By the 1960s, computers were faster than their predecessors and semiconductors had replaced vacuum tubes only to be replaced in a few years by tiny integrated circuit boards. Due to microminiaturization in the 1970s, these circuits were etched onto wafer-thin rectangular pieces of silicon. This integrated circuitry is known as a chip and is used in microcomputers of all kinds.

It has been forecasted that by the end of this decade, exceptionally faster and smaller computers will replace those in use today.

Prefixes				
negative and positive	size	location	time and order	number
unlike			post-war	

Text Study

Practice 1. Какое из предложений отражает основную мысль текста?

1. Only hardware is necessary to make up a computer system. 2. Software alone doesn't constitute a computer system. 3. A computer system needs both hardware and software to be completed.

Practice 2. Определите, какие из следующих предложений соответствуют содержанию текста.

1. A system is a good mixture of parts working together. 2. Input and output devices operate more slowly than decision-making devices. 3. The "computer" is the "hardware". 4. The processor is usually referred to as the CPU. 5. Peripherals fall into Input-Output Devices and mass storage devices.

AFTER-TEXT SECTION

Text Discussion

Practice 1. Расскажите об основных подсистемах компьютера, используя диаграмму на с. 362. Воспользуйтесь активным словарем, данным ниже.

Active Vocabulary

Область применения	Существительные и сочетания с существительными	Глаголы и глагольные сочетания	Наречия	Коннекторы
части компьютерной системы, устройство компьютера	**hardware** **CPU** **processor** **main memory** **input device** **output device** **mass storage device** **software** **program** **application software**	**to be made up of** **to consist of**	**effectively** **directly** **easily**	для уточнения высказывания: **or** **such as** **that is** для выражения «причины»: **as**
действие компьютера		**to carry out instructions** **to store data** **to hold data** **to enter data** **to be read by** **to transmit** **to process** **to instruct CPU** **to direct**		

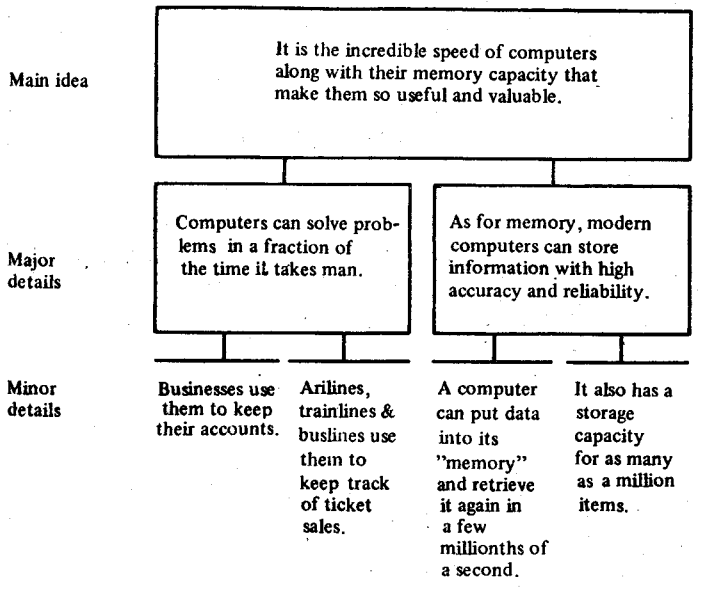
Text 3B

PRE-TEXT SECTION

Practice 1. Прочитайте следующий отрывок и изучите диаграмму, в которой отражены: главная мысль (main idea), основные детали (major details) и вспомогательные детали (minor details). Подобный анализ помогает определить логику текста, а также составить его реферат, аннотацию, кратко пересказать текст.

It is the incredible speed of computers along with their memory capacity that make them so useful and valuable.

Computers can solve problems in a fraction of the time it takes man. For this reason, businesses use them to keep their accounts, and airlines, trainlines and buslines use them to keep track of ticket sales. As for memory, modern computers can store information with high accuracy and reliability, A computer can put data into its "memory" and retrieve it again in a few millionths of a second. It also has a storage capacity for as many as a million items.



Practice 2. Прочитайте текст о применении компьютеров на железнодорожном транспорте и определите, какое из предложений передает наиболее общую мысль текста — об использовании компьютеров при распределении железнодорожных билетов на различные поезда.

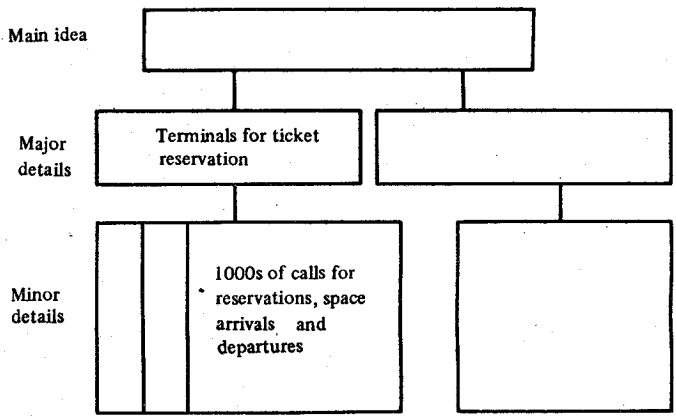
Application of Computers

Railways use large computer systems to control ticket reservations and to give immediate information on the status of its trains. The computer system is connected by private telephone lines to terminals in major train stations and ticket reservations for customers are made through there. The passenger's name, type of accommodation and the train schedule is put into computer's memory.

On a typical day, a railway's computer system gets thousands of telephone calls about reservations, space on other railways, and requests for arrivals and departures. A big advantage of the railway computer ticket reservation system is its rapidity because a cancelled booking can be sold anywhere in the system just a few seconds later. Railway computer systems are not used for reservations alone. They are used for a variety of other jobs including schedule, planning, freight and cargo loading, meal planning, personnel availability, accounting and stock control.

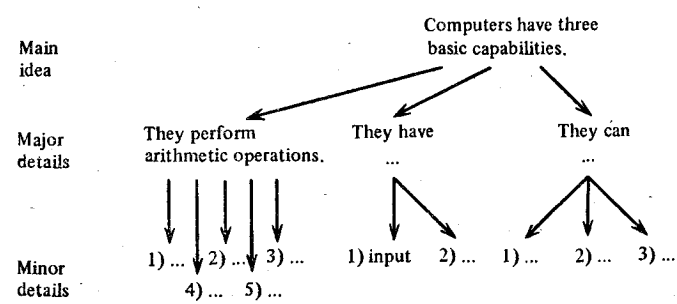
AFTER-TEXT DISCUSSION

Practice 1. Дополните следующую схему.



Practice 2. Сократите текст, ориентируясь на полученную схему.

Practice 3. Перескажите текст: а) кратко (раскрыть верхние блоки схемы); б) подробно (раскрыть все блоки схемы).



Text 1

Pre-Text Section

Practice 1. Прочитайте текст и найдите в нем следующую информацию:

— какие 3 основные стадии производственного процесса будут полностью автоматизированы;
— что представляет собой схема завода будущего;
— с помощью чего будет осуществляться связь между всеми участками производства;
— на каких участках будут заняты люди и какую работу они будут выполнять.

Tomorrow's Factory

Machining is only one part of the overall production process in the engineering workshop. There are two more basic operations: design and administration.

In the engineering industry of the future, all three of these operations will be done with the help of computers, which will greatly reduce the need for labour.

There would be three main computers: one each for the flexible manufacturing system, design and administration. Instructions that enter the first computer control how and which goods are made; draughtsmen work out which goods they want made with the second machine; and in the third are lodged all the details about orders, scheduling, the state of stocks and so on. All three computers are linked to each other, and also to an automated warehouse from which raw materials are passed by a transport mechanism to the factory floor and the machining area.

The few places where people would be involved with the factory's processes would be in the design room and in a control area where the factory's administrators sit. Draughtsmen would design products using their keyboards and screens. The codes representing these parts would come along wires to the production computer, which, in turn, would instruct its battery of machine tools to make the items. There would be a few "seeing" robots in the production department, to make the assembly job easier. Meanwhile, the factory's administrators

would keep track of the whole operation, getting information from the system by keying in instructions to their terminals.

At the heart of the factory would be a complex communications network that links all the machines in the plant so that they constantly relay instructions to each other. In this way all the machines in the plant would inform each other of what is going on. The mechanisms in the plants will be linked by wires in the same way as the telephone network connects up towns and villages, houses and offices. The main difference is that the machines will talk to each other in a binary code.

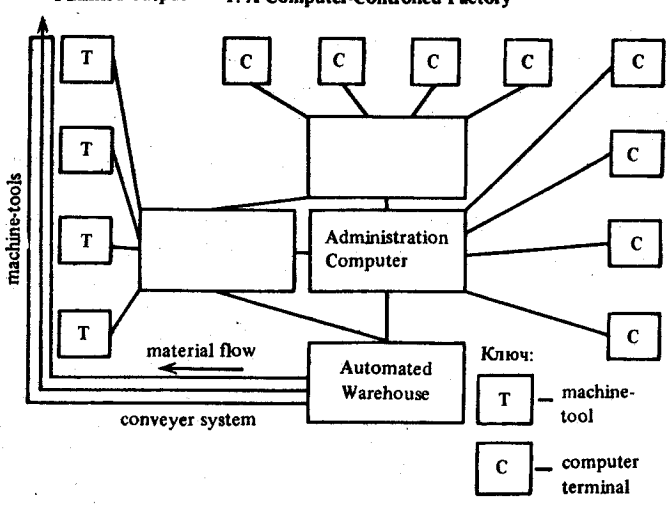
It would not be an unmanned factory, but it would be pretty near such a thing. Given the rate of technical progress over the past ten to twenty years, such plants will be with us by the end of the century.

---

draughtsman чертежник
to be lodged размещаться
scheduling график, планирование
stock сырье, заготовка
warehouse склад
keyboard клавиатура
screen экран
to keep track of следить за
terminal клемма, ввод или вывод
network сеть
to relay передавать
wire провод

After-Text Section

Practice 1. Опираясь на информацию текста, заполните следующие схему и таблицу.



2. Functions of the Main Elements of the Factory

Element	Function
design computer	controls how and which goods are made
production computer	
administration computer	
"seeing" robots	
transport mechanism	
warehouse	
communication network	

Text 2

Pre-Text Section

Practice 1. Прежде чем приступить к чтению текста, вспомните все, что знаете о гибких производственных системах.

Practice 2. Прочитайте текст и скажите, в каком из абзацев текста приводится уже известная вам информация.

Practice 3. Прочитайте текст еще раз и скажите, информацию по каким из приведенных ниже пунктов вы также нашли в тексте:

— принцип работы системы;
— описание отдельных узлов;
— основная отличительная особенность;
— преимущества;
— недостатки;
— области применения;
— принцип управления системой;
— сравнение с автоматической производственной ячейкой, с автоматической станочной линией.

Practice 4. Расположите отмеченные вами пункты в порядке следования информации в тексте.

One step on the road to the completely automated production was the development of production cells of machines controlled by other machines. Here, a "supervisor" computer could control up to ten to twenty computerized machines. With these systems there was less work for people. A separate operator for each machine-tool was no longer required. However, the production cells still needed people to feed instructions to the central computer. They required workers to load raw bits of metal and take off finished products.

Another step to organization of unmanned production is a flexible manufacturing system. This type of production system has appeared in the past few years. In this equipment, a central computer controls each separate machine-tool and also arranges for the blocks of metal being machined to travel from one machine-tool to another by some transport mechanism. The transport mechanism can vary. It can be a conveyer belt that carries parts around the system; it can be a sequence of robots that grab the components and place them in the relevant machine-tool at the appropriate moment.

The key factor of this system is its flexibility. Not only does the central computer tell the machines to perform a wide range of functions. It also directs the transport mechanism to carry parts round the system in a manner which the computer decides is the most efficient. Thus in a system comprising machines A to D, the central computer could ensure that a part due for a series of complex machining operations visits first A, then C, before going back to B and on to D. At each point in the system, the part would be machined in a different way until it becomes a finished product. The next component that enters the system could then travel in an entirely different sequence. Thus this method of making things differs from the inflexible automation of the transfer line, where there is no chance of varying the sequence in which parts travel through the system: it is A to B to C to D.

Operating of the new system is not too difficult. An engineer sits in a control room with a keyboard equipment terminal and probably 2 computers — one each to control the transport mechanism and the machine-tool themselves. He types into the terminal the details of the parts he wants made, and when is the time for making them. The job for scheduling the work between the various machines in the system is then left to the two computers.

Flexible systems around the world make anything from razors to parts for complicated machinery and turbine blades.

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production cell производственная ячейка
sequence последовательность
to grab захватывать
relevant/appropriate соответственный
to comprise включать в себя
transfer line автоматическая (станочная) линия

AFTER-TEXT SECTION

Practice 1. На основании полученной из текста информации
— скажите, в чем отличие гибкой производственной системы от автоматической станочной линии; от автоматической производственной ячейки;
— составьте схему управления гибкой системой.

Text 3

Pre-Text Section

Practice 1. Прежде чем прочитать текст, ответьте на следующий вопрос.

Do you think that robots can ever completely replace people at work?

Practice 2. Прочитайте текст и определите, подтверждает он или опровергает ваше мнение.

Robots — the Ideal Workers?

We hear many complaints about work in factories; the work is often boring, heavy and repetitive; the operative doesn't have to think about the work; he gets no job satisfaction.

The answer is a robot. For many jobs a robot is much better than human operative. Once it has been programmed, it will do its job over and over again. It never gets bored; it works at a constant speed; it doesn't make mistakes; its work is always of the same standard; it doesn't get tired; it can work 24 hours a day without breaks for food, rest or sleep.

Robots have other advantages, too. They can be designed to do almost any job. You can't change the human body, but a robot's arms, for example, can be made to move in any direction. Robots also can do very heavy work and they can operate in conditions that are too dangerous, too hot or too cold for people to work in. They can work under water, in poisonous gas and in radioactive areas.

It is obvious that robots have many advantages over human beings. However, it is also true that humans can do many things that robots can't. For example, humans can carry out a task without having to be told exactly how to do it first — in other words, they don't always

have to be programmed. Humans can move, but robots are usually fixed in one place. If they are able to move, robots can do it only in a very limited way. Unlike robots, people can know whether what they are doing is good or bad, and whether it is boring or interesting. Also robots are only just beginning to be able to understand speech and writing, but humans can communicate easily with each other by these methods, and by many others — telephone, drawing, radio, and so on — as well.

And we should not forget that robots owe their existence to humans — we make them, repair them and control them, not the other way round.

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complaint жалоба
the operative *зд.* рабочий
to owe one's existence быть обязанным своим существованием
the other way round наоборот

After-Text Section

Practice 1. На основании информации из текста заполните следующую таблицу.

Advantages of robots	Advantages of humans
They never get bored.	They don't have to be programmed.

Practice 2. Закончите текст, вставив в него слова из текста "Robots — the Ideal Workers?"

Robots are particularly useful for ... in places where ... would die. They don't ... air, so they can be useful in space or ... . Special ... have also been ... for handling ... raw materials. A number of industrial and military ... are also used to ... in ... gases. So in many ways robots mean that people do not have to ... in ... jobs. But, of course, ... are still needed to ... and repair the robots.

Text 4

Pre-Text Section

Practice 1. Переведите заглавие, предварительно прочитав 1-е предложение текста.

Practice 2. Предположите, о чем пойдет речь в тексте с таким заглавием.

Practice 3. Прочитайте текст с целью подтверждения правильности вашего предположения.

Practice 4. Достаточно ли точно отражает заглавие содержание текста? Какое из приведенных ниже заглавий вы выбрали бы?

Electronization
Electronics
Electronic Base of Flexible Production

Three "Pillars" of Flexible Poduction Systems

The three basic conditions for the development of flexible systems are technology, equipment and electronization. Electronization is extensive development and wide use of electronic equipment: computers at all levels, sensors, information transmission systems and so on. In flexible production a computer must play the role of organizer and guide. Before the appearance of microelectronics the greater part of labour productivity increment after automation was "devoured" by inspectors, record keepers and other workers dealing with routine operations. The more production was automated, the larger became the army of people specializing in these fields: parts had to be checked, counted. The management had to be promptly informed about the production process. The condition of machines and instruments had to be constantly checked. In flexible systems microelectronics must assume all these tasks. Our country has produced in large numbers big and small computers, microcomputers, numerical programmed control systems for machine-tools, presses and industrial robots. New designs of pickups, including sensors, are being developed.

The task is to increase two-three times the production of computers, and develop at high rates the production of facilities for automating the work of engineers, highly efficient small computers, personal computers, numerical programmed control systems for multifunctional machine-tools and flexible production modules, programmed master controllers. Thus, the electronic base of flexible production is developing rather dynamically in the USSR.

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guide руководитель
increment увеличение, возрастание
to devour пожирать, поглощать
to check проверять, контролировать
to assume принимать на себя
pickup датчик

After-Text Section

Practice 1. Вы ознакомились с содержанием текста. Скажите

— что входит в понятие «электронная база гибкого производства»;

— какова роль компьютера в автоматизированном производстве;

— какова роль микроэлектроники.

Подтвердите свой ответ ссылкой на текст.

Text 5

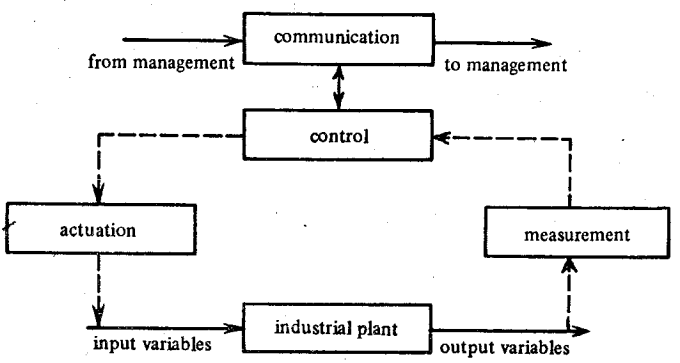
Pre-Text Section

Practice 1. Прочитайте текст и выполните следующие за ним задания.

Applications in the Process Industries

The first computer control system went on line in an industrial plant in 1959. Since then, there have been remarkable advances in processing and transmitting information electronically. Developments in the technology of digital hardware, software, basic sensors and all forms of communication offer the potential for industrial control systems that are highly automated and provide improved operating performance.

The earliest applications of computer control were in the process industries. The process industries are those which change the composition of materials to produce metals of higher value. Here automation is in some ways easier, and is fully developed. In process industries instruments are available to monitor the continuous flow of a product and to send the data to the computer, which can then direct changes in the process by adjusting valves and switches.



The elements of a control system are shown in the above figure. The important functions are measurement, control, actuation and communication. Measurement refers to the sensing of variables such as flow rate, temperature, pressure, level, and chemical composition, and the transmission of the measurement to the controller. Control is the decision-making operation. It compares the measured state of the process with the desired conditions and decides how the variables should be manipulated. Actuation is the means by which the operating variables are manipulated. Typical actuators are valves, rheostats, switches and relays. Communication includes the display of information to the plant operators as well as the transmission of important variables to the plant management.

The organization of a plant control system is comprised at different levels. The lowest level is occupied by the control computer that regulates a single process unit holding it to desired operating conditions and moving the unit to a safe condition in emergencies. The next step is a supervisory computer responsible for coordinating several units, for scheduling operations, and for optimizing the plant's performance. At the top level is the manager control computer, which supplies the manager with current information about manufacturing operations.

Improved communications are making it possible to use systems in which elements of control system are located throughout the plant and communicate with each other through networks. Communication over these networks is by a digital signal.

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instrument прибор, аппарат
to monitor контролировать
to adjust манипулировать
variables переменные величины
actuator исполнительный механизм
process unit технологическая установка
in emergencies при чрезвычайных обстоятельствах

After-Text Section

Practice 1. Опираясь на информацию текста, заполните следующие таблицы.

1. Elements of a Control System

element	function
...	senses the variables and sends the data to the controller
control element	...
actuation element	...
...	displays the information to the plant operators and transmits the variables to the plant management

2. Organization of a Plant Control System

computer	function
...	regulating the process and watching for system failures
...	optimizing and scheduling tasks
...	gathering and application of both process and business information for decision making

Text 6

Pre-Text Section

Practice 1. Прочитайте последний абзац текста. Предположите, какое содержание текста может предшествовать такому выводу.

Practice 2. Прочитайте текст. Подтвердились ли ваши предположения? Перечислите все предложения текста, на основании которых сделан вывод, приведенный в последнем абзаце.

Practice 3. Озаглавьте текст.

One of the industries in which automation has already established itself is steel-making. Those who have seen a steel mill will know something of the variety of processes, from the blast-furnace onwards, which are interlinked before the final rod or sheet appears on its way to an engineering shop or a motor-car factory. To make each of the departments in the mill fully efficient, you can control it by a computer, fed with

all the information required to operate it. In the case of the blast-furnace, the computer would need to be supplied with information about raw materials which go into the furnace, the temperatures at which the furnace works, and the best way of dealing with the various ingredients.

The operation of a steel plant is a complex and highly skilled operation, requiring a great deal of knowledge, a great deal of information and rapid decision-making, to make sure each manufacturing unit operates efficiently in relation to the next stage in the process. A computer can digest all this, make a very large number of intermediate decisions, and present the managers immediately and continuously with all the information to enable them to take the final decisions that are necessary to operate the plant at maximum efficiency.

Without automation, the manager makes decisions on the basis of very limited information and a great deal of experience. The computer-aided manager is in a completely different position. Before he gets it, and even before he needs it, the information is processed, all actions which can be decided by the computer already taken, giving him the essential facts, so that he sometimes is faced with one, two, or three basic choices. He still has to make his selection of these choices, but he knows what the choices are. Before he makes his final decision, he is very likely to ask the computer a question: "If I decided to do this instead of that, what will the consequences be?" And he knows of the consequences of his choices in advance, because the computer allows him to test them.

This automation does not replace human decisions on important issues. It makes sure that people who have to make these decisions have adequate information to work on. It is not a question of computers replacing men: it is a question of extending men's facilities by machines so that they become better, more competent men.

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steel mill металлургический завод
blast furnace доменная печь
to be interlinked быть взаимосвязанными
to digest усваивать, приводить в систему
intermediate промежуточный
experience опыт
choice выбор
consequences последствия
in advance заранее
adequate достаточный
to replace заменять
to extend facilities расширять возможности

After-Text Section

Practice 1. Расскажите о роли компьютера и человека в управлении автоматизированным производством, заполнив следующую таблицу.

computer	manager
1.	1.

Text 7

Pre-Text Section

Practice 1. Прочитайте текст и составьте его план.

Digital Computers and Their Uses

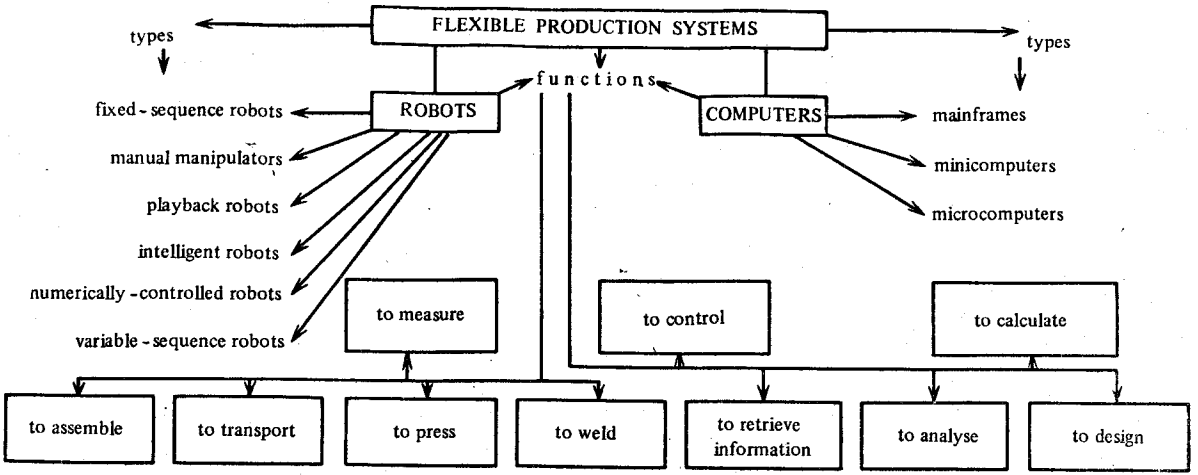
In the digital computer the numbers to be manipulated are represented by sequences of digits which are first recorded in suitable code — usually the binary code — and then converted into positive and negative electrical impulses, and stored in electrical or magnetic registers.

The technique of making the computer carry out calculations is known as "programming", which involves first breaking the calculation down into a sequence of arithmetic operations, and then preparing a series of instructions which make the computer carry out the required operations on the stored information, in the correct order. It is now possible to add or subtract two large numbers in one to two microseconds, and to multiply or divide them in ten to twenty microseconds.

There are many situations in which this ability to carry out and analyse large quantities of arithmetic data according to instructions is of great importance. Some examples are fields of scientific investigation such as crystallography, atomic physics and astronomy, where masses of experimental data are involved and complex theoretical concepts need to be tested against them; in engineering design where the design parametres, of which there are many, can be varied systematically and their effects studied and optimized; and for the storage of data in libraries.

A particular important application of the digital computer in simplified form is as a component in the

ДЕНОТАТНАЯ СХЕМА



control equipment of manufacturing processes — as the nerve centre which accumulates and analyses data recording the operating conditions and performances of the plant, and sends out instructions for their modifications. This is one aspect of what is called "automation" — the replacement of human control by instrumental control.

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number цифра
to record записывать
digit цифра (от 0 до 9)
calculation вычисление
in the correct order в нужной последовательности
to add складывать
to subtract вычитать
to multiply умножать
to divide делить
ability способность
concept понятие, представление

After-Text Section

Practice 1. Опираясь на информацию текста, дайте ответы на следующие вопросы.

1. What is a digital computer? 2. How does it work? 3. What are the possible uses of a digital computer?

ЛАБОРАТОРНЫЕ РАБОТЫ

Лабораторная работа № 1

ORAL TOPIC: ON SPECIALITY

1. Закончите ситуацию. Подтвердите, что данное высказывание справедливо и для вас. Прослушайте образец.

— I am most interested in tractor-making. And what about you?
— You see, I am also most interested in tractor-making.

А теперь выполняйте сами. Проверьте правильность своего ответа по ответу диктора. Повторите за диктором правильный ответ.

1. — I am most interested in auto-making research. And what about you?
   (— You see, I am also most interested in auto-making research.)
2. — I am most interested in engine designing. And what about you?
   (— You see, I am also most interested in engine designing.)
3. — I am most interested in tyre-building. And what about you?
   (— You see, I am also most interested in tyre-building.)
4. — I am most interested in fuel-equipment. And what about you?
   (— You see, I am also most interested in fuel-equipment.)
5. — I am most interested in auto-making. And what about you?
   (— You see, I am also most interested in auto-making.)

2. Прослушайте следующий диалог. Обратите внимание на выражение to be going to do something.

— Hello, Nick. Glad to see you. What are you going to do after lectures?

— I am going to go to the library.
— Are you going to study there?
— Yes, I am going to study physics. Let's go there together.
— With pleasure.

Прослушайте диалог еще раз. Переведите диалог. Проверьте свой перевод по переводу диктора.

— Здравствуй, Коля. Рад тебя видеть. Что ты собираешься делать после лекций?
— Я хочу пойти в библиотеку.
— Ты будешь там заниматься?
— Да, хочу позаниматься физикой. Пойдем вместе.
— С удовольствием.

3. Спросите диктора, собирается ли он сделать следующее. Прослушайте образец.

...to study tractor-making.
— Are you going to study tractor-making?

А теперь выполняйте сами. Проверьте правильность своего вопроса по ключу. Повторите за диктором правильный вопрос.

1. ...to study auto-making.
   (Are you going to study auto-making?)
2. ...to be an automobile engineer.
   (Are you going to be an automobile engineer?)
3. ...to work in the field of auto-making.
   (Are you going to work in the field of auto-making?)
4. ...to work at the Research Institute.
   (Are you going to work at the Research Institute?)
5. ...to design engines.
   (Are you going to design engines?)

4. Закончите ситуацию, сказав о том, что вы собираетесь сделать. Прослушайте образец.

— Do you study auto-making?
(to be an automobile engineer)
— Yes, I do. I am going to be an automobile engineer.

А теперь выполняйте сами. Проверьте правильность своего ответа по ответу диктора. Повторите за диктором правильный ответ.

1. — Do you study at MAMI?
   (to be an engineer)
   — Yes, I do. I am going to be an engineer.
2. — Do you study tractor-making?
   (to work at a tractor plant)
   — Yes, I do. I am going to work at a tractor plant.

3. — Do you work in the engine laboratory at the Institute?
(to investigate engine designing)
— Yes, I do. I am going to investigate engine designing.
4. — Do you investigate tractor engine designing there?
(to design new tractor engines)
— Yes, I do. I am going to design new tractor engines.

5. Прослушайте диалог. При повторном прослушивании повторите диалог за диктором. Обратите внимание на интонацию. Выучите диалог наизусть.

— Are you going to be an automobile engineer?
— You see, that was the idea when I came here, but I am most interested in tractor making now.

Контрольные упражнения

1. Расскажите о себе.
2. Расскажите о своих планах на будущее.
3. Расскажите о планах вашего товарища.
4. Воспроизведите диалог с вашим товарищем.

Лабораторная работа № 2

ORAL TOPIC: ON SPECIALITY

1. Прослушайте диктора. Диктор сообщит вам некоторые сведения о научно-исследовательской работе своего института. Эти сведения и будут темой вашей беседы с диктором.

I am an engineer. I work at the Research Institute. I'll tell you about scientific and engineering work at our Institute.

As you know, transport is one of the largest branches in the general system of the world economy. At present great progress is made in technical reequipment of automobile transport. Our Institute conducts research in this field. Our research is directed along the following three lines: increase of the weight, speed and frequency of movement of transport units. We also develop new types of vehicles, such as electromobiles, cars with magnetic suspension and electronic control systems and so on. In the near future these types of vehicles will he employed everywhere.

А теперь побеседуйте с диктором. Правильность своих ответов проверьте по ключу.

— And what about you? Are you an engineer too? (No, I am not.)
— You say, you are not an engineer. What are you then?
(I am a student.)
— I see, and where do you study?
(I study at MAMI.)
— Oh, glad to hear it. As my future colleague, I suppose you know the main trends in the auto-industry.
— Do you consider the technical reequipment of transport to be one of them?
(Of course, I do.)
— Can you tell me along what three lines it is made?
(It is made along the following three lines: increase of the weight, speed and frequency of movement of transport units.)
— You are right. Increase of the weight, speed and frequency of movement of transport units are three lines along which the technical reequipment is made. And what types of vehicles do you think will be employed in the near future?
(I think, electromobiles and cars with magnetic suspension and electronic control systems will be widely used in the near future.)
— I quite agree with you. Electromobiles and cars with magnetic suspension and electronic control systems are types of vehicles which will be widely used in the future.

2. Прослушайте еще один диалог на эту же тему. Постарайтесь запомнить его.

— Where do you work?
— I work at the Research Institute.
— What problem do you work at?
— We work at the problem of technical reequipment of autotransport.
— Along what lines do you conduct your research?
— We direct our research in the following three lines: increase of the weight, speed and frequency of movement of transport units.
— What types of vehicles do you develop?
— We develop new types of vehicles.

— How do you imagine cars of future?
— I think they will be electromobiles and cars with electronic control systems.

Прослушайте диалог еще раз и повторите его за диктором.

Контрольные упражнения

1. Воспроизведите этот диалог со своим товарищем.
2. Расскажите, над чем работает ваш товарищ.
3. Уточните проблему, над которой вы работаете.
4. Расскажите о работе одного из научно-исследовательских институтов.

Лабораторная работа № 3

ORAL TOPIC: ON RESEARCH

В лабораторной работе № 2 работник одного из научно-исследовательских институтов автомобильной промышленности рассказал вам об исследовательской работе, проводимой институтом. Прослушайте несколько кратких диалогов двух коллег.

Диалог № 1

— Doctor B., you are working on the problem of *manufacturing a new less toxic engine.* It would be useful for us both to discuss some experimental details.
— Very glad to meet you. Your latest results are interesting.

1. Прослушайте диалог еще раз и запомните его.
2. А теперь воспроизведите этот диалог со своим товарищем, изменив проблему, над которой работает тов. В. Используйте при этом одно из следующих слов и словосочетаний.

air pollution, automation, specialization

Диалог № 2

— At present we are conducting research in *two new fuel systems.*
— I am sure both systems are reliable in operation.

Прослушайте диалог еще раз и запомните его. Воспроизведите диалог со своим товарищем, изменив область исследования. Используйте при этом одно из следующих слов и словосочетаний.

safety devices, suspension systems, transmission

Диалог № 3

— How are *the measurements* made? I am interested in some technical points.
— *The measurements* are made on a special stand. The data of *the measurements* are put into the electronic computer.

Прослушайте диалог еще раз и запомните его. Воспроизведите диалог со своим товарищем, изменив предмет обсуждения. Используйте при этом одно из следующих слов.

the experiments, the tests, the check-ups, the trials

А теперь прослушайте полный вариант диалога. Постарайтесь запомнить его.

— Doctor B., may I introduce myself? My name is A. As far as I know, you are working on the problem of manufacturing a new less toxic engine. Our group is studying a similar problem. I think it would be useful for us both to discuss some experimental details.
— Very glad to meet you. Your latest results are interesting.
— At present we are conducting research in new fuel equipment. We use two different systems. Since one of the systems employs the latest developments in electronics, it has certain advantages.
— I am sure both systems are reliable in operation but how are the measurements made? I am interested in some technical points of your testing.
— The measurements are made on a special stand. The data of the measurements are put into the electronic computer.

Контрольные упражнения

1. Воспроизведите диалог со своим товарищем.
2. Расскажите об исследованиях, проводимых тов. А.
3. Расскажите о проблеме, над которой вы работаете (работали, будете работать).
4. Расспросите своего товарища о проблеме, над которой он работает (работал, будет работать).

Лабораторная работа № 4

ORAL TOPIC: ON RESEARCH

1. Прослушайте диктора. Он расскажет о научно-исследовательской работе, проводимой студентами института. Эти сведения и будут темой вашей беседы с диктором.

I am a student of the Moscow Automechanical Institute. I am going to tell you about scientific and engineering work at our Institute.

As you know, there is cooperation between industry and education. The higher schools serve the needs of industry by training well-qualified engineers. That's why students must participate in scientific and research work at higher schools. Our Institute trains engineers for the automobile industry. In order to be better prepared for work in industry we carry on research work in different students' groups and societies. We carry on research work under professors and teachers of our Institute. Professors and teachers help us to develop our abilities in a certain field of engineering or science. We have many labs with modern equipment at our Institute where we can conduct scientific research. After receiving diplomas we can actively participate in basic and applied research.

2. Прослушайте диалог диктора с одним из студентов института. Постарайтесь запомнить его.

— As I have already told you, I study at MAMI. Do you study at the same Institute?
— Yes, I do.
— Glad to hear it. After graduating from the Institute I am going to be an engineer. And what about you?
— I am going to be an engineer, too.
— I see. You are also going to be an engineer. I think knowledge of mathematics, stress analysis, economics, mechanical and electrical engineering will be necessary in your future work. Do you agree with me?
— I quite agree with you.
— I see. But, as you know, theory must be supported by practice. That's why students of our Institute are engaged in practical work. Will you also be engaged in practical work during summer vacations?
— Yes, I shall.

— That's right. And your work in laboratories and drawing offices will also help you to improve your knowledge. Can you improve your knowledge by working there?
— I think I can.
— I quite agree with you. And in order to be better prepared for work in industry students must carry on research work. Mustn't they?
— Of course, they must.
— They must and they do it in different students' groups and societies under professors and teachers of our Institute. Your studies, practical and research work will help you to become a well-qualified specialist. And even when you receive your diploma you mustn't finish your education. Will you continue your education?
— Yes, I shall.
— You say you will. That's very good. Good luck to you.

3. Воспроизведите этот диалог с диктором, взяв на себя роль студента.

Контрольные упражнения

1. Расскажите о подготовке высококвалифицированных инженеров в вашем институте.
2. Расскажите о вашей учебе в институте.
3. Расскажите о студенческой научно-исследовательской работе.
4. Расскажите о связи промышленности с институтом.
5. Расспросите своего товарища о научно-исследовательской работе, проводимой в институте.

Лабораторная работа № 5

ORAL TOPIC: THE ENGINEER AND PRODUCTION

1. Составьте с помощью диктора несколько кратких диалогов, которые могут возникнуть между двумя инженерами в процессе производства. а) Прослушайте предложение. Спросите, закончено ли уже действие. Прослушайте образец.

Диктор: We are discussing the new technique.
Студент: Have you discussed it *already*?

А теперь выполняйте. Проверьте правильность своих вопросов и ответов по вопросам и ответам диктора.

1. We are conducting an experiment.
(Have you conducted it already?)

2. We are developing a new process.
   (Have you developed it already?)
3. We are designing a new engine.
   (Have you designed it already?)
4. We are testing the new equipment.
   (Have you tested it already?)

b) Прослушайте вопрос и ответьте на него отрицательно, усилив отрицание наречием never. Прослушайте образец.

Диктор: Have you *ever* visited this autoplant?
Студент: I have *never* visited this autoplant.

А теперь выполняйте. Проверьте правильность своих ответов по ответам диктора.

1. Have you ever seen testing grounds?
   (I have never seen testing grounds.)
2. Have you ever assembled engines?
   (I have never assembled engines.)
3. Have you ever performed rig tests?
   (I have never performed rig tests.)
4. Have you ever designed turbines?
   (I have never designed turbines.)
5. Have you ever tested cars?
   (I have never tested cars.)

c) Прослушайте вопрос и ответьте, что действие (намерение) только что было выполнено. Прослушайте образец.

Диктор: Are you going to complete the experiment?
Студент: I have *just* completed it.

А теперь выполняйте. Проверьте правильность своих ответов по ответам диктора.

1. Are you going to apply the new method?
   (I have just applied it.)
2. Are you going to alter this process?
   (I have just altered it.)
3. Are you going to order this material?
   (I have just ordered it.)
4. Are you going to study this problem?
   (I have just studied it.)
5. Are you going to prove this theory?
   (I have just proved it.)

d) Прослушайте вопрос и ответьте на него отрицательно. Прослушайте образец.

Диктор: Has the problem been studied already?
Студент: No, it has not yet. The problem has not been studied yet.

А теперь выполняйте. Проверьте правильность своих ответов по ответам диктора.

1. — Has the research been completed already?
   (— No, it has not yet.
   — The research has not been completed yet.)
2. — Has the data been obtained already?
   (— No, it has not yet.
   — The data has not been obtained yet.)
3. — Has the new engine been investigated already?
   (— No, it has not yet.
   — The new engine has not been investigated yet.)
4. — Has the new programme been launched already?
   (— No, it has not yet.
   — The new programme has not been launched yet.)
5. — Has the new technique been employed already?
   (— No, it has not yet.
   — The new technique has not been employed yet.)

Контрольные задания

Составьте диалог о лабораторной работе, которую вы выполняли на этой неделе или в этом месяце.

Лабораторная работа № 6

ORAL TOPIC: THE ENGINEER AND NEW MATERIALS

1. С помощью диктора составьте краткие диалоги о роли и функциях современного инженера на производстве.

а) Скажите, что входило бы в функции вашего товарища, если бы он был инженером-технологом. Прослушайте образец.

Диктор: ...to know changes in material technology.
Студент: He would know changes in material technology.

А теперь выполняйте. Правильность своего высказывания проверьте по высказыванию диктора.

1. ...to know new trends in technology
   (He would know new trends in technology.)
2. ...to study composite materials
   (He would study composite materials.)
3. ...to utilize new processes.
   (He would utilize new processes.)
4. ...to develop new techniques.
   (He would develop new techniques.)

b) Скажите, что бы сделали вы, если бы вы отвечали за производственный процесс. Прослушайте образец.

Диктор: ...to plan routing of the materials.
Студент: I should plan routing of the materials.

А теперь выполняйте. Проверьте правильность своего высказывания по высказыванию диктора.

1. ...to conceive the idea
   (I should conceive the idea.)
2. ...to make drawings
   (I should make drawings.)
3. ...to order materials
   (I should order materials.)
4. ...to design tools
   (I should design tools.)

c) Прослушайте вопрос диктора и ответьте на него. Прослушайте образец.

Диктор: What would you do at the plant if you were a production engineer?
(...to plan smooth flow of materials)
Студент: If I were a production engineer, I should plan smooth flow of materials.

А теперь выполняйте. Проверьте правильность своего высказывания по высказыванию диктора.

1.— What would you do if you were a research engineer?
(...to conceive ideas)
(— If I were a research engineer I should conceive ideas.)
2.— What would you do if you were a design engineer?
(...to make drawings)
(— If I were a design engineer I should make drawings.)
3.— What would you do if you were a planning engineer?
(...to order materials)
(— If I were a planning engineer I should order materials.)
4.— What would you do if you were a tool engineer?
(...to design tools)
(— If I were a tool engineer I should design tools.)

2. С помощью диктора составьте краткие диалоги, которые могут возникнуть между двумя инженерами на производстве. а) Спросите у диктора, выполнено ли действие (получен ли положительный результат). Прослушайте образец.

Диктор: If we had not used new technological processes we shouldn't have achieved good results.
Студент: Have you achieved good results?

А теперь выполняйте. Проверьте правильность своего вопроса по вопросу диктора.

1.— If superconductivity had not been discovered we shouldn't have produced superconductive alloys today.
(— Have you produced superconductive alloys?)
2.— If highly durable metal alloys had not been developed we shouldn't have manufactured modern rockets today.
(— Have you manufactured modern rockets?)
3.— If successful development in electronics had not been achieved we shouldn't have applied a broad scale of automation now.
(— Have you applied a broad scale of automation?)
4.— If materials technology had not been changed we shouldn't have designed such perfected machines.
(— Have you designed perfected machines?)

b) Прослушайте предложение и переделайте его, выразив желательность действия. Прослушайте образец.

Диктор: I shall experiment with plastics.
Студент: I should experiment with plastics.

А теперь выполняйте. Проверьте правильность своего предложения по предложению диктора.

1. I shall use ceramics for producing tools.
(I should use ceramics for producing tools.)
2. I shall study thermal conductivity of carbon.
(I should study thermal conductivity of carbon.)
3. I shall introduce a new finishing process.
(I should introduce a new finishing process.)
4. I shall use powder metallurgy technique for manufacturing complex components.
(I should use powder metallurgy technique for manufacturing complex components.)

Контрольные задания

Поговорите с товарищем о роли и функциях инженера-технолога.

ТЕКСТЫ ДЛЯ АУДИРОВАНИЯ

Текст для аудирования № 1

1. Прослушайте сообщение и заполните таблицу.

	Weight	Height	Number
Tyres			
Truck			

Trucks are getting larger and so do the tyres that move them. Weighing almost four tons and standing nearly 35 metres high, this tyre was built for a 200-ton truck. The truck has six such tyres.

2. Уточните свою запись, прослушав сообщение еще раз.

Текст для аудирования № 2

1. Прослушайте сообщение и скажите: кто, по словам Эйнштейна, делает открытия?

How New Inventions Are Made?

"How are new inventions that change the face of the world made?" somebody asked the great scientist Albert Einstein. "Quite simply," answered the scientist. "Everybody knows that something is impossible. And there is always a man who does not know it and he makes the invention."

2. Прослушайте сообщение еще раз и проверьте, правильно ли понят ответ ученого.

Текст для аудирования № 3

1. Прослушайте сообщение и дайте ответ на вопрос "How old is the wheel?"

How Old Is the Wheel?

Nobody knows the name of the person who invented the wheel. But it is possible to date the invention. Archaeologists found the oldest wheeled carriage in the world in Mesopotamia — it is 5,500 years old. And recently, Soviet archaeologists found parts of a wooden wheel in the Crimea, which is 4,500 years old. The expedition has found several other wheels belonging to different epochs.

2. Прослушайте еще раз и сообщите дополнительные сведения о колесе.

Текст для аудирования № 4

1. Прослушайте сообщение, фиксируя внимание на следующем:

а) какую продукцию выпускают предприятия г. Риги, столицы Латвии;
б) предприятие ВЭФ и его продукция.

VEF, Latvia's Largest Industry

Riga is a major industrial centre of Latvia. The city's enterprises produce a great variety of goods — electric trains, mini-buses, diesels, farm machinery, electric equipment, textiles and all sorts of other goods. However, Riga's most important industry are the radios and radiotechnics made by VEF and the Radioteknika factory.

VEF is Latvia's largest industry. The enterprise is almost a town in itself, with its own streets and parks. Its workshops with the very latest equipment stand on really extensive grounds. The VEF trademark is well-known all over the USSR and in the countries to which the radios are exported.

VEF is not that young an enterprise — it is over 50 years old. It started as a few small electrical-engineering workshops, but began to develop apace after Soviet power was formed in Latvia in 1940. The enterprise has specialized in radio and telephone equipment.

From the second half of the 60s, VEF have produced transistor radios.

The elegant, reliable, easy to use radios are well-known all over the world. They have been shown at many international exhibitions and have won many prizes. One in four is exported.

2. Прослушайте сообщение еще раз и ответьте как можно полнее на поставленные вопросы.

Текст для аудирования № 5

1. Прослушайте сообщение и постарайтесь понять его содержание.

Plastics

Plastics are substances, which can be formed into any shape by the application of heat and pressure.

Plastics are usually produced by synthesis from such natural materials as water, air, coal, salt and natural gas. The technology is simple and cheap. Because many materials are available and many different combinations

are possible, the family of plastics is very large and is growing larger from day to day. They all are different in properties, characteristics and application. Their lightness, strength, hardness, chemical resistance and other useful properties make it possible to use plastics in large quantities in electric and electronic equipment, house construction, transportation, agriculture, corrosion-resistant applications.

There is no industry now where plastics are not used. Scientists in different countries are looking for new plastics and new fields of their application. Plastics really have a great future.

2. Прослушайте сообщение еще раз и отметьте в тетрадях предложения, которые соответствуют содержанию текста, знаком (+) и знаком (—) те, которые не соответствуют содержанию текста.

1. Plastics are substances which have no future. 2. They are synthesized from water, air, coal, salt and gas. 3. The technology of their production is complex. 4. Plastics are very much the same in properties, characteristics and application. 5. Their properties such as strength, lightness, hardness and chemical resistance determine their wide application everywhere.

Текст для аудирования № 6

1. Прослушайте сообщение и постарайтесь понять, о каком открытии идет речь. Запомните следующие слова.

a semiconductor полупроводник, glass стекло, under exposure to light под воздействием света

Soviet scientists have discovered that a certain type of glass possesses semiconducting properties. This glass has been used to develop a new class of semiconductors which has valuable features: reliability, durable storage capacity, resistance to radiation and the possibility of it being used as photoconductors — materials which change their electrical properties under exposure to light.

2. Прослушайте сообщение еще раз и расскажите на русском языке о новом открытии советских ученых.

Текст для аудирования № 7

1. Прослушайте сообщение и постарайтесь понять его содержание. Запомните следующие слова.

diamond ['daɪəmənd] алмаз, synthesize ['sɪnθɪsaɪz] синтезировать, below ниже, germanium [dʒə:'mænɪəm]

and silicon ['sɪlɪkən] химические элементы — германий и кремний

Diamonds from Gas

For the first time in the world the Soviet Union has synthesized diamonds from gas. The technology is simple and cheap. The diamonds are synthesized at below atmospheric pressure and at a very low temperature. The application of gas-made diamonds in the machining of such hard materials as germanium and silicon has shown that the new material is of high technical and economic efficiency.

2. Прослушайте сообщение еще раз и запишите его содержание на русском языке.

ТЕСТЫ

Тест по грамматике № 1

1. Выберите нужную форму вспомогательного глагола.

1. This plant ... reconstructed only 5 years ago. (will be, is, does, was) 2. Our country ... produce many more automobiles in 10 years. (does, is, will, shall) 3. These new problems ... not much worked at now. (will be, are, do, were)

2. Закончите предложения, выбрав правильный порядок слов.

a) We have ...
   1. in our country many factories at present.
   2. in our country at present many factories.
   3. many factories in our country at present.
   4. at present in our country many factories.

b) Students visited ...
   1. at the plant all the laboratories yesterday.
   2. all the laboratories at the plant yesterday.
   3. yesterday at the plant all the laboratories.
   4. all the laboratories yesterday at the plant.

3. Подберите нужный английский эквивалент.

1.— Are there ... scientific research institutes in Kiev?
— Yes, there are many.
(some, no, any)
2. The students didn't have ... lectures on physics last year.
(some, no, any)

4. Отметьте предложения, в которых нужно употребить пассив при переводе.

1. Открытие электрона было очень важной вехой в науке. 2. Новая модель этого автомобиля будет выпущена в 2000 году. 3. Много лет инженеры работали над созданием этого аппарата. 4. На патент этого изобретателя очень часто ссылаются в технической литературе. 5. В этой работе рассматривали свойства электрона.

5. Отметьте английские предложения, эквивалентные данным русским предложениям.

a) В нашей стране много специализированных заводов.
1. Our country will have many specialized plants.
2. There were many specialized plants in our country.
3. There are many specialized plants in our country.
4. Many specialized plants are in our country.

b) В середине XX века появилось много новых отраслей техники.
1. In the middle of the 20th century there were many new branches of engineering.
2. In the middle of the 20th century there appear many new branches of engineering.
3. Many new branches of engineering will appear in the middle of the 20th century.
4. In the middle of the 20th century there appeared many new branches of engineering.

6. Отметьте вопрос, ответом на который может служить следующее.

a) Yes, it will.
1. When will city traffic undergo changes?
2. Did city traffic undergo changes?
3. What undergoes changes?
4. Will city traffic undergo changes?

b) It was created more than 70 years ago.
1. What was created in our country?
2. Where was automobile industry created?
3. When will automobile industry be created?
4. When was automobile industry created in our country?

7. Отметьте правильные вопросы к данному предложению.

We shall achieve the reliability of this new design in a few years.
1. What did we achieve?
2. When shall we achieve the reliability of this new design?

3. Do we achieve the reliability of this new design?
4. What shall we achieve in a few years?
5. Shall we achieve the reliability of this new design in a few years?

8. Отметьте правильные ответы к поставленному вопросу.

Who developed the automobile theory and provided the basic formulas of auto designing?
1. Academician E. A. Chudakov did.
2. N. R. Brilling did.
3. Our engineers develop the automobile theory and provide the basic formulas of auto designing.
4. They will develop the automobile theory and provide the basic formulas of auto designing.

9. Найдите русское предложение, при переводе которого надо употребить глагол does.

1. Кто работает над этой проблемой? 2. Этот завод будет производить в два раза больше автомобилей через 5 лет. 3. Когда обычно начинается лекция по химии? 4. Эта лаборатория не занималась конструированием новых моделей автобусов. 5. Используется ли новый тип двигателя на этих автомобилях?

10. Найдите русское предложение, при переводе которого надо употребить глагол do.

1. Кто разработал эту проблему? 2. Производство двигателей на этом заводе в прошлом году значительно увеличилось. 3. Когда вы обычно работаете в лаборатории? 4. Кто испытывает этот двигатель? 5. Где испытывают этот двигатель?

Тест по грамматике № 2

1. Выберите нужную форму глагола.

1. All the achievements of modern science ... in modern production processes now. (will be used, are being used, will use, were used) 2. When I came in he ... an article on internal combustion engine. (read, reads, was read, was reading) 3. Scientific information ... very rapidly at present. (will grow, is growing, is being grown)

2. Выберите вариант, соответствующий выделенному слову в предложении.

1. Что ты здесь *делаешь?* (do, were doing, are doing, did) 2. Он пришел в лабораторию, когда *испытывался*

новый тип карбюратора. (was tested, tested, was being tested, is being tested) 3. В последнее время этот вопрос широко обсуждался в литературе, а сейчас *готовится* научная программа экспериментальных исследований. (prepares, is prepared, is preparing, is being prepared)

3. Какие из следующих прилагательных образуют степени сравнения при помощи слов more и most?

short, specific, speedy, powerful, efficient, great, practical

4. Выберите нужную форму степени сравнения прилагательных для следующих предложений.

1. The Likhachev Motor Works is ... than the Volzhsky Motor Works. (older, old, oldest) 2. The report on new fuel equipment was ... of all. (interesting, more interesting, the most interesting)

5. Какой из английских эквивалентов будет соответствовать выделенной русской конструкции?

1. Эта подвеска *совсем не такая тяжелая, как* та. (not so heavy as, as heavy as, not so quite heavy as) 2. Топливное оборудование автомобиля *такое же сложное, как* электрооборудование. (not so complicated as, as complicated as, almost as complicated as)

6. Отметьте английские предложения, эквивалентные данному русскому предложению.

Наша лаборатория в два раза больше вашей.

1. Our laboratory is two times larger than yours.
2. Our laboratory is 15 years older than yours.
3. Our laboratory is twice as large as yours.
4. Our laboratory is not so large as yours.

7. Подберите нужное английское слово.

1. The ... you study the deeper is your knowledge. (much, more, most) 2. The more the students read English the ... they speak. (good, better, best)

8. Подберите подходящий английский эквивалент.

1. The engineer had (мало) work to do that day. (small, little, few, a few) 2. We must have (много) knowledge to operate this device. (many, more, much, most) 3. I can speak English (немного). (few, a few, little, a little)

9. Какое слово-заменитель можно употребить вместо выделенного английского слова?

1. This method is more efficient than *the method* of engineer Petrov. (that, those, one, ones) 2. These machines are more powerful than *the machines* operating in our shop. (ones, those, that, one) 3. This method is highly efficient, but that *method* is even better. (that, ones, one, those)

10. Подберите соответствующие эквиваленты.
a) Какой глагол выражает умение?

must, may, can, to be (to), to be allowed (to), to have (to)

b) Какой глагол выражает долженствование?

can, must, may, to be allowed (to), to be (to)

c) Найдите эквиваленты глагола must.

to be able (to), to be allowed (to), to have (to), to be (to), to be obliged (to)

d) Найдите эквиваленты глагола may.

to be able (to), to be allowed (to), to be (to), to have (to), to be obliged (to)

e) В каком случае глагол to be выражает долженствование?

1. These experiments are of great importance. 2. These experiments are to help us in our work. 3. The students are conducting an experiment now.

f) В каком случае глагол to have выражает долженствование?

1. We shall have a meeting tomorrow. 2. They have already finished the experiment. 3. This student will have to make a report about his work.

Тест по грамматике № 3

1. Определите, в каком случае глагол to have является вспомогательным для образования формы Perfect.

a) 1. We have many laboratory tests this year. 2. We have made many laboratory tests this year. 3. We have to make many laboratory tests this year.

b) 1. Old automobiles had no amenities for drivers. 2. He had already finished his experiment when we came. 3. He had to repeat his experiment once more last week.

2. Определите, в каком случае говорится о законченном действии.

a) 1. He is collecting the necessary material. 2. He has to collect the necessary material. 3. He has already col-

lected the necessary material. 4. He will collect the necessary material.

b) 1. I was finishing the experiment. 2. I have finished the experiment. 3. I shall finish the experiment. 4. I have to finish the experiment.

3. Выберите нужный эквивалент для предложения.

a) Our engineers have improved this new method of work.

1. Наши инженеры улучшат этот новый метод работы.

2. Наши инженеры улучшили этот новый метод работы.

3. Наши инженеры улучшают этот новый метод работы.

4. Наши инженеры должны улучшать этот новый метод работы.

b) By 1972 the total number of automobiles in all countries had exceeded 250,000,000.

1. В 1972 году общее количество автомобилей во всех странах превысило 250 000 000.

2. К 1972 году общее количество автомобилей во всех странах превышало 250 000 000.

3. К 1972 году общее количество автомобилей во всех странах должно было превысить 250 000 000.

c) Modern factories of the machine-building industry have been recently constructed in this area.

1. В этом районе были построены за последнее время современные заводы машиностроительной промышленности.

2. Этот район за последнее время построил современные заводы машиностроительной промышленности.

3. В этом районе за последнее время строятся современные заводы машиностроительной промышленности.

4. Вставьте нужный формальный показатель.

1. Our industry has greatly developed ... the time of the World War II. (already, this year, since, never, ever) 2. I have ... been to England. (to-day, ever, this morning, for, never)

5. Выберите нужную форму вспомогательного глагола.

1. All means of production ... been recently expanded in our country. (were, will, had, have) 2. By 1968 he ... graduated from the Institute. (was, has, have, had)

6. Выберите предложение, при переводе которого употребляется форма Perfect.

a) 1. В 1928 году в Советском государстве был построен 841 автомобиль. 2. К концу первой пятилетки Советское государство построило 23 800 автомобилей. 3. Дореволюционная Россия выпустила только 10 пассажирских автомобилей.

b) 1. Я уже видел этот прибор на выставке. 2. Я увижу этот прибор на выставке скоро. 3. Я видел этот прибор на выставке в прошлом году.

c) 1. Новая установка будет испытана в следующем году. 2. Новую установку испытают к концу года. 3. Новая установка проходит сейчас испытания.

7. Определите предложение, содержащее глагол в сослагательном наклонении.

1. If he comes he will complete this experiment. 2. If he came he would complete this experiment. 3. He said that he would complete this experiment if he came.

8. Какое предложение выражает нереальное действие, которое могло бы произойти в прошлом?

1. He had done it before we came. 2. He would have done it then. 3. He said that he would have done it then. 4. He did it is last week.

9. Какой из союзов укажет, что далее последует отрицательный вывод?

1. so that; 2. lest; 3. in order that

10. В каком случае нельзя будет использовать компьютер как машину-переводчик?

They changed the design of the computer...

1. ...so that it should be used as a translating machine. 2. ...lest it should be used as a translating machine.

11. Вставьте подходящий союз.

1. Everybody knows ... chemistry is closely connected with the progress of the world. (what, how, that, why, if) 2. It is interesting to know ... discovery was discussed at the last conference. (what, whose, when, that, who)

12. Какой союз употребляется при переводе предложений:

1. Мы еще не решили, отправится ли экспедиция завтра. (that, when, how, if, why) 2. Я не был уверен, имеется ли этот справочник в нашей библиотеке. (how, if, what, when, that)

13. Определите, где можно опустить союз без изменения значения предложения.

1. The chemical elements which constitute the matter are made up of atoms. 2. The atom which scientists considered indivisible is a structure of very small particles. 3. The atom is a kind of solar system which consists of the nucleus and electrons. 4. The electrons which carry negative charges move in orbits round the nucleus.

14. Определите, в каких из следующих предложений в русском переводе перед союзом придаточного предложения надо поставить предлог.

1. The particles the nucleus is made up of are called "protons" and "neutrons". 2. The atom which is spoken of as neutral has equal negative and positive charges. 3. The atom whose nucleus has one proton and one electron is that of hydrogen. 4. The electron is a particle that carries a negative charge of electricity.

15. Найдите предложения с определительными придаточными предложениями.

1. An atom is a kind of solar system where electrons move in orbits round the nucleus. 2. A neutron has a property which allows it to penetrate all. 3. We know the number of protons in the nucleus of an element determines its atomic number.

16. Выделите союз, указывающий, что вводимое им предложение
a) объясняет причину.

1. whether; 2. after; 3. because

b) ставит условие.

1. provided; 2. in order that; 3. before

c) указывает на следствие.

1. that; 2. that's why; 3. which

d) указывает на цель.

1. how; 2. in order that; 3. since

e) содержит оговорку или предостережение.

1. whom; 2. though; 3. after

f) указывает на сопутствующее действие.

1. while; 2. why; 3. how

17. Укажите союзы, выпадающие из ряда:
a) для выражения условия.

1. if; 2. provided; 3. unless; 4. that

b) для выражения цели.

1. in order that; 2. so that; 3. as; 4. lest

c) для выражения времени.

1. while; 2. though; 3. as soon as; 4. as long as

d) для выражения причины.

1. as; 2. since; 3. until; 4. because

18. Закончите предложения.

a) She wanted to know (будет ли продолжен опыт).
   1. why the experiment would continue.
   2. whether the experiment would continue.
   3. whether the experiment will continue.

b) Radium is very expensive (так как он встречается чрезвычайно редко).
   1. whether it is very rare.
   2. since it is very rare.
   3. provided it is very rare.

c) A car can move as quickly as a train (при условии, если он имеет мощный двигатель).
   1. as it has a powerful engine.
   2. unless it has a powerful engine.
   3. provided it has a powerful engine.

d) (То, что ядро несет положительный электрический заряд,) is certain.
   1. That the nucleus carries a positive electrical charge...
   2. Provided the nucleus carries a positive electrical charge...
   3. Since the nucleus carries a positive electrical charge...

19. Найдите русский эквивалент английскому предложению.

Everybody knew how closely chemistry was connected with the progress of science.

1. Все знали, как тесно химия связана с прогрессом науки.
2. Все знают, как тесно химия связана с прогрессом науки.
3. Все знали, как тесно химия была связана с прогрессом науки.

20. Найдите английский эквивалент русскому предложению.

Он сказал, что будет работать на заводе после окончания института.

1. He says he will work at the plant after graduating from the Institute.
2. He said he would work at the plant after graduating from the Institute.
3. He says he will have to work at the plant after graduating from the Institute.

ПРИЛОЖЕНИЯ

Приложение 1

Частотные суффиксы (Suffixes)

N-Suffixes		
Suffix	Meaning	Examples
-ance	state	performance
-ence	quality of	independence
-er, -or	a person who / a thing which	programmer, operator / compiler, accumulator
-ation, -tion	the act of	execution
-ist, -yst	a person who	analyst, typist
-ness	condition of	cleanliness
-ion	action/state	conversion
-ing	activity	multiplexing
-ment	state, action	measurement
-ity	state, quality	electricity
-ian	pertaining to	electrician
-ism	condition/state	magnetism
-dom	domain/condition	freedom
-ship	condition/state	relationship, partnership, friendship
-ary		binary

V-Suffixes		
Suffix	Meaning	Examples
-ize, -ate, -fy, -en	to make	computerize / automate, activate, calculate / simplify / harden, widen

Adv-Suffixes		
Suffix	Meaning	Examples
-ly	in the manner of	electronically, logically, comparably, helpfully
-wards	in the direction of	downwards, forwards

Adj-Suffixes		
Suffix	Meaning	Examples
-al **-ar** **-ic** **-ical**	have the quality of	computational, logical circular magnetic, automatic electrical
-able **-ible**	capable of being	comparable divisible
-ous **-ious**	like, full of	dangerous religious
-ful	characterized by	helpful
-less	without	careless
-ish	like	yellowish
-ed	having	computed, punched
-ive	quality of	interactive
-ing	to make or do	programming, coding, processing, multiplexing

Частотные префиксы (Prefixes)

Negative and positive	Size	Location	Time and order	Number
un- **non-** **dis-** **in-** **re-**	**semi-** **mini-** **micro-**	**inter-** **super-** **trans-** **ex-** **extra-** **mid-**	**pre-** **ante-** **fore-** **post-**	**mono-** **bi-** **hex-** **oct-** **multi-**

Negative and positive prefixes			
	Prefix	Meaning	Examples
Negative	**un-** **in-** **im-** **il-** **ir-**	not, not good enough	unmagnetized, unpunched incomplete impossible illegal irregular, irrelevant
	non-	not connected with	non-programmable non-impact
	mis-	bad, wrong	mispronounce
	dis-	opposite feeling opposite action	disagree disconnect
	anti-	against	antisocial
	de-	reduce, reverse	demagnetize, decode
	under-	too little	underestimate
Positive	**re-**	do again	reorganize
	over-	too much	overheat

Prefixes of size		
Prefix	Meaning	Examples
semi-	half, partly	semiconductor
equi-	equal	equidistant
maxi-	big	maxicomputer
micro-	small	microcomputer
mini-	little	minicomputer
macro-	large	macroeconomics
mega-		megabyte

Prefixes of location		
Prefix	Meaning	Examples
inter-	between, among	interface, interactive
super-	over	supersonic
trans-	across	transmit, transfer
ex-	out	exclude, extrinsic
extra-	beyond	extraordinary
sub-	under	subschema
infra-	below	infra-red
peri-	around	peripheral

Prefixes of time and order		
Prefix	Meaning	Examples
ante-, **pre-**	before	antecedent prefix
prime-	first	primary, primitive
post-	after	postdated
retro-	backward	retroactive

Prefixes of number		
Prefix	Meaning	Examples
semi-	half	semicircle
mono-	one	monochromatic
bi-	two	binary
tri-	three	triangle
quad-	four	quadruple
penta-	five	pentagon
hex-	six	hexadecimal
septem-	seven	septuagenarian
oct-	eight	octal
dec-	ten	decimal
multi-	many	multiprogramming, multiplexor

Other prefixes		
pro-	for	program
auto-	self	automatic
co-	together	coordinate
neo-	new	neoclassical
pan-	all	pan-Asian

Приложение II

Меры измерений (Units of Measurement)

Length:

1 inch	= 25.4 millimetres	1 mm	= 0.04 in
0.016 in	= 0.4 mm	1 cm	= 0.4 in
0.001 in	= 0.025 mm	1 m	= 3.3 ft (1.1 yd)
1 foot	= 0.3 metres	1 km	= 0.62 miles
1 yard	= 0.9 m		
1 mile	= 1.6 km		

Area:

1 sq. inch	= 6.45 cm^2	1 mm^2	= 0.0015 in^2
1 sq. foot	= 0.09 m^2	1 cm^2	= 0.155 in^2
1 sq. yard	= 0.84 m^2	1 m^2	= 10.8 ft^2
1 sq. mile	= 2.6 km^2	1 km^2	= 0.4 sq. miles

Volume:

1 cubic inch	= 16.4 cm^3	1 cm^3	= 0.06 in^3
1 cubic foot	= 0.03 m^3	1 m^3	= 35.3 ft^3
1 cubic yard	= 0.8 m^3		

Capacity:

1 pint	= 0.57 litres	1 litre	= 0.22 gallons (GB)
1 quart	= 1.14 litres		= 0.26 gallons (US)
1 gallon (GB)	= 4.6 litres		
1 gallon (US)	= 3.8 litres		

Mass:

1 ounce (oz)	= 28.3 grams	1 kg	= 0.04 oz
1 pound (lb)	= 0.45 kg	1 kg	= 2.2 lbs
1 hundredweight	= 50.8 kg	1 tonne	= 0.98 tons
1 ton	= 1016 kg		

Density:

1 lb/in^3	= 27.7 g/cm^3	1 kg/m^3	= 0.06 lb/ft^3
1 lb/ft^3	= 16.02 kg/m^3		

Acceleration:

1 ft/s^2	= 0.3 m/s^2	1 m/s^2	= 3.3 ft/s^2

Torque:

1 lb ft	= 1.36 newton metres	1 Nm	= 0.74 lb ft

Pressure and Stress:

1 p.s.i. (lb/in^2)	= 6900 N/m^2	1 N/m^2	= $145*10^6$ p.s.i.

Energy:

1 British thermal unit (B.t.u.)	= 1.05 kilojoules (kJ)
1 therm	= 105.5 megajoules (MJ)
1 kilowatt hour (kWh)	= 3.6 MJ
1 calorie	= 4.2 J

Power:

1 horsepower (hp)	= 746 watts (W)
1 metric horsepower	= 736 W

Правила чтения некоторых математических символов

Дробные числительные (Fractional Numerals)

Простые дроби (Common Fractions). Числитель выражается количественным (three, ten, thirty-six и т. д.), а знаменатель — порядковым числительным (third, tenth, thirty-sixth и т. д.). Если числитель больше единицы, то знаменатель принимает окончание множественного числа "s".

$\frac{1}{2}$	a half; one half
$\frac{1}{3}$	a third; one third
$\frac{1}{4}$	a) a quarter; one quarter b) a fourth; one fourth
$\frac{1}{10}$	a tenth; one tenth
$\frac{1}{100}$	a (one) hundredth
$\frac{1}{1000}$	a (one) thousandth
$\frac{1}{1234}$	a (one) thousand two hundred and thirty-fourth
$\frac{3}{4}$	a) three fourths b) three quarters
$2\frac{1}{2}$	two and a half
$4\frac{1}{3}$	four and a third
$125\frac{3}{4}$	a (one) hundred and twenty-five and three-fourths (three quarters)

Десятичные дроби (Decimal Fractions)

В десятичных дробях целое число отделяется от дроби точкой, называемой point. Каждая цифра читается отдельно. «Ноль целых» может совсем не ставиться и не читаться или читаться одним из следующих трех способов: o [ou], nought [nɔ:t], zero ['ziərou].

0.1 .1	1) o point one 2) nought point one 3) zero point one 4) point one
0.01 .01	1) o point o one 2) nought point nought one 3) zero point zero one 4) point nought one 5) point zero one
0.25 .25	1) nought point two five 2) point two five

2.35	two point three five
45.67	1) four five point six seven 2) forty-five point six seven
0.001 .001	1) o point o o one 2) nought point nought nought one 3) zero point zero zero one 4) point nought nought one 5) point two oes one

Отдельные знаки, выражения и уравнения

+	plus (sign of addition), positive
−	minus (sign of subtraction), negative
± (∓)	plus or minus (minus or plus)
×	times by (multiplication sign)
·	multiplied by
:	sign of division; colon; ratios sign; divided by
=	sign of equality
( )	1) round brackets 2) parantheses
[ ]	1) square brackets 2) brackets
{ }	braces
Σ	sigma ['sɪgmə], summation of
a=b	1) a equals b 2) a is equal to b 3) a is b
a≠b	a is not equal to b; a is not b
a±b	a plus or minus b
a≈b	a approximately equals b
a>b	a is greater than b
a<b	a is less than b
x=∞	x approaches infinity
a⩾b	a is equal to or greater than b
1×1=1	once one is one
2×2=4	twice two is four
6×5=30	six times five or 6 multiplied by 5 is (equals; is equal to; are; makes; make) thirty
30=6×5	thirty is five times as large as six
s=vt	1) s equals (is equal to) v multiplied by t 2) s equals v times t
1:2	the ratio of one to two
12:3=4	1) 12 divided by 3 equals 4 2) 12 divided by 3 is 4
20:5=16:4	1) the ratio of 20 to 5 equals the ratio of 16 to 4 2) 20 is to 5 as 16 is to 4
$v=\frac{s}{t}$	1) v equals s divided by t 3) v is s over t
a+b=c	a plus b { is; are; equals; is equal to } c
7+3<12	7 plus 3 is less than 12
12>7+3	12 is greater than 7 plus 3
c−b=a	c minus b { is; equals; is } a (b from c) { equal to; leaves }

$72-16=56$	72 minus 16 { is; equals; is equal to; leaves } 56 (16 from 72)
x^2	1) x square; x squared 2) x to the second power 3) the square of x 4) the second power of x
$5^2=25$	1) the second power of 5 is 25 2) 5 square is 25 3) 5 to the second power is equal to 25 4) the square of 5 is 25
y^3	1) y cubed; y cube 2) y to the third power 3) the cube of y 4) y to the third
z^{-10}	1) z to the minus tenth 2) z to the minus tenth power
$\sqrt{4}=\pm 2$	the square root of 4 is (equals) plus or minus 2
$\sqrt{a}$	the square root of a
$\sqrt[3]{a}$	the cube root of a
$\sqrt[5]{a^2}$	the fifth root of a square
a'	a prime
a''	1) a second prime 2) a double prime
a_1	a first
a_2	a second
a_m	a m-th; a sub m
R_a	R a-th; R sub a
f'_c	f c-th prime; f sub c prime
a'_1	a first prime
a''_2	a second prime
$\frac{d_z}{d_x}$	first derivative of z with respect to x
$\frac{d_z^2}{d_x^2}$	second derivative of z with respect to x
$y=f(x)$	y is a function of x
$a=\frac{v_1-v}{t}$	a equals (is equal to), line of division (dash) v sub t minus v divided by (over) t

Проценты

% pct or p.c.	per cent
‰	per mille
2 % 2 p.c.	two per cent
5 ‰	five per mille
$\frac{3}{8}$ %	1) three eighth per cent 2) three eighths of one per cent

$\frac{1}{2}$ %	1) a half per cent 2) a half of one per cent
0.3 %	1) point three per cent 2) nought point three per cent 3) zero point three of one per cent

Примечание: Cent и mille во множественном числе не принимают окончания s.

Именованные числа

$\frac{2}{3}$ ton	two thirds of a ton
$\frac{1}{2}$ ton	half a ton (перед half нет артикля, перед ton отсутствует of)
$\frac{3}{4}$ km	three quarters of a kilometer
.75	point seven five of a kilometer
1.75	one point seven five kilometers
13 lbs, 13 lb	thirteen pounds
$1\frac{1}{2}$ hrs; $1\frac{1}{2}$ hr	1) one and a half hours 2) one (an) hour and a half
$2\frac{1}{3}$ lbs, $2\frac{1}{3}$ lb	1) two and a third pound 2) two pounds and a third
60 mi/hr	sixty miles per hour
$\frac{240\ km}{4\ hr}$	240 kilometers per 4 hours
6 ft/sec	6 feet per second
1 ft/sec	1 foot per second
74 cu. yd./hr	74 cubic yards per hour
31 m.p.h.	31 miles per hour
40 h./p.; 40 HP	40 horse power
kg/cm^2	kilogram per square centimeter
k/sq. in.	kip per square inch (1000 pounds per square inch)
20°	twenty degrees
6′	1) 6 minutes 2) 6 feet
10″	1) 10 seconds 2) 10 inches
0 °C	zero degrees Centigrade (Celsius)
100 °C	one (a) hundred degrees Centigrade
32 °F	thirty-two degrees Fahrenheit
200 r.p.m.	two hundred revolutions per minute