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# АНГЛИЙСКИЙ ДЛЯ ТЕХНИЧЕСКИХ ВУЗОВ

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Учебное пособие соответствует программе по английскому языку для технических вузов. Первая часть охватывает повторительный курс фонетики, основные тематические разделы. В нее включен повторительный курс грамматики, ряд закрепительных упражнений.

Вторая часть содержит основные разделы: металлы и металлообработка, пластмассы и композитные материалы, станки и оборудование, сварка, автоматизация и робототехника, компьютерные технологии.

Предназначено для студентов технических вузов. Может быть использовано студентами колледжей и для самостоятельного обучения.



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## Содержание

## От автора

Задача, поставленная перед нами практической преподавательской деятельностью была очень непростой — нужно было создать универсальное учебное пособие для студентов ***всех*** технических ВУЗов. Но единой «технической» специальности не существует. Спектр технических специальностей настолько разнообразен, что единственным способом определить круг студентов (читательскую аудиторию) является отбросить все нетехнические специальности — гуманитарные.

Кроме того, студенты-«технари» на старших курсах приобретают специальности, уникальные для своего региона и нужд местной промышленности. Для того, чтобы сделать учебник максимально универсальным, мы разбили книгу на две части.

Тематический текст (являющийся также и полно изложенной устной темой) составляет основу каждого из девяти уроков первой, общей части. В первой, общей части, предназначенной для студентов всех технических специальностей, предлагаются обязательные вузовские темы: About myself (О себе), My working day (Мой рабочий день), My Academy (Мой ВУЗ), цикл страноведческих тем — Great Britain, London, USA, Transport Industry, Russian Federation, Moscow, My Home Town.

Каждый из девяти уроков первой части состоит из трех частей, логически и методически связанных между собой: так называемой ***фонетической зарядки***

(*phonetical warm-up*) — повторения правил чтения и корректировочных упражнений по произношению, базового текста с тематическим словарем и упражнениями на проверку понимания и навыков извлечения информации, устными и дискуссионными упражнениями на закрепление материала. Второй текст урока предназначен для классного и внеаудиторного чтения и развития навыков работы со словарем и передачи содержания на английском языке. Урок завершается блоком кратко изложенной грамматики по обязательным разделам и закрепляющими упражнениями.

Вторая часть учебника предназначена для аудиторных и внеаудиторных занятий по английскому языку на втором-третьем курсе. Она представляет собой самостоятельное, структурно независимое пособие для развития навыков чтения, извлечения и обработки информации по специальности. В целях универсализации пособия каждый из девяти уроков самостоятелен. При составлении мы исходили из общефилософского принципа «от общего к частному», логически переходя от более общих тем — материаловедение (металлы, сплавы, пластмассы) к более специализированным разделам (сварка, автоматика и робототехника, автотехника). Завершают книгу уроки «Компьютеры» и «Современные компьютерные технологии», подводящие итог научно-техническому развитию. Они актуальны для студентов всех технических специальностей.

Все тексты, использованные во второй части являются оригинальными. Некоторая сложность их обусловлена установкой автора на их неадаптированный, оригинальный характер.

Третьей частью данного пособия является Reader (тексты для дополнительного чтения). Он содержит





восемнадцать тематических текстов и отрывков по различным аспектам технических специальностей. Приложения (Appendix A, B, C) завершают учебник, предоставляя студентам и преподавателям богатый справочный материал.

Good luck!

**Условные обозначения:**

🗣 — упражнения для устной работы в аудитории

🕮 — опорные (базовые) тексты для аудиторного чтения и обсуждения

— дополнительные тексты для чтения и перевода

— дискуссионные упражнения

— дополнительный словарь

— письменные упражнения

# Вводный урок

**I. Краткая история английского языка.**
**II. Особенности фонетического строя (произношения).**
**III. Транскрипционные знаки, алфавит.**

Историю английского языка принято делить на три периода:

1) Англо-саксонский, или староанглийский (Old English), — приблизительно до 1150 г.;

2) Среднеанглийский (Middle English) — приблизительно от 1150 до 1500 г.;

3) Современный английский (Modern English) — язык последних четырех столетий.

Староанглийский язык был языком близким к немецкому языку и обладал такой же сложной системой грамматических форм, как и современный немецкий язык.

Староанглийский язык имел ряд грамматических форм имен существительных. Он имел три рода имен существительных — мужской, женский и средний, мало связанных со значением слова. Так, существительное *hand—рука* было женского рода, *fot — нога* — мужского рода, *wif — женщина* — среднего рода и т. д.

Имена существительные имели четыре падежа, причем падежные окончания были очень разнообразны, в зависимости от рода существительного и окончания его основы. Прилагательные согласовались с существительными в роде, числе и падеже.





Спряжение глагола было основано на целом ряде форм, причем глагол изменялся и по числам, и по лицам и имел для этого специальные окончания, сохранившиеся и в среднеанглийском языке (*I love, thou lovest, we loven* — настоящее время; *I lovede, thou lovedest, we loveden*— прошедшее время и т. д.).

Система спряжения английского глагола была отлична от современной. Сослагательное наклонение (Subjunctive Mood) занимало особое место, имело свои особые формы и играло в староанглийском языке такую же важную роль, какую оно и до сих пор играет в немецком языке. Глагольные времена и другие формы образовывались главным образом путем изменения самого глагола, а не при помощи вспомогательных глаголов, как сейчас. Все времена группы Continuous, начав образовываться в течение среднеанглийского периода, укрепились в языке только к XVII столетию, а некоторые формы, как, например, Present Continuous Passive Voice — *The house is being built* — еще позднее.

Вспомогательный глагол *do* употреблялся сначала лишь как основной глагол, с XVI столетия просто как усилитель значения основного глагола и до XVII столетия не служил специальным признаком вопросительной и отрицательной форм глагола в Present и Past Indefinite, каким он служит в современном языке. Эта специальная функция укрепилась за ним только с XVII столетия.

С течением времени в ходе развития и под влиянием ряда языков, проникавших в Англию вместе с наводнявшими ее римлянами, датчанами, норманофранцузами, структура английского языка сильно

изменилась. Большинство грамматических форм отпадало постепенно: исчезло склонение существительных, исчезла форма рода, прилагательное стало неизменяемой частью речи. Все изменение глагола свелось к четырем формам: исчезло большинство форм сослагательного наклонения. Вместе с тем система глагольных времен усложнилась и развилась. Благодаря широкому использованию вспомогательных глаголов стало возможным выражать тонкие оттенки отношений ко времени, степени и характеру совершения действия (Continuous и Perfect Tenses).

В результате этих изменений современный английский язык превратился в язык с очень малым количеством форм словоизменения. Те отношения между словами, которые в других языках, например в русском или немецком, выражаются формами отдельных слов (падеж, форма лица, форма рода и т. д.), в современном английском языке выражаются или порядком слов в предложении, или несамостоятельными словами (предлогами, вспомогательными глаголами).

Изменением в формах слов в современном английском языке выражаются следующие явления:

1) Множественное число существительных;

2) Притяжательный падеж (Possessive Case) существительных, обозначающих живые существа, местоимений *one* и местоимений *somebody, anybody, everybody*;

3) Именительный и косвенный падежи личных местоимений (Nominative Case, Objective Case);

4) Множественное число местоимений *this, that, ne, other*;





5) Именительный, косвенный и притяжательный падежи местоимения *who (who, whom, whose)*;

6) Четыре основные формы глагола: первая — инфинитив, настоящее время, повелительное наклонение; вторая — прошедшее время; третья — причастие прошедшего времени и часть Perfect Tenses; четвертая — причастие настоящего времени, герундий и часть Continuous;

7) Форма 3-го лица единственного числа настоящего времени изъявительного наклонения.

В остальных случаях отношения между словами в современном английском языке выражаются так называемыми аналитическими формами, включающими в себя различные несамостоятельные слова — предлоги, союзы, вспомогательные глаголы, артикли и т. д. Большинство временных форм глагола, форм залога и наклонения образуются при помощи вспомогательных глаголов. Предлоги в ряде случаев передают падежные отношения. В большом количестве случаев отношения между членами предложения в современном английском языке выражаются их местом в предложении; очень часто смысл высказывания становится ясным лишь благодаря твердому, закрепленному порядку слов в предложении. Это особенно важно потому, что из-за отсутствия формальных окончаний и словоизменений и наличия лишь небольшого количества характерных для определенной части речи суффиксов одно и то же слово в английском языке может служить разными частями речи. Выяснить подлинное значение такого слова можно по его месту в предложении, т. е. по его синтаксической функции можно определить, какая это часть речи. Например:

***I light the candle. Я зажигаю свечу.***

В этом примере слово *light* стоит непосредственно за подлежащим, следовательно это сказуемое, т. е. глагол в личной форме.

### Звуки и письмо

В результате сложного исторического развития данного языка и системы его письменности возникло значительное рассогласование между графическим образом (написанием) слова и его звуковым составом (произношением), что привело к системе специальной записи звукового образа слова — фонетической транскрипции. Транскрипционные значки звуков пишутся раздельно и заключаются в квадратные скобки.

В английском алфавите имеется 20 согласных и 6 гласных букв. Однако некоторые согласные имеют двойное чтение, сочетания двух согласных могут передавать один согласный звук, а 6 гласных букв передают 20 гласных звуков в зависимости от положения гласной в слове (ударное или неударное) и от типа слога (открытый или закрытый). Поэтому для успешного изучения языка были разработаны типичные для современного английского языка правила звуко-буквенных соответствий, при помощи которых можно прочесть наибольшее количество слов.

Трудность английского языка, а при правильном изучении и легкость его, заключаются в том, что исключениями из этих правил чаще всего являются самые употребительные слова, которые быстро запоминаются в силу их частого употребления.

Следует помнить три основных правила произношения английских слов:





**1. Краткость или долгота гласных звуков в русском языке не влияет на смысл слова. В английском же языке долгота или краткость произнесенного гласного звука меняет смысл слова. Так, [ʃip] — корабль, а [ʃi:p] — овца.**

**2. В отличие от русского языка в английском языке согласные звуки не оглушаются в конце слова. Оглушение согласных отражается на смысле слова. Например: [bæg] — сумка, [bæk] — спина.**

**3. Гласная буква *e* в конце слова не читается. Чтение гласной буквы в английском языке зависит от ее положения в слове (ударное или неударное) и от типа слога (открытый или закрытый).**

Открытым называется слог, оканчивающийся на гласную букву. Например: he, she, dai-ly. Закрытым называется слог, оканчивающийся на согласную букву. Например: pen, pencil. Кроме того, в английском языке имеются слова с нечитаемой конечной гласной буквой ***e***, которые графически являются двусложными, а звуковой образ такого слова является односложным. Такой слог называется условно-открытым: make [meik], Pete [pi:t], mine [main].

В ударном положении гласная буква читается по одному из типов слога, а в безударном положении звук ослабляется в направлении к нейтральному звуку. Например: data ['deitə].

В ударном открытом и условно-открытом типе слога все гласные имеют алфавитное чтение. Например: be [bi:] (открытый слог), eve [i:v] (условно-открытый). Алфавитное чтение гласная сохраняет и тогда, когда за ней следует другая гласная ***e*** или ***a***: beam, sea, etc.

## Транскрипционные знаки

**а) гласные**

[i:] — долгий ***и***
[ɪ] — краткий, открытый ***и***
[e] — ***э*** в словах *этот, экий*
[æ] — более открытый, чем ***э***
[ɑ:] — долгий, глубокий ***а***
[ɔ] — краткий, открытый ***о***
[ɔ:] — долгий ***о***
[o] — закрытый, близкий к ***у*** звук ***о***
[u] — краткий ***у*** со слабым округлением губ
[u:] — долгий ***у*** без сильного округления губ
[ʌ] — краткий гласный, приближающийся к русскому ***а*** в словах *варить, бранить*
[ə] — безударный гласный, напоминающий русский безударный гласный в словах: *нужен, молоток*
[ə:] — в русском отсутствует, средний между долгим ***о*** и ***э***

**б) двугласные (дифтонги)**

| | |
|---|---|
| [ei] — эй | [ɔi] — ой |
| [ou] — оу | [iə] — иа |
| [ai] — ай | [ɛə] — эа |
| [au] — ау | [uə] — уа |

**в) согласные**

[p] — п
[b] — б
[m] — м
[w] — звук, образующийся с положением губ, как при б, но с маленьким отверстием между губами, как при свисте
[f] — ф
[v] — в





[θ] (без голоса) } оба звука образуются при помощи языка, кончик которого помещается между передними зубами как в шепелявом русском з
[ð] (с голосом) }
[s] — ***с***
[z] — ***з***
[t] — ***т***, произнесенное не у зубов, а у десен
[d] — ***д***, произнесенное не у зубов, а у десен
[n] — ***н***
[l] — ***л***
[r] — звук произносится без вибрации кончика языка в отличие от русского ***р***
[ʃ] — мягкий русский ***ш***
[ʒ] — мягкий русский ***ж*** в слове *вожжи*
[tʃ] — ***ч***, более сильный, чем в русском
[ʤ] — озвонченный ***ч***
[k] — ***к***
[g] — ***г***
[ŋ] — заднеязычный ***н***, произнесенный задней частью спинки языка
[h] — простой выдох
[j] — ***й***

## English alphabet
(Английский алфавит)

| Буква | Название | Буква | Название |
|---|---|---|---|
| A a | [ei] | N n | [en] |
| B b | [ bi:] | O o | [ou] |
| C c | [si:] | P p | [pi:] |
| D d | [di:] | Q q | [kju:] |
| E e | [i:] | R r | [a:] |
| F f | [ef] | S s | [es] |
| G g | [ʤi:] | T t | [ti:] |
| H h | [eitʃ] | U u | [ ju:] |
| I i | [ai] | V v | [vi:] |
| J j | [ʤei] | W w | [ˊdʌblju:] |
| K k | [ kei] | X x | [eks] |
| L l | [el] | Y y | [wai] |
| M m | [em] | Z z | [zed] |

# Part I

# UNIT 1
## ABOUT MYSELF

I. Гласные звуки [i], [i:].
II. Text A: «About myself»,
Text B: «My Biography».
III. Личные местоимения, определенный и неопределенный артикль, множественное число существительных.

### Phonetic warm-up
### (Фонетическая разминка)

**Гласный звук [i]** При произнесении краткого гласного звука [i] кончик языка находится у основания нижних зубов: оттенок русского звука [*и*] в словах *шить, шило* практически совпадает с английским [i]: **it, sit, in**

**Гласный звук [i:]** При произнесении долгого гласного [i:] язык продвинут вперед, кончик языка касается нижних зубов, губы несколько растянуты и слегка обнажают зубы. Оттенок русского звука [*и*] в словах ***ива, иго, игры, избы*** практически совпадает с английским звуком [i:].

Сочетания ***ee, ea*** — читаются [i:]. Например, ***meet, peat.***

Долгота звука влияет на лексическое значение слова.

Например: **feet** (ноги) — **fit** (вмещаться), **steel** (сталь) — **still** (все еще)





**Exercise A**
lead — lid
if — it — tip — kit
did — bill
mill — meal
pill — peel
keel — kill
sit — seat

**Exercise B**
did — deed
pit — peat
fit — feet
it — eat
lid — lead

**Exercise C**
bin — bean
beat — bin
sit — seat
steel — still
feel — fill — feet
fit — eat — bean
simple — Pete — feel — peel
meet — meat — ill — bill — steel — feel

**Exercise D**
Be — been — bean
me — meet — meat
see — seat — seed
meal — seal — mean
pea — Pete — peat
sea — see — meet
bee — been — feet
mean — lean — keen

**Exercise E**

I see a sea. I see a clean sheet. I eat meat. I like meat.

I like tea. I make tea. I take tea. I like fine tea. I like fine meals.

People make steel. People make fine steel. People make steel pipes. People make fine steel planes. I like life. I like kind people. I like kind smiles. I feel fine. I smile.

## Text A: «ABOUT MYSELF»

Hello, friends. Let me first **introduce** myself. My name is Ann or Anya for my friends. My surname or last name is Sokolova. I was born on the 2nd of October in Sochi, Krasnodarsky Krai. This is the most beautiful city in Russia situated on the **Black Sea coast**. Now I am a **first-year student** at the Technical Academy. In five years I'll be an engineer.

Now let me describe my **appearance**. I am tall and **slim** and have fair hair and blue eyes. My friends say that I am pretty. I think I am just good-looking. I love sports and music. I was very serious about a **career** in **gymnastics** when I was in the 5th form. But then I broke my arm and doctors didn't let me go in for gymnastics. I love to listen to modern music and dance. I dance a lot and I hope I am good at it. I also love swimming. I always swim in the Black sea when I visit my parents, my dear family.

I would like to tell you about my family. There are five people in our family. My father's name is Vladimir Stepanovich. He is a **mathematician** by education and businessman by profession. My mother's name is Tatyana Petrovna. She is a **housewife**. She has much work about the house because I have a younger sister. She is a pupil. My sister Natasha is in the fifth form. My grandmother,





my mother's mother, lives with us. She is very **kind** and helps us **a lot**.

Our family is very friendly, we have many friends. In summer many relatives come to visit us. And, of course, they use a **chance** to spend **several** weeks in beautiful Sochi.

In May I have finished school No 5 in Sochi. I did well in all the subjects but my favourite subjects at school were Physics and Computer Science. I also enjoyed English lessons.

I am very interested in learning English because I always wanted to become a programmer or maybe a businesswoman. I also think that the knowledge of foreign languages helps in everyday life and career.

Two years ago I travelled much around Europe. I have visited **France, Germany, Belgium, the Netherlands** and **the United Kingdom**. There the knowledge of English helped me a lot.

As you see, my biography isn't very long yet. But we'll meet again in the next lesson and I'll tell you more about myself. See you later...

*Vocabulary:*

**introduce** [ɪntrə'dju:s] — представлять, знакомить
**Black Sea coast** [kəust] — побережье Черного моря
**a first-year student** — студент(ка) первого курса
**region** ['ri:ʤən] — область
**appearance** [ə'pɪərəns] — внешность
**slim** — стройная
**career** [kə'rɪə] — карьера
**gymnastics** [ʤɪm'næstɪks] — гимнастика
**mathematician** [mæθəmə'tɪʃən] — математик
**housewife** ['hauswaɪf] — домохозяйка
**several** ['sɛvərl] — несколько
**to do well** — зд. успевать

**chance** [ʧɑ:ns] — случай, шанс
**kind** — добрый
**a lot** — много
**the Netherlands** — Нидерланды
**the United Kingdom** — Соединенное Королевство (Великобритания)

*ADD TO YOUR ACTIVE VOCABULARY (Пополни свой активный словарь):*

**tall** [tɔ:l] — высокий
**short** [ʃɔ:t] — маленького роста
**stout** [staut] — приземистый, коренастый
**slim** — стройный
**fat** [fæt] — толстый
**plumpy** [plʌmpɪ] — полный
**fair hair** [fɛə´hɛə´] — светлые волосы
**blonde** [blɔnd] — блондин(ка)
**brunette** [bru:´nɛt] — брюнет(ка)
**gray hair** — седые волосы
**bold headed** [bəuld] — лысый
**short sighted** — близорукий
**smart, clever, bright** — умный (я)
**stupid** [´stju:pɪd] — тупой, глупый
**boring** — скучный
**fun to be with** — веселый человек
**easy to go along** — легкий в общении
**quiet** [´kwaɪət] — спокойный
**impulsive** [ɪm´pʌlsɪv] — порывистый, импульсивный
**aggressive** [ə´grɛsɪv] — агрессивный
**rude** [ru:d] — невежливый, грубый
**shy** [ʃaɪ], **confused** [kən´fju:zd] — застенчивый
**active** [´æktɪv] — активный
**talkative** [´tɔ:kətɪv] — разговорчивый
**enthusiastic** [ɪnθu:zɪ´æstɪk] — энтузиаст, затейник





***Exercise 1.1.*** **Please, introduce yourself. The questions below will certainly help you:**

1. What is your name?
2. Where and when were you born?
3. How old are you?
5. Have you got a family?
6. How many people are there in your family?
7. Do you have brothers, sisters, grandparents in your family?
8. Where do you live?
9. Did you study well at school?
10. What school did you finish?
11. Did your teacher of English help you to choose your future profession?
12. What was your favourite subject?
13. What do you like to read?
14. What sport do you go in for?
15. What are you going to be?
16. Do you still live with your parents?
17. Do you have a girlfriend / boyfriend?

**Exercise 1.2. Bring a picture of a person you know well (mother, father, grandfather, friend) to class. Show it and describe that person. Use the active vocabulary of the unit.**

## Text B: «MY BIOGRAPHY»

*after Mark Twain*

I was born on the 30-th of November 1835 in the village of Florida, Missouri. My father was John Marshal Clemens.

According to tradition some of my great-great parents were pirates and slave traders — a respectable trade in

the 16-th century. In my time I wished to be a pirate myself.

Florida contained a hundred people and when I was born I increased the population by one per cent. It had two streets and a lot of lanes. Both the streets and the lanes were **paved** [peɪv] (мостить) with the same material — black mud in wet times, deep dust in dry. Most of the houses were of wood — there were none of brick and none of stone. Everywhere around were fields and woods.

My uncle was a farmer. I have never met a better man than he was. He was a middle-aged man whose head was clear and whose heart was honest and simple. I stayed at his house for three months every year till I was thirteen years old. Nowhere else was I happier than at his house. He had eight children and owned about fourteen Negro slaves whom he had bought from other farmers. My uncle and everyone on the farm treated the slaves kindly. All the Negroes on the farm were friends of ours and with those of our own age we were playmates. Since my childhood I have learned to like the black race and admire some of its fine qualities. In my school days nobody told me that it was wrong to sell and buy people. It is only much later that I realized all the horror of slavery.

The country school was three miles from my uncle's farm. It stood in a forest and could take in about twenty five boys and girls. We attended school once or twice a week. I was a **sickly** ['sɪklɪ] (хилый) child and lived mainly on medicine the first seven years of my life.

When I was twelve years old my father died. After my father's death our family was left penniless. I was taken from school at once and placed in the office of a local newspaper as printer's **apprentice** [ə'prentɪs] (подмастерье) where I could receive board and clothes but no money.





For ten years I worked in printshops of various cities. I started my journalistic life as a reporter on a newspaper in San-Francisco. It was then that I began to sign my publications by my penname Mark Twain.

*General understanding:*

1. In what state was Samuel Clemens born?
2. What were the great-great parents of Mark Twain?
3. What did Mark Twain want to be?
4. What were the streets and lanes of Florida paved with?
5. How does the author describe his uncle?
6. How many slaves did Mark Twain's uncle own?
7. What was the author's attitude toward slavery?
8. Was Mark Twain a healthy boy?
9. When did the author start his career of a writer?

## GRAMMAR

**Неопределенный и определенный артикли.**

Неопределенный артикль **a (an)** происходит от числительного one (один), определенный — от указательного местоимения **that** (тот).

**Артикль употребляется:**

— перед каждым нарицательным существительным.

Если перед существительным артикль не употребляется, то нужно уметь объяснить, почему.

**Артикль не употребляется** если перед существительным стоит:

- указательное или притяжательное местоимение,
- другое существительное в притяжательном падеже,
- количественное числительное,
- отрицание ***no***.

Например: ***This is my book. It's friend's book. I have one book.***

Упоминая предмет впервые, мы употребляем перед ним неопределенный артикль ***a(an)***. Упоминая этот же предмет вторично, мы ставим перед ним определенный артикль ***the***. Например: ***This is a book. The book is interesting.***

**Неопределенный артикль a (an)**

употребляется перед ***единичным, отдельным*** предметом, который мы не выделяем из класса ему подобных. Неопределенный артикль ***an*** обычно стоит перед существительным, которое начинается с гласного звука: ***an apple, an egg.***

Например: ***I bought a book yesterday.*** Я купил вчера книгу (одну из многих ей подобных). ***I have an apple.*** У меня есть яблоко (одно, какое-то).

Неопределенный артикль ***a (an)*** может употребляться только с исчисляемыми существительными, стоящими в единственном числе. Перед неисчисляемыми существительными или существительными во множественном числе неопределенный артикль опускается.

**Неопределенный артикль не употребляется:**

а) с неисчисляемыми и «абстрактными» существительными:

***I like coffee and tea. Friendship is very important in our life.***

б) с существительными во множественном числе:

***They are students now.***

в) с именами собственными:

***I told Jane about that.***

г) с существительными, перед которыми стоят притяжательные или указательные местоимения:





***This car is better than that. My bike is old.***

д) с существительными, за которыми следует количественное числительное, обозначающее номер:

***I have read page eight of the magazine.***

Неопределенный артикль ***a*** необходим в конструкциях:

I have a... This is a... I am a... What a fine day!

I see a... There is a... He is a...

**Определенный артикль *the*** выделяет предмет или предметы из класса им подобных:

***The book I bought yesterday was interesting*** — Книга, которую я купил вчера, была интересной (это — конкретная книга, которую говорящий выделяет из класса ей подобных).

Определенный артикль ***the*** употребляется как с исчисляемыми, так и с неисчисляемыми существительными, как с единственным, так и с множественным числом.

Например: ***This is a book. The book is interesting*** (исчисляемое в единственном числе).

***This is meat. The meat is fresh.*** (неисчисляемое)

***These are books. The books are good.*** (множественное число).

**Определенный артикль употребляется:**

а) когда известно (из контекста, из окружающей обстановки) о каком предмете (предметах, явлениях) идет речь: ***Open the door, please. I am going to the Academy.***

б) когда речь идет о единственном в своем роде предмете или явлении: ***The moon is shining brightly.***

в) когда существительное имеет ограничивающее определение, чаще всего с предлогом of.

***I don't know the name of this pupil.***

г) в словосочетаниях типа ***in the north, to the west, at the cinema, the same, in the country, the rest of the ...***

д) если перед существительным стоит прилагательное в превосходной степени

***This is the most interesting book.***

е) перед порядковыми числительными

***He lives on the fifth floor.***

### Географические названия и артикль

С географическими названиями и с именами собственными, артикль, как правило, не употребляется, кроме следующих случаев:

а) с названиями морей, рек, океанов, горных хребтов, групп островов используется определенный артикль: ***the Pacific Ocean, the Black Sea, the Thames, the British Isles.***

б) определенный артикль используется с несколькими названиями стран, областей и городов, (хотя обычно с этими типами названий артикль не используется):

***the Ukraine, the Crimea, the Caucasus, the Netherlands, the Hague, the Riviera, the Congo, the West Indies***

в) определенный артикль используется с названиями стран типа:

***the Russian Federation, the United States of America, the United Kingdom.***

г) перед собирательным именем семьи ***The Petrovs*** — Петровы

***Exercise 1.3.*** **Translate into Russian. Explain the use (использование) of definite (определенных) and indefinite (неопределенных) articles:**

1. Last week I met my friend. He was with a young girl. The girl was a student of our Academy. 2. This is a





pencil. The pencil is red. 3. She is a teacher. She is our teacher of English. 4. It is a lake. The lake is deep. It's one of the deepest lakes in the world. 5. There are many flowers in your garden. The flowers are beautiful. 6. Did you write a plan? Give me your plan, please. Is this plan effective? 7. The Black Sea is in the South of Russia. 8. This is Mike. He works as an engineer. Mike is a highly qualified engineer. 9. There are some schools in our street. The schools are new. 10. Gagarin was the first cosmonaut of the world. 11. In summer the sky is blue and the sun shines brightly. 12. The Petrovs are very friendly. 13. This is Ann's book. I don't like such books. 14. Winter begins in December.

***Exercise 1.4.*** **Insert (вставьте) the article where necessary:**

1. This ... pencil is broken. Give me that ... pencil, please. 2. I can see three ... boys. ... boys are playing. 3. I have ... bicycle. ... bicycle is black. My ... friend has no ... bicycle. 4. Our ... room is large. 5. We wrote ... dictation yesterday. ... dictation was long. 6. She has two ... daughters and one ... son. Her ... son is ... pupil. 7. My ... brother's ... friend has no ... dog. 8. This is ... tree. ... tree is green. 9. She has ... ball. ... ball is ... big. 10. I got ... letter from my ... friend yesterday. ... letter was interesting.

***Exercise 1.5.*** **Use the articles *a, an, the* where it is necessary:**

1. Yesterday I saw ... new film, but ... film wasn't very interesting. 2. London is situated on ... Thames. 3. Yuri Gagarin was ... first man to fly over ... Earth in spaceship. 4. My daughter will go school ... next year. 5. I decided to visit ... Ivanovs, but they were not at ... home.

6. In ... summer we live in ... country. 7. Lomonosov, ... great Russian scientist, was born in ... small village on ... shore of ... White Sea. 8. ... United States of America is one of ... most powerful countries of the world. 9. Is your dress made of ... silk or ... cotton? 10...Peter's brother is ... student and we are ...pupils. 11.What would you like: ... apple or ... orange? 12. What ... strange man he is!

**Exercise 1.5. Use the articles *a, an, the* where it is necessary:**

1...Volga is ... longest river in ... Europe. 2. ...History and ... Literature were ... my favourite subjects at ... school. 3.What is ... nearest way to ... Drama Theatre? 4. ...butter and ... cheese are made of ... milk. 5. Usually I get up at ... 7 o'clock in ... morning. 6...Rostov is situated on ... Don. 7. Will you have ... cup of ... tea? 8.What ... good friend you are! 9. We shall go to ...cinema ... next week together with ... Petrovs. 10. This is ... book, ... book is very interesting. 11. Do you see ... sun in ... sky today? 12.He is ... engineer by ... profession.

**Exercise 1.6. Insert (вставьте) the article where necessary:**

Three men came to ... New York for ... holiday. They came to ... very large hotel and took ... room there. Their room was on ... forty-fifth floor. In ... evening ... friends went to ... theatre and came back to ... hotel very late.

«I am very sorry,» said ... clerk of ... hotel, «but ... lifts do not work tonight. If you don't want to walk up to your room, we shall make ... beds for you in ... hall.» «No, no,» said one of ... friends, «no, thank you. We don't want to sleep in ... hall. We shall walk up to our room.»





Then he turned to his friends and said: «It is not easy to walk up to ... forty-fifth floor, but we shall make it easier. On ... way to ... room I shall tell you some jokes; then you, Andy, will sing us some songs; then you, Peter, will tell us some interesting stories.» So they began walking up to their room. Tom told them many jokes; Andy sang some songs.

At last they came to ... thirty sixth floor. They were tired and decided to have ... rest. «Well,» said Tom, «now it is your turn, Peter. After all ... jokes, I would like to hear ... sad story. Tell us ... long and interesting story with ... sad end.» «... story which I am going to tell you,» said Peter, «is sad enough. We left ... key to our room in ... hall.»

**Образование множественного числа имен существительных.**

***Множественное число*** существительных (кроме тех, у которых основа оканчивается на ***-ch, -s, -ss, -sh, -x)*** образуется путем прибавления к основе окончания ***-s: a boy — boys, a trick — tricks, a pen — pens, a girl — girls.***

***Множественное число*** существительных, основа которых оканчивается на ***-ch, -s, -ss, -sh, -x***, а также существительных, имеющих, как правило, окончание ***-o***, образуется путем прибавления к основе окончания ***-es: a bench — benches, a bus- buses, a glass — glasses, a box — boxes, a potato — potatoes.***

Существительные, оканчивающиеся на ***-y*** (после согласной) во множественном числе имеют окончание ***-ies: an army — armies, a fly — flies, a lady — ladies.***

Конечное ***f(-fe)***, как правило, меняется на ***-ves:***

***a calf — calves, a knife — knives, a shelf — shelves, a wife — wives*** (но: ***roof — roofs***).

Ряд существительных образует множественное число ***не по общим правилам:***

а) изменяется корневая гласная:

***a man — men, a woman — women, a foot — feet, a tooth — teeth, a goose — geese, a mouse — mice***

б) добавляется окончание ***-en:***

***an ox — oxen, a child — children.***

в) заимствуются формы единственного и множественного числа из латинского и греческого языков:

***a formula — formulae (formulas), a crisis — crises, a criterion — criteria, an index — indices, a bacterium — bacteria, an axis — axes***

В английском языке есть существительные, которые имеют одну (общую) форму для единственного и множественного числа: ***a deer*** (олень) — ***deer*** (олени), ***a sheep*** (овца) — ***sheep*** (овцы), ***a fish*** (рыба) — ***fish*** (рыбы), ***swine(*** свинья) — swine(свиньи).

Некоторые существительные имеют ***только единственное число: advice, information, news, knowledge, furniture, luggage.***

Некоторые — ***только множественное число: clothes, riches, damages, goods, looks, manners, thanks.***

| | |
|---|---|
| **Запомните:** | this is — these are<br>that is — those are<br>there is — there are<br>it is — they are |

***Exercise 1.7.*** **Decide which of the following nouns are countable (исчисляемые) or uncountable (неисчисляемые):**

Time, water, machine, music, snow, word, coffee, money, idea, family, darkness, knowledge, sea, hour, tree, silver, meat, happiness, information, speed, book,





news, house, friend, milk, student, pen, paper, clothes, picture, air, goods.

***Exercise 1.8.*** **Read and translate the sentences. Decide which of the underlined nouns (существительных) are countable or uncountable and explain why:**

1. We have read all the official **papers**. There were some sheets **of paper** on the table. 2.Two **coffees**, please. I like **strong coffee**. 3.Give me two **glasses**. Are they made **of glass** or plastics? 4. Many thousands of **bricks** are produced at the factory. Our school is built of **brick**.

***Exercise 1.9.*** **Write down the following nouns in plural.**

Box, sheep, place, library, photo, mouse, lady, glass, bush, dress, country, bus, party, wife, day, knife, knowledge, month, pen, hero, goose, company, life, deer, tomato, city, man, play, news, child, fruit, shelf, leaf, foot, fish, woman, money, information.

***Exercise 1.10.*** **Write down the following nouns in plural:**

A star, a mountain, a tree, a waiter, the queen, a man, a woman, an eye, a shelf, a box, a city, a boy, a goose, a watch, a mouse, a dress, a toy, a sheep, a tooth, a child, an ox, a deer, a life, a tomato.

***Exercise 1.11.*** **Write down the following nouns in plural:**

this man, that match, this tea-cup, this egg, that wall, that picture, this foot, that mountain, this lady, that window, this knife

✍ ***Exercise 1.12.*** **Put the following sentences in plural and write them down. Pay attention to the changes of the verb (глагол):**

1. A new house is in our street. 2. This story is very interesting. 3. There was a woman, a man, a boy and a girl in the room. 4. In the farm-yard we could see an ox, a sheep, a cow and a goose. 5. Put this knife on that table. 6. Why don't you eat this potato? 7. This strawberry is still green. 8. A yellow leaf has fallen to the ground. 9. Can you see a bird in that tree? 10. Does your tooth still ache? 11. I held up my foot to the fire to warm it. 12. His child studies very well. 13. Is this worker an Englishman or a German? — He is a Frenchman. 14. What is that child's name? 15. The cat has caught a mouse. 16. I have hurt my foot. 17. The wolf has been shot. 18. He keeps his toy in a box. 19. This man works at our office.

✍ ***Exercise 1.13.*** **Put the following sentences in plural and write them down. Pay attention to the changes of the verb:**

1. This is my stocking. 2. He has a new suit. 3. This metal is very hard. 4. That ship is a Russian one. 5. I heard her voice. 6. His dog does not like bread. 7. The plate was on the table. 8. This town is very large. 9. I was talking to her at the tram stop yesterday. 10. Is that girl your sister? 11. I shall give you my book. 12. This story will be a good one. 13. Is this a good match? 14. The boy put his book on the desk. 15. She took off her hat. 16. That house is new. 17. The pupil put his book into the bag. 18. Is this student coming with us, too? 19. The woman didn't say anything. 20. Does she speak English?





**Притяжательный падеж существительных**

| | |
|---|---|
| **Examples:** | The child's toys — The children's toys |
| | The boy's books — The boys' books |

✍ ***Exercise 1.14.*** **Use the Possessive Case of the Nouns:**

**Example:** The poems of Lermontov. (Lermontov's poems).

1. The toy of their children. 2. The questions of my son. 3. The wife of my brother. 4. The table of our teacher. 5. The life of animals. 6. The voice of this girl. 7. The new tool of the workers. 8. The letter of Peter. 9. The car of my parents. 10 The room of my friend. 11. The handbags of these women. 12. The flat of my sister is large. 13. The children of my brother are at home. 14. The room of the boys is large.

✍ ***Exercise 1.15.*** **Translate into English.**

1. Это семья моего друга. Отец моего друга — инженер. Мать моего друга — учитель. 2. Она взяла книги своего брата. 3. Дайте мне тетради ваших учеников. 4. Вы видели книгу нашего учителя? 5. Вчера дети моего брата ходили в кино. 6. Он показал мне письмо своей сестры. 7. Чья это сумка? — Это сумка Петра. 8. Чьи это словари? — Это словари студентов. 9. Принесите игрушки детей.

# UNIT 2
## MY WORKING DAY

I. **Гласные звуки** [e], [æ].
II. **Text A: «My working day»,**
**Text B: «Nick's usual working day».**
III. **Степени сравнения прилагательных и наречий, порядок слов в английском предложении, типы вопросов.**

**Гласный звук** [e]

При произнесении гласного [e] масса языка находится в передней части ротовой полости. Кончик языка находится у нижних зубов. Губы слегка растянуты. Звук близок к русскому звуку [э] в словах ***эти, жесть***.

**Гласный звук** [æ]

При произнесении звука [æ] губы несколько растянуты, нижняя челюсть сильно опущена, кончик языка касается нижних зубов, а средняя спинка языка немного выгибается вперед и кверху.

**Exercise A**
am — Ann — lamp
man — can — cat
sat — hat — bat
Pat — rat — cam

**Exercise B**
tan — ten
pan — pen





bad — bed
land — lend
tanned — tent
fan — fen
man — men
pat — pet

**Exercise C**
bat — bet
pet — net — red
let — met
ten — pen — men — hen

### *Text A: «MY WORKING DAY»*

Hi again... As you already know, I am a first-year student of the Technical Academy. My parents live in Sochi and I study in Rostov-on-Don so I need some **housing**. There are two **opportunities** for me: I can live in a **dormitory** (a students **hostel**), or **to rent a flat (an apartment)**.

I decided to rent a flat. To make the rent smaller, I also decided to **share** my flat with another girl — Natasha Kozlova. She studies at the Academy, too, and she is my best friend now. I'll tell you more about her later.

Now, let me describe my usual working day. My classes begin at 8:30. So on **week-days** I have to get up at 7:15. I don't have an **alarm clock** and **usually** my **roommate** wakes me up and my working day begins. I **turn on** the radio and do my morning exercises while Natasha takes a shower. I don't take a bath in the morning because I don't have enough time for it. I take a cool shower (that's

when I **completely** wake up), brush my teeth. After that I go back to our room and **get dressed**. I brush my hair and put on a light **make-up**. Then we have breakfast. Natasha makes breakfast every Monday, Wednesday and Friday. I have to **serve** breakfast on Tuesdays, Thursdays and Saturdays. I love to listen to the latest news on the radio **while** I am eating and Natasha **prefers** light music.

We leave the house at ten minutes past eight and walk to the nearest bus-stop. We live **rather** far from the Academy and it usually takes us about a quarter of an hour to get there by bus. Sometimes when the weather is fine and we have **enough** time we walk to the Academy. It is very **healthy** to walk much.

The classes begin at 8:30 in the morning and they end at 2:00 p.m. We have lectures in different subjects. As a rule we have three or four classes a day. Sometimes it is very hard to wait till they end.

Usually I don't **miss** my classes because I want to pass my exams **successfully**. But sometimes I do, especially when the weather is fine and the classes are **boring**.

At 11:50 we have lunch. That's my favourite time. That is the time to **share** the latest news and **to gossip**. My friends and I prefer not to go to the **canteen** and we often have lunch in a small cafe not too far from the Academy. At 12:30 we **have to be back** to our classes. During the working day we also have several short **breaks** that last for ten minutes.

Occasionally I have to stay at the Academy till 5 or even 6 o'clock in the evening because I go to the library to get ready for my practical classes or to write a **report**. As a rule I have no free time on week-days. So by the end of the week I get very **tired**.





We come home at about 7 o'clock in the evening. We eat supper together and share the latest news.

After supper we wash dishes, drink coffee or tee and watch TV. I prefer old comedies and Natasha likes serials or films about travelling. Sometimes Natasha and I go for a walk in the park or visit our friends.

At about eleven at night I go to bed. I like to read something before going to bed and Natasha likes to listen to some music. Sometimes I fall asleep while I am reading and Natasha gets up and switches off the light and says — Good night!

*Vocabulary:*

**housing** — жилье
**opportunity** — возможность
**dormitory, students hostel** — студенческое общежитие
**to rent a flat (an apartment)** — снимать квартиру
**to share** — делить(-ся)
**week-days** — будние дни
**alarm clock** — будильник
**usually** ['ju:ʒuəlɪ] — обычно
**roommate** — сосед по комнате
**rather** ['rɑ:ðə'] — довольно
**to turn on (off)** — включать, выключать
**enough** [ɪ'nʌf] — достаточно
**completely** [kəm'pli:tlɪ] — полностью, совершенно
**to get dressed** — одеваться
**to serve** [sə:v] — обслуживать
**make up** — макияж
**while** [waɪl] — пока, в то время как
**to prefer** [prɪ'fə:] — предпочитать
**healthy** ['hɛlθɪ] — здоровый, полезный
**to miss** [mɪs] — пропускать
**successfully** [sək'sɛsfəlɪ] — успешно

**boring** [ˈbɔːrɪŋ] — скучный
**to gossip** [ˈgɔsɪp] — сплетничать
**have to be back** — должны вернуться
**break** [breɪk] — перерыв
**report** [rɪˈpɔːt] — доклад
**share** [ʃɛə] — делиться
**canteen** [kænˈtiːn] — столовая

*ADD TO YOUR ACTIVE VOCABULARY*

**tape-recorder** — магнитофон
**to brush one's hair** — причесывать волосы
**it takes me ... minutes to get to the Academy by bus** — у меня уходит ... минут, чтобы добраться до Академии на автобусе
**cloackroom** — гардероб
**upstairs** [ʌpˈstɛəz] наверху, вверх по лестнице
**downstairs** [ˈdaunˈstɛəz] — внизу, вниз по лестнице
**to miss classes** — пропускать занятия
**to pass exams** — сдать экзамены
**to do well** — делать успехи, хорошо учиться
**for the first (second) course** — на первое (второе) блюдо
**to get ready** — подготовиться
**as a rule** — как правило
**to get tired** — устать
**to take pleasure in** — получать удовольствие от...
**to look forward to** — ждать с нетерпением
**acquaintance** [əˈkweɪntəns] — знакомый

*Exercise 2.1.* **Write one sentence with each word:**
1. Usual — usually — as usual — unusual
2. occasion — occasional — occasionally
3. to end — to finish — to be over
4. to start — to begin — to get ready for
5. on Sunday — at five o'clock — in cafeteria ...





6. full time student — part time student
7. freshman — second year student — school graduate

*Exercise 2.2.* **Translate into English:**
- быть студентом (студенкой) дневного отделения
- рассказать вам о...
- в будние дни
- просыпаться — вставать в 7 часов утра
- включать магнитофон
- принимать душ
- чистить зубы
- одеваться
- слушать последние новости
- У меня уходит час, чтобы добраться до института
- ездить на автобусе (троллейбусе, трамвае)
- опаздывать на занятия
- заканчиваться в 15:50 вечера
- пропускать занятия
- сдать экзамены успешно
- время от времени
- подготовиться к занятиям
- как правило
- устать
- приходить домой
- быть дома
- иметь свободное время

*Exercise 2.3.* **Tell about your typical day. The following questions will help you:**
1. Do you get up early?
2. Is it easy for you to get up early?
3. Do you wake up yourself or does your alarm-clock wake you up?

4. Do you do your morning exercises?
5. What do you prefer: a hot or a cold shower in the morning?
6. How long does it take you to get dressed?
7. What do you usually have for breakfast?
8. Some people look through newspapers or listen to the latest news on the radio while having breakfast. What about you?
9. When do you usually leave your house?
10. Do you work? If yes, where?
11. How long does it take you to get to your Academy (Institute)?
12. Do you go there by bus/trolley-bus or walk?
13. Where do you usually have lunch (dinner)?
14. What time do you come home?
15. How long does it take you to do your homework?
16. How do you usually spend your evenings?
17. Do you have a lot of free time?
18. Do you play any musical instrument?
19. Are you fond of listening to music?
20. What kind of music do you prefer?
21. Do you collect anything (stamps, records, postcards, coins, matchboxes, etc.)?
22. What time do you usually go to bed?

***Exercise 2.4.*** **Tell about:**

a) the working-day of your father or mother
b) the usual weekend at home
c) the best day of your life
d) a holiday spent with your friends or relatives (New Year's day, Christmas, 8th of March)
e) the working day of famous people (writers, artists, politicians etc.)





## Text B: «NICK'S USUAL WORKING DAY»

Hi, nice to meet you all!

My name is Nick Price. I am a freshman at MIT — Massachusetts Institute of Technology. I am not from Boston myself. I was born in Vermilion, Ohio, not far from Cleveland.

My family is not very rich, that is why I can't afford to live on a campus. But it is a rule, that every student must reside during his or her freshman year on the campus. To cover some of the expenses I've got to work part-time on the campus. I work in cafeteria.

Now let me tell you about my usual working day. I wake up at seven in the morning. My alarm-clock radio is tuned to my favourite radio station. My roommate Todd Hall is a football player. He jogs every morning at 6:30. He is still out jogging when I get up. First I take a cold shower and brush my teeth. Then I dress myself up and rush to work — to the University cafeteria. I wash dishes and clean the tables. It is not a very interesting job, I know that, but soon I'll be a cook and will earn more. My boss Suzie is very strict but very nice when you do your job properly.

My first class starts at 11:15. The professor is never late for his classes. The lecture hall we sit in has about 100 seats. MIT is a very big school. I think that it is the best school of science and technology in the US.

At 2:00 p.m. I eat lunch at school cafeteria. The food is free for me because I work there. I am a vegetarian and I don't like drinks with caffeine. I prefer cool filtered water or juice.

Then I have two more classes. I need to go to the library right after the classes to do my homework. There I meet

my friends and we talk a lot. Twice a week I play basketball with my friends. I swim once a week. Usually after library we go out to the cafe or just sit outside and talk.

I have dinner at 6:00 p.m. at the little Chinese restaurant not too far from the dormitory or I cook myself in the kitchen in my dorm. My favourite food is salami pizza and potato salad.

After dinner I watch TV or play ping-pong with my friends. When it is Friday, we go to the football game.

I usually read before I go to bed. It calms me down after the long day. I guess, that's pretty much it for now. See you later!

*General understanding:*

1. Where does Nick Price study?
2. What year of study is he in?
3. Is Nick from Boston?
4. Is Nick's family a rich one?
5. What is Nick's job? Do you think he enjoys it?
6. Is Massachusetts Institute of Technology a good school?
7. Where does Nick spend his evenings?
8. What does Nick usually do on Friday nights?

## GRAMMAR

§ 1. Степени сравнения прилагательных и наречий

1. Односложные (и некоторые двусложные) прилагательные и наречия образуют ***сравнительную*** степень путем прибавления суффикса *-er*, ***превосходную*** — путем прибавления суффикса *-est:*

***high — higher — the highest*** (высокий — выше — самый высокий),

***big — bigger — the biggest*** (большой — больше — самый большой).





Прилагательные и наречия, оканчивающиеся на *-y*, меняют окончание на *-ier и -iest.*

Конечная согласная у односложных прилагательных и наречий удваивается.

Например: ***happy — happier — the happiest.***
***hot — hotter — the hottest***

2. Многосложные прилагательные и наречия, оканчивающиеся на *-ly*, образуют

***сравнительную*** степень путем прибавления слов ***more (less),***

***превосходную*** — путем прибавления слов ***most (least)***

***interesting — more (less) interesting — most (least) interesting,***

***easily — more (less) easily — most (least) easily.***

3. Ряд прилагательных и наречий являются исключениями:

***good, well*** (хороший, хорошо) — ***better*** (лучше) — ***the best*** (самый хороший),

***bad*** (плохой) — ***worse*** (хуже) — ***the worst*** (самый плохой)

***little*** (маленький, мало) — ***less*** (меньше) — ***the least*** (наименьший)

***many (much) — more — the most***

***far — farther (further) — the farthest (furthest)***

Существительное, определяемое прилагательным в превосходной степени, всегда имеет определенный артикль: ***the largest building.***

***Exercise 2.5.*** **Make up comparative and superlative forms of the listed below adjectives (прилагательные) and adverbs (наречия):**

1. large, tall, long, easy, hot, big, cold, nice, bad, strong, short,wide, good, happy, high, low, busy, well, little, many, far.

2. wonderful, necessary, quickly, interesting, comfortable, popular, active, famous, pleasant, beautiful, slowly, clearly.

✍ *Exercise 2.6.* **Open the brackets using the right form of adjectives:**

1. Winter is (cold) season of the year. 2. Moscow is (large) than St.Petersburg. 3. Which is (long) day of the year? 4. The Alps are (high) mountains in Europe. 5. Even (long) day has an end. 6. It is one of (important) questions of our conference. 7. Your English is (good) now. 8. Who knows him (well) than you? 9. We have (little) interest in this work than you. 10. Health is (good) than wealth. 11. Your son worked (well) of all. 12. Today you worked (slowly) than usually.

*Exercise 2.7.* **Translate the sentences:**

1. This book is not so interesting as that one. 2. The Baltic Sea is not so warm as the Black Sea. 3. The more you read, the more you know. 4. My brother is not as tall as you are. 5. The earlier you get up, the more you can do. 6. Today the wind is as strong as it was yesterday. 7. Your room is as light as mine. 8. John knows Russian as well as English. 9. Mary is not so lazy as her brother. 10. The longer the night is, the shorter the day. 11. The less people think, the more they talk.

✍ *Exercise 2.8.* **Translate the sentences:**

1. Лев Толстой — один из самых популярных писателей в мире.

2. Этот роман интереснее, чем тот.

3. Ваш дом выше нашего? Нет, он такой же высокий, как и ваш.





4. Это — самая прекрасная картина во всей коллекции.

5. Население Российской Федерации больше населения Великобритании.

6. Он выполнил работу быстрее, чем вы.

7. Австралия — одна из наименее населенных стран.

8. Его работа лучше вашей, но работа Анны — самая лучшая.

9. Россия — самая большая страна в мире.

10. Я живу не так далеко от института, как мой друг.

11. В июле столько же дней, сколько и в августе.

12. Самолет быстрее, чем поезд.

§ 2. <u>Порядок слов в английском предложении</u>

В английском предложении каждый член предложения, как правило, имеет свое определенное место. Так, в простом распространенном повествовательном предложении на первом месте стоит

1) **подлежащее**, за ним следует

2) **сказуемое**, далее идет

3) **дополнение** (беспредложное, прямое, предложное) и затем

4) **обстоятельства** (образа действия, места, времени).

Например: 1) ***I*** 2) ***gave*** 3) ***my brother*** 3) ***a book*** 4) ***yesterday.***

*Exercise 2.9.* **Build the sentences from the words:**

a) Is, best, she, friend, my.

b) Learn, different, students, our, subjects.

c) The, is, Russia, the, in, country, largest, world.

d) In, the, we, city, live, a, flat, in, of, center, the.

e) Reading, is, my, of, best, son's, fond, friend.

§ 3. Основные типы вопросов, используемые в английском языке

1. Общий вопрос

Общий вопрос относится ко всему предложению в целом, и ответом на него будут слова *yes* или *no*:

***Do you like ice-cream? — Yes, I do.***
***Can you speak English? — Yes, I can.***
***Are you a schoolboy? — No, I am not.***
***Have you bought a text book? — Yes, I have.***

**Порядок слов в общем вопросе**

1) вспомогательный глагол(модальный, глагол-связка),
2) подлежащее (существительное или местоимение),
3) смысловой глагол (или дополнение).

2. Специальный вопрос

**Специальный вопрос** относится к какому-нибудь члену предложения или их группе и требует конкретного ответа:

***What is your name? — My name is Peter.***
***Where do you live? — I live in Rostov.***

**Порядок слов в специальном вопросе**

1) вопросительное слово *(what, where, who, when, how* и т. д.),
2) вспомогательный глагол (модальный, глагол-связка),
3) подлежащее,
4) смысловой глагол,
5) дополнения,
6) обстоятельства (места, времени, образа действия и т. д.).

В специальных вопросах, обращенных к **подлежащему** в Present и Past Indefinite, не употребляется





вспомогательный глагол ***do (did)*** и сохраняется прямой порядок слов:

***Who wants to go to the cinema? Who lives in this house?***

3. Альтернативный вопрос

**Альтернативный вопрос** предполагает выбор из двух возможностей:

***Do you like coffee or tea?*** — Вы любите кофе или чай? Альтернативный вопрос начинается как общий вопрос, затем следует разделительный союз ***or*** и вторая часть вопроса.

4. Разделительный вопрос (Tail Question)

Разделительный вопрос состоит из двух частей. Первая часть — это повествовательное предложение (утвердительное или отрицательное), вторая, отделенная запятой от первой — краткий вопрос ***(tail*** — «хвостик»):

***Your are a pupil, aren't you?*** — Вы ученик, не правда ли?

Если в повествовательной части разделительного вопроса содержится ***утверждение,*** то во второй — ***отрицание.*** Если в повествовательной части — ***отрицание,*** то во второй части, как правило, — ***утверждение:***

***You are a student, aren't you?***
***You don't go to school every day, do you?***

***Exercise 2.10.*** **Read and translate into English:**

1. She is a student.
— Is she a student?
— Yes, she is. / No, she isn't.
2. He speaks English well.
— Does he speak English well?
— Yes, he does. / No, he doesn't.

3. They have many books.
— Have they many books?
— Yes, they have. / No, they haven't.
4. The weather was fine yesterday.
— Was the weather fine yesterday?
Yes, it was. / No, it wasn't.
5. We saw a new film yesterday.
— Did we see a new film yesterday?
— Yes, we did. / No, we didn't.
6. You can read well.
— Can you read well?
— Yes, you can. / No, you can't.
7. There will be five lessons tomorrow.
— Will there be five lessons tomorrow?
—Yes, there will. / No, there will not (won't).

✍ 🗣 ***Exercise 2.11.*** **Put the questions to the following sentences:**

**1. общие**

**2. специальные**

**3. разделительные**

1. There is a book on the table. 2. He must work hard today. 3. We are leaving for Moscow next week. 4. We were reading the whole evening. 5. They don't go to work on Sunday. 6. It is not cold today. 7. Ann has already begun to read a new book. 8. We learn English at school. 9. They will show you how to get there. 10. They finished the translation before the end of the lesson. 11. I didn't feel well that evening. 12. It wasn' difficult to do this task.

🗣 ***Exercise 2.12.*** **Read and translate the sentences:.**

1. Our family lives in a three-room flat.
— Does your family live in a three-room flat or in a house?





— It lives in a three-room flat.
2. They went to the same school.
— Did they go to the same school or to different schools?
— They went to the same school.
3. He will read this book tomorrow.
— Will he read this text tomorrow or next week?
— He will read it tomorrow.
4. They are playing chess now.
— Are they playing chess or cards now?
— They are playing chess.
5. Our teacher has told us to write.
— Has our teacher told us to write or to read?
— He has told us to write.

✍ ***Exercise 2.13.*** **Translate the sentences into English:**

1. Вам нравится больше английский язык или французский?
2. Он живет в Ростове или в области?
3. Она его младшая или старшая сестра?
4. Студенты уже сдали экзамены или нет?
5. Петровы поедут летом на юг или на север?
6. Ваш друг учится в академии или в университете?
7. Он знает ее лучше или вы?

✍ ***Exercise 2.14.*** **Write down alternatve questions to the following sentences:**

1. Our teacher knows several foreign languages. 2. He has graduated from our University last year. 3. We shall go to Samara next week. 4. They are working in our garden. 5. I have just read this book. 6. I took this book from my friend. 7. He likes reading books. 8. She has many relatives abroad. 9. They were in many countries. 10. Russia is the largest country in the world.

# UNIT 3
# MY ACADEMY

**I. Гласные звуки** [ɑ:], [ʌ], **дифтонги** [ɛə], [ei].
**II. Text A: «My Academy»,**
**Text B: «Moscow State University».**
**III. §1. Безличные и неопределенно-личные предложения.**
**§2. Неопределенные местоимения *some, any*, отрицательное местоимение *no* и их производные.**

**Гласный звук** [ɑ:]

При произнесении английского гласного [ɑ:] рот открыт почти как для русского звука, но язык отодвигается дальше назад и книзу и лежит плоско. Кончик языка оттянут от нижних зубов. Губы не растянуты и не выдвинуты вперед.

**Гласный звук** [ʌ]

При произнесении краткого гласного [ʌ] губы немножко растянуты, язык отодвинут назад, несколько глубже, чем для русского звука [а]. Кончик языка находится у нижних зубов, напоминает русский звук [а] в словах *камыш, сады, валы*.

**Дифтонг** [ɛə]. Ядро звука — гласный похожий на русский звук в слове это. Скольжение происходит в направлении нейтрального гласного с оттенком звука.

**Дифтонг** [ei]. Дифтонг, ядром которого является гласный, а скольжение происходит в направлении





гласного. Произнося дифтонг необходимо следить за тем, чтобы ядро не было таким широким, как русский гласный [э], а второй элемент не превращался в русский звук [й].

**Exercise A**
car — far — bar
half — calf — bath
part — park — fart
cart — barter — shark
spark — bath — mark
park — raft — plant

**Exercise B**
mare — air — pair
care — dare — rare
fare — fair — hair

**Exercise C**
tape — hate — bate
mate — plate — Kate
late — fate — rate
brave — maple — main
pain — name — day
date — may — pay
lay — hay — Ray

**Exercise D**
us — bus
tub — mud
must — sum
humble — tumble
sun — hunt
trust — last

## Text A: «ANN'S ACADEMY»

Hello again! Now let me tell you about my Polytechnical Academy. I am really glad that I study here. It is one of the finest country's higher educational institutions. Many famous people have graduated from my Academy, and not only engineers or scientists, but many outstanding writers, actors, showmen and politicians. Studying at our Academy gives a solid background in all spheres of knowledge and prepares for practical work.

Our Academy is quite large and old. It was founded in the 19th century by the famous Russian inventor Vladimir Komarov. First, it was a small department of a large University, but later it was rearranged into an independent institution. Nowadays it is a large school where more than 5,000 students are **currently enrolled.** About 3,000 are **full-time students**, like me, and the rest are **part time-students**. There are also about 150 graduate students. They **conduct** independent research work and have pedagogical practice.

The **course of study** at my academy lasts five years. There are many faculties in my academy. Here are some of them: the faculty of **industrial automation** and **robotics**, the faculty of **plastics**, the faculty of **machine tools** and the faculty of **metalworking**.

Our academy is large and we have several buildings. One of the buildings is for lectures and seminars only. There are many large halls there so that students of 3–4 groups together can fit in there. And that is more than 100 people. The acoustics [ə'ku:stɪks] in such large halls is very good but sometimes it is very **noisy** when students **chat** during the lecture.





We have two laboratory buildings which are **equipped with up-to-date equipment** and there students can **carry on** lab works and conduct various experiments. Many students from my group do their own **research work**.

There are several cafes at the academy. My favourite one is situated in a separate **one-storeyed** building and people say that this is the oldest canteen or student's cafe. The food there is **tasty** and very **affordable.**

There are also several dormitories or hostel buildings where students from other cities live. But you know already that I don't live in a dormitory — I rent an apartment.

*Vocabulary:*

**currently** — в настоящее время
**to be enrolled** — числиться в списках студентов
**full-time students** — студенты дневного отделения
**part time-students** — студенты вечернего отделения
**to conduct** — проводить
**course of study** — курс обучения
**industrial automation** — промышленная автоматика
**robotics** — робототехника
**plastics** — пластмассы
**machine-tools** — станки
**metalworking** — металлообработка
**figure** [f'ɪgə] — фигура, цифра
**noisy** — шумный
**to chat** — беседовать, болтать
**to be equipped with** — быть оборудованным
**up-to-date equipment** — современное оборудование
**carry on** — проводить
**research** [rɪ'sə:tʃ] **work** — исследовательская работа
**one-storeyed** — одноэтажное

**tasty** ['teɪstɪ] — вкусный
**affordable** — доступная (to afford — позволять)

*ADD TO YOUR ACTIVE VOCABULARY*

a) **classroom** — класс, аудитория
**lecture hall** — лекционный зал
**laboratory** — лаборатория
**gym (gymnasium)** — спортзал
b) **semester (term)** — семестр
**school year** — учебный год
**course of studies** — курс обучения
**academy** — академия
**university** — университет
**institute** — институт
**faculty, college, department** — факультет (ex. **College of physics — факультет физики)**
**department, chair of ...** — кафедра
**head of the department, chief of the department, chair (man,woman)** — зав. кафедрой
**substitute** — заместитель
c) **teaching instructor (TI)** — преподаватель
**professor** — профессор
**dean** — декан
**Rector** — ректор
**teaching staff, faculty members** — преподавательский состав
d) **full-time student** — студент(ка) дневного отделения
**part-time student** — студент(ка)-«вечерник»
**student of distant education** — студент(ка) «заочник»
**student of preparatory courses** — слушатель подкурсов, «подкурсник»
**undergraduate student** — студент 1–4(5) курсов





**graduate student** — студент 5–6 курсов (магистрант, аспирант

***Exercise 3.1.*** **Tell about:**
a) your secondary school (college)
b) the faculty of your university
c) your favourite teacher at school.

***Exercise 3.2.*** **Do you know?**
1) When was your University or Academy established?
2) Who was the first Rector?
3) Were there any famous a) scientists, engineers b) politicians c) artists among the graduates of your Institute?
4) How many people are currently enrolled?
5) What is the most popular faculty in your Academy?

***Exercise 3.3.*** **Do you agree or disagree with the following statements:**
a) Larger schools are better than smaller ones.
b) It is impossible to enter the university if you haven't attended preparatory courses.
c) The best professors are the oldest ones.
d) It is better to live in a dormitory or student hostel than to rent an apartment.
e) Professors always know more than students and teaching instructors.

## *Text B: «MOSCOW STATE UNIVERSITY»*

Moscow State University is the oldest, autonomous, self-governing and state-supported institution of higher learning, founded in 1755 by the scientist

Mikhail Vasilyevich Lomonosov. Located in Moscow, the university is composed of faculties of biology, chemistry, computational mathematics and cybernetics, economics, foreign languages, fundamental medicine, geography, geology, history, journalism, law, mechanics and mathematics, physics, psychology, sociology, and soil sciences, as well as an institute of Asian and African Studies. Several museums, colleges, and a number of institutes are affiliated with Moscow University, and a preparatory faculty teaches Russian language and other subjects to foreign students.

Except for the science faculties and some of the arts faculties — which are situated in south-western Moscow — the remainder of the faculties are located in the older university buildings in the centre of the city. A diploma in a given field of study is awarded after five or five and a half years of study. After three additional years and the completion of a thesis, the *kandidat nauk* degree is awarded. The highest degree, the Doctor of Sciences, may be attained upon completion of a thesis based on independent research.

## GRAMMAR

**А) Безличные и неопределенно-личные предложения.**

Английские предложения отличаются от русских тем, что в них всегда есть подлежащее и сказуемое. Поэтому в безличных предложениях, когда нет подлежащего, используется в качестве формального подлежащего местоимение ***it***.

***It is cold today.*** Сегодня холодно.

Как видим, безличные предложения такого типа состоят из местоимения ***it***, которое не переводится, глагола-связки в нужном по смыслу времени и именной части сказуемого, выраженного чаще всего именем прилагательным. Именная часть может быть также выражена именем существительным или именем числительным.





***It's nice to meet you.*** Приятно познакомиться.

***It is nine o'clock now.*** Сейчас девять часов.

Очень часто безличные предложения описывают явление природы, состояние погоды, обозначают время, расстояние.

Вопросительная и отрицательная формы безличных предложений образуются по тем же правилам, что и вопросительные и отрицательные формы предложений с именным составным сказуемым.

***Is it cold?*** — Холодно?

***Wasn't it interesting?*** — Разве это не было интересно?

Частица not ставится после первого вспомогательного глагола.

***Exercise 3.4.*** **Переведите на английский язык.**

1. Сегодня холодно. 2. Идет снег целый день. 3. Сейчас утро. 4. Было приятно познакомиться с вашим другом. 5. Поздно. Пора спать. 6. Разве это не смешно? 7. Сейчас уже 10 часов утра. 8. На улице холодно? 9. Сейчас ранняя весна, но уже тепло. 10. Это далеко отсюда?

**В) Неопределенные местоимения *some, any*, отрицательное местоимение *no* и их производные.**

Употребление ***some*** и ***any***, а также их производных определяется типом предложения.

В утвердительном предложении употребляются, как правило, местоимение ***some*** и его производные:

***Give me something to read, please.***

***I met him somewhere before.***

В вопросительных и отрицательных предложениях обычно используются местоимение ***any*** и его производные:

***Have you seen him anywhere?***

***Is there anything I can do for you?***

В отрицательных предложениях используется либо местоимение ***any*** и его производные,

***I cannot find this book anywhere.***

либо отрицательное местоимение ***no***

***There is nobody in that room.***

***There isn't anybody in that room.***

Различия между местоимениями ***any*** и ***some*** — в степени неопределенности, поэтому иногда местоимение ***any*** можно встретить и в утвердительных предложениях:

***You can find this book anywhere.*** — Эту книгу вы можете найти где угодно.

***Exercise 3.5.*** **Make 16 pronouns and translate them:**

Образец: ***some + body = somebody*** — кто-то, кто-нибудь

| | |
|---|---|
| some | body |
| any | one |
| no | thing |
| every | where |

***Exercise 3.6.*** **Insert *somebody, anybody, nobody* or *everybody*:**

1.The question was so difficult that ... could answer it. 2. ... left his bag in our classroom yesterday. 3. Has ... in this group got a dictionary? 4. I am afraid there is ... in the office now. It is too late. 5. ... knows that water is necessary for plants. 6. Is there ... here who knows English? 7. You must find ... who can help you. 6. ... knew anything about our home task. 9. ... can answer this question. It is very easy. 10. There is ... in the next room. I don't know him. 11. Please tell us the story. ... knows it. 12. Is there ... in my group who lives in the hostel? 13. Has ... here got a red pencil?





***Exercise 3.7.*** **Translate into English:**

1. Тут есть кто-нибудь? 2. В саду никого нет. 3. В нашей комнате есть кто-нибудь? 4. В классе есть кто-то. 5. Там никого нет. 6. В саду есть кто-нибудь? 7. На столе есть что-нибудь? — Нет, там ничего нет. 8. В сумке что-то есть. 9. В этой книге есть что-нибудь интересное? 10. На стене есть какие-нибудь картины? — Да, там есть несколько. 11. В кабинете директора есть кто-нибудь? — Нет, там никого нет. 12. В нашей библиотеке есть какие-то книги на английском языке. 13. В вашей библиотеке есть какие-нибудь книги на английском языке? 14. Мой друг не хочет мне ничего сказать. 15. Я хочу провести летние каникулы где-нибудь на берегу Черного моря. 16. Если вы голодны, поищите что-нибудь в холодильнике. 17. Расскажите нам все о вашем путешествии.18. Никто нигде не помог ему.

# UNIT 4
# MY HOME TOWN

I. **Гласные звуки** [u.], [u].
II. **Text A: «Sochi»,**
**Text B: «Rostov-on-Don».**
III. **§1. Местоимения *little* и *few* и местоименные выражения *a little* и *a few*.**
**§2. Оборот *there is / there are*.**

**Гласный звук** [u:]

При произнесении долгого гласного звука [u:] губы напряжены и сильно округлены, но гораздо меньше выдвинуты вперед, чем при русском звуке **[у]**: moon.

На письме передается буквосочетанием двойное ***O***, за исключением случаев перед буквой ***k***. **Например: soon** — *скоро, вскоре,* **moon** — *луна*

***Исключение***: **book** — книга (краткое *и*)

**Гласный звук** [u]

При произнесении краткого гласного звука [u] губы заметно округлены, но не выдвинуты вперед, язык оттянут назад, но несколько меньше, чем для *u:* (u долгого). Звук напоминает безударный русский звук [у] в словах *пустой, тупой*, произнесенный без выдвижения губ вперед:

***hook*** — крюк, ***look*** — взгляд

**Запомните слова, в которых в качестве исключения произносится [u]: put — класть, pull — тянуть, push — толкать, full — полный**





**Exercise A**
too — tooth — food
boot — fool — foot
soon — spoon — tooth
boot — mood — shook

**Exercise B**
took — shook — nook
hook — look — cook

**Exercise C**
fool — pool — hook
fool — too — book
cook — boot — loop
foot — cool — mood
shook — soon — spoon — moon

**Exercise D**
pull (тянуть) — pool (бассейн)
tool (инструмент) — full (полный)

## *Text A: «SOCHI»*

**«Big Sochi — the best place on the Earth!»**

Hello, everyone! Here is Ann Sokolova again. This time I'll tell you about my lovely hometown — Sochi. I am sure everyone knows where Sochi is. For those who are not really sure I **remind** that it is situated on the Black Sea coast about 1500 km south from Moscow.

But what makes this city so special? Sochi is called the city of three seasons because there's no winter here. As we usually say, «the golden autumn slowly **turns into** the early spring.» When golden leaves slowly fall down on the earth the first flowers begin to **blossom**. Sochi is

the only northern subtropical city in Russia. One can bathe in the Black Sea from May till October because the water of the Black Sea is still warm. The water of the Black Sea contains many **chemical substances** such as **iodine, chlorine, bromine, sulphates, carbonates, sodium, potassium**, etc. All of them react with your body and make you healthier. There are many mineral water springs in Sochi and its area.

Have you ever heard the name Big Sochi? Sochi is one of the most **stretched** cities along the sea coast — it is 148 km long! Small towns and cities Adler, Khosta, Kudepsta, Dagomys and Lazarevskoye belong to Big Sochi!

The history of this area goes back to the **ancient** times.

One can call this area **«the Cradle of Mankind »**. People came here from the **Asia Minor** 400–350 thousand years ago. There are more than 150 historical places of interest in the area. Here the **camps** and **caves** of **prehistoric** people have been found.

The **dolmens** — massive prehistoric **grave structures** from the 2nd thousand **B.C.** are the **features** of the **Bronze era**. The most **ancient** five-stone dolmens are found in the Sochi area. **Travellers** of the 19th century called dolmens «the houses of the giants» because each grave stone **weighs from** 500 to 3000 kg. It is still **uncertain** what technical developments made it possible to **construct** such structures.

The rich lands of Caucasus always **attracted invaders**: Greeks, Romans, Arabs, Genuese, Turks.

In the VI$^{th}$ century **B.C.** the Black Sea coast attracted Greek colonists, who have based a number of **trade-settlements**, such as Dioscuria (modern city of Sukhumi), Pitiunt (Pitsunda), Triglif (Gagra).





Christian religion was brought over from the **Byzantynne** three centuries earlier than to Russia. In the end of X$^{th}$ — beginning of the XI$^{th}$ centuries **A.D.** the first known christian constructions **were** built in Loo, Galitsino and Veseloye.

During the **XVIII$^{th}$–XIX$^{th}$** centuries Russia **conducted** long wars **with Turkey** for the **exit** to the Black sea. In 1829, after **the end** of Russian-Turkish war, by the **peace treaty** the Black Sea coast of Caucasus, from the **mouth of the** Kuban **river** up to a fort St.Nicholas (to the south of modern city Poti), has departed to Russia.

Symbol of the victory of the Russian **weapon** in the war of 1829 is the monument near modern hotel «Leningrad» — «**Anchor** and **Cannon**».

The end of Russian-Turkish war has not solved all the problems of strengthening of Russia on the Black Sea coast. The Black Sea coastal line consisting of 17 forts was created with this **purpose**.

On April 21st, 1838 a small wooden **fortress** was established in the Sochi river area to protect this land from local tribes. It was named Alexandria **in honour of emperess** Alexandra. It was renamed one year later, on May 18, 1839 and became Navaginskoye. But in 1854, because of the beginning of the Crimean war, the fortress was destroyed by Russian army. Russians left this area. Only 10 years later, on March 25th, 1864 the new fortress named Dakhovskiy was established on the place of the Navaginskiy fortress.

In 1896 by the decision of the Tsarist government fortress Dakhovskiy was renamed in the settlement of Sochi, after the name of the river Sochi.

In the end of XIX$^{th}$ century the Black Sea coast was intensively **occupied** by the immigrants from central parts of Russia, Moldova, the Ukraine, Byelorussia, Georgia and Armenians and Greeks from Turkey. The

Sochi district becomes multinational area of Russian Empire.

In Soviet times Sochi was a quickly developing port, industrial and **resort city** on the Black sea. The fast development of the city and construction of modern houses was **due to** Joseph Stalin's sympathy to this place. Many streets in the center of Sochi look like the center of Moscow built in 30s and 50s.

Untll now the favourite residence of Russian Presidents was Bocharov creek (ручей). Ski resorts of Krasnaya polyana, warm blue waters of Black sea, **luxurious** tennis courts create **irresistable** atmosphere around the place.

I guess, I have taken a lot of your attention already. You know yourself what a popular resort is Sochi nowadays. Just buy the ticket and have your suitcases packed!

*Vocabulary:*

**to remind** — напоминать
**to turn into** — прврщаться (во что-либо)
**blossom** — цвести
**chemical substances** — химические вещества
**iodine** [ˈaɪəudiːn] — йод
**chlorine** [ˈklɔːriːn] — хлор
**bromine** [ˈbrɔːmiːn] — бром
**sulphate** [ˈsʌlfeɪt] — сульфат
**carbonates** [ˈkɑːbəneɪts] — карбонаты
**sodium** [ˈsəudɪəm] — натрий
**potassium** [pəˈtæsɪəm] — калий
**to be stretched** — быть вытянутым
**events** — события, мероприятия
**«the Cradle of Mankind»** — «колыбель человечества»
**B.C. (Before Christ)** — до н.э.
**Asia Minor** — п-ов Малая Азия
**camp** [kæmp] — лагерь





**cave** [keɪv] — пещера
**Bronze era** — бронзовый век
**pre-historic** — доисторический
**grave structures** — могильники
**dolmens** — дольмены
**features** — особенности
**to weigh** — весить
**uncertain** — неопреленный
**construct** — возводить, строить
**attract** [əˈtrækt] — привлекать
**invader** [ɪnˈveɪdəˈ] — захватчик
**trade-settlements** — торговые поселения, фактории
**Byzantynne** — Византия
**A.D. — (Anno Domini)** — нашей эры (н.э.)
**to conduct** — проводить
**exit** [ˈɛksɪt] — выход
**peace treaty** [ˈtriːtɪ] — мирный договор
**mouth of the river** — устье реки
**weapon** [ˈwɛpən] — оружие
**anchor** [ˈæŋkəˈ] — якорь
**cannon** — пушка
**purpose** [ˈpəːpəs] — цель
**fortress** [ˈfɔːtrɪs] — форт, укрепление
**in honour of emperess Alexandra** — в честь императрицы Александры
**to be occupied** [ˈɔkjupaɪd] — быть занятым, заселенным
**due to** — благодаря (кому-либо, чему-либо)
**luxurious** [lʌgˈzjuərɪəs] — роскошный
**irresistible** [ɪrɪˈzɪstɪbl] — неотразимый

*ADD TO YOUR ACTIVE VOCABULARY:*

a) **village** — село, деревня
**cossack's settlement** — казачья станица

**town** — небольшой город
**suburbs** — пригороды
**city** — крупный город
**center of the region** — районный центр
**capital of the republic** — столица республики
**capital of the federal district** — столица федерального округа

b) **ancient history** — древняя история
**medieval history** — средневековая история
**Dark Ages** — средние века
**Tsarist's Russia** — царская Россия
**Great October revolution** — Великая октябрьская революция
**Great Patriotic War** — Великая Отечественная война
**WWII (World War II)** — вторая мировая война
**soviet times** — советские времена
**former USSR** — бывший СССР

c) **historical center** — исторический центр
**cultural center** — культурный центр
**trade center** — торговый центр
**transport center** — транспортный центр

***Exercise 4.1.*** **Translate into English:**

1. Мой родной город был основан во время царствования Николая I.

2. Первое укрепление на месте современного Сочи было названо в честь императрицы Александры.

3. Во время Великой отечественной войны немецкие войска дважды захватывали наш город.

4. Владимир — один из древнейших русских городов.

5. Мягкий климат и плодородные земли всегда привлекали захватчиков на берега Кубани.

6. Великий русский изобретатель Владимир Комаров жил и работал в нашем городе.





7. Современный Новороссийск — это крупнейший портовый город на побережье Черного моря.

8. Наш город является одновременно крупным индустриальным и историческим центром региона.

***Exercise 4.2.*** **Answer the following questions:**

1. Do you study in your hometown or you just live here while studying?

2. Do you like the city where you study? Why and why not?

3. Do you know the history of your hometown?

4. When was your hometown founded?

5. Do you know any famous people who were born in your hometown?

6. What are the places of interest in your hometown?

7. What is your favourite place in your hometown?

***Exercise 4.3.*** **Derive the adjective (прилагательное) from the noun (существительное):**

- history — historical
- military —
- culture —
- science —
- industry —
- trade —
- agriculture —
- administration —
- politics —

## Text B: «ROSTOV-ON-DON»

Rostov-on-Don, the capital of the Southern federal district and Rostov region, is a comparatively young

city. Not so long ago Rostovites celebrated its 250th anniversary. The city was founded in 1749 when a custom-house on the Temernik river was set up. According to a legend, Tsar Peter the First tried the water from a spring when he stopped on the right bank of the Don on his way to Azov. He was so pleased with the taste of water that he called the spring «Bogaty istochnik» — Rich spring. The name of the spring gave the name to the street. The water is being bottled now and sold all over the country.

But only years later, after the death of Tsar Peter I, under the rule of Katherine II a fortress was built here. The main purpose of the fortress was to support the customs effectively operating in this trade and transport active region. The fortress was named after Dimitry Rostovsky, the Archbishop of Rostov the Great. The town grew later on, round the walls of the fortress and it was also called «Rostov which lies on the river Don».

Rostov is situated on the right bank of the river Don, not far from the Sea of Azov. Due to its geographical position the city grew rapidly.

After the hard years of the Civil War Rostovites restored the ruined economy of the region.

During the World War II Rostov was occupied by the Germans twice. They destroyed almost all the city. Nowadays Rostov is the largest city in the South of the country. It's a big sea and river port and an important railway junction. Rostov is called «The Gateway to the Caucasus».

The main branch of industry is agricultural machine building. «Rostselmash» is a giant machine building plant producing a lot of agricultural machines. Factories of Rostov produce champagne, cigarettes, musical





instruments which are well-known abroad. There is also a big helicopter plant in Rostov.

Rostov is the cultural centre of the Rostov region. There are many educational establishments in Rostov including the Rostov State University founded in Warsaw in 1815. There are six theatres in Rostov (Gorky Drama Theatre, Philharmonic, Puppet Theatre, Theatre of Musical Comedy, Theatre of Young Spectators and Musical Theatre).

There are two museums (Local Lore Museum, Fine Arts Museum), eight stadiums, several Palaces of Culture, a lot of cinemas, libraries, parks and gardens.

Rostov is famous for many prominent people who lived here.

The city is very green. There are a lot of parks in the city. In summer you can see a lot of people on the beach on the left bank of the Don river.

***General understanding:***

1. What is the status of Rostov-on-Don now?
2. Is Rostov-on-Don an old city?
3. What role did Peter the Great play in the history of Rostov-on-Don?
4. Why did Peter the Great call the spring «rich».
5. When was the first fortress built? How was it called?

## GRAMMAR

§1. Местоимения *little* и *few* и местоименные выражения *a little* и *a few*.

Местоимение ***little*** и местоименное выражение ***a little*** употребляются с неисчисляемыми существительными, местоимение ***few*** и местоименное выражение ***a few*** — с исчисляемыми:

***Give me a little water, please.***
***There is little milk in the bottle.***
***I have a few friends in Minsk.***
***I've got only few pencils in the box.***

Местоимения *few* и *little* означают «мало», а местоименные выражения *a few* и *a little* — «немного».

*Much* (много) употребляется с неисчисляемыми существительными, *many* (много) — с исчисляемыми.

***Exercise 4.4.*** **Insert *much, many, little, a little, few, a few:***

1. I'd like to say . words about my travelling. 2. She gave him ... water to wash his hands and face. 3. He had ... English books at home, so he had to go to the library. 4. After the lesson everybody felt ... tired. 5. Let's stay here ... longer. I like it here. 6. There were ... new words in the text and Peter spent ... time learning them. 7. There was ... sugar in the bowl, and we had to put ... sugar there. 8. My mother knows German ... and she can help you with the translation of this text. 10. When we walked ... farther down the road we met another group of pupils. 11. Have you got ... time before the lesson?

***Exercise 4.5.*** **Translate into English:**

Много тетрадей, много молока, много воды, много дней, много газет, много мела, много снега, много лет, много картин, много музыки, много сахара, много чая, много лимонов, много мяса, много комнат, много учителей, много работы, много воздуха, много птиц, много машин.

***Exercise 4.6.*** **Insert *much* or *many*:**

1. Please don't ask me ... questions. 2. How ... money have you got? 3. I never eat ... bread with soup. 4. Why





did you eat so ... ice-cream? 5. She wrote us ... letters from the country. 6. ... of these students don't like to look up words in the dictionary. 7. ... in this work was too difficult for me. 8. He spent ... time writing his composition in Literature. 9. There were ... plates on the table. 10. Thank you very ... ! 11. ... of my friends are preparing for their entrance examinations now. 12. I don't like ... sugar in my tea.

***Exercise 4.7.*** **Translate into English:**

1. В стакане есть немного молока. 2. В тетради осталось мало чистых страниц. 3. У тебя много кофе? — Нет, очень мало. 4. Немногие из англичан говорят по-русски. 5. У них здесь очень мало друзей. 6. У него очень мало времени для чтения. 7. У Петра много русских книг и мало английских книг. 8. У меня есть немного времени вечером, чтобы закончить эту работу. 9. Я провожу много времени в библиотеке, потому что я готовлюсь к экзаменам.

## §2. Оборот *there is / there are*.

Оборот ***there is / there are*** служит для выражения наличия (отсутствия) какого-либо предмета в определенном месте или в определенное время. Формы прошедшего и будущего времени: ***there was, there were*** и ***there will be.***

***There are some pictures on the wall.*** На стене несколько картин.

***There was nobody in the room.*** В комнате никого не было.

Выбор формы глагола to be зависит от числа существительного, следующего сразу за ним:

***There is a chair and two armchairs in the room.***

***There are two armchairs and a chair in the room.***

Вопросительные предложения с оборотом ***there is / there are*** строятся следующим образом

Общий вопрос: ***Is there anything in the bag? Will there be lessons tomorrow?***

Специальный вопрос: ***What is there in the bag?***

Разделительный вопрос. ***There are some pupils in the classroom, aren't there?***

✍ ***Exercise 4.8.*** **Insert *to be* in the right form:**

1.There ... a telegram on the table. 2. ... there any telegrams from Moscow? Yes, there ... some . 3. ... there ... a flight for Moscow tomorrow? Yes, there ... . 4. There ... much snow last winter. 5.There ... a lot of stars and planets in space. 6. ... there ... a lift in your future house? Yes, there ... ... . 7. Some years ago there ... many old houses in our street. 8. ... there any lectures yesterday? No, there ... 9. ... there a lamp over the table? Yes, there ... . 10. ... there any interesting stories in this book? 11. ... there a test last lesson? No, there ... . 12. Soon there ... ... a new film on.

***Exercise 4.9.*** **Translate the following sentences and put general questions to them:**

1. There are some new pupils in our group. 2. There is no book on the table. 3. There were many old houses in our street. 4. There are 4 seasons in a year. 5. There will be a conference next week. 6. There are many large cities in our country. 7. There was nobody in the room. 8. There are 7 days in a week. 9. There is something on the shelf. 10. There are many places of interest in London. 11. There are many beautiful flowers in our garden. 12. There was much work last week.





✍ ***Exercise 4.10.*** **Rewrite the following sentences in *Past Indefinite* and *Future Indefinite*, translate them into Russian:**

1. There is much snow in winter. 2. There are 4 theatres in our city. 3. There is no lift in our house. 4. There are many new books in our library. 5. There is little milk in the bottle. 6. There are 3 rooms in our flat. 7. There is a map on the wall.

# UNIT 5
# RUSSIA IS MY HOMELAND

I. **Гласные звуки** [ɔ:], [ɔ], **дифтонг** [əu].
II. **Text A: «The Russian Federation»,**
**Text B: «Moscow».**
III. **§1. Времена английского глагола,**
**§2. Правильные и неправильные глаголы.**

**Гласный звук** [ɔ:] — долгий гласный. Для того, чтобы правильно произнести звук, следует придать органам речи положение, как при произнесении звука [a:], затем значительно округлить губы и несколько выдвинуть их вперед.

**Гласный звук** [ɔ]. Для того, чтобы произнести, следует исходить из положения органов речи при произнесении звука [a:], затем слегка округлить губы и произнести краткий звук [ɔ].

**Дифтонг** [əu]. Звук представляет собой нечто среднее между русскими звуками [о] и [э]. Губы при произнесении начала этого дифтонга слегка растянуты и округлены. Скольжение происходит в направлении гласного [u].

**Exercise A**
more — score — tore
floor — for — form





fork — pork — sport
dawn — hawk — because

**Exercise B**
not — top — hot
dot — mop — mob

**Exercise C**
tone — note — smoke
cone — loan — moan
code — hope — cope
lobe — mould — gold
boat — soap — coat

## Text A: «THE RUSSIAN FEDERATION»

The Russian Federation is the largest country in the world. It **occupies** about 1/6 of the Earth **surface.** The country is situated in Eastern Europe, Northern and Central Asia. Its **total area** is over 17 million square km.

Our land is washed by 12 seas, most of which are the seas of three oceans: the Arctic, the Atlantic and the Pacific. In the south and in the west the country **borders on** fourteen countrees. It also has a sea-border with the USA.

There is hardly a country in the world where such a great variety of flora and fauna can be found as in our land. Our country has **numerous** forests, plains and **steppes, taiga** and tundra, **highlands** and deserts. The highest mountains in our land are the Altai, the **Urals** and the **Caucasus.** There are over two thousand rivers in the Russian Federation. The longest of them are the Volga, the Ob, the Yenisei, the Lena and the Amur. Our land is also rich in various lakes with the deepest lake in the world, the Baikal, included.

On the Russian territory there are 11 time zones. The **climate conditions** are rather different: from arctic and **moderate** to continental and subtropical. Our country is one of the richest in natural resources countries in the world: oil, natural gas, coal, different **ores, ferrous and non-ferrous** metals and other minerals.

The Russian Federation **is a** multinational **state**. It **comprises** many national **districts**, several autonomous republics and regions. The population of the country is about 140 million people.

Moscow is the capital of our Homeland. It is the largest political, scientific, cultural and industrial center of the country and one of the most beautiful cities on the globe. Russian is the official language of the state. The national symbols of the Russian Federation are a white-blue-red **banner** and a double-headed eagle.

The Russian Federation is a constitutional republic headed by the President. The country government consists of three branches: **legislative, executive** and **judicial**. The President controls only the executive branch — the government, but not the Supreme Court and Federal Assembly.

The legislative **power belongs** to the **Federal Assembly** comprising **two chambers: the Council of Federation** (upper Chamber) **and the State Duma** (lower Chamber). Each chamber is headed by the Speaker. The executive power belongs to the government (the Cabinet of Ministers) headed by the Prime Minister. The judicial power belongs to the system of Courts comprising the Constitutional Court, the **Supreme Court** and federal courts.

Our country has a multiparty system. The largest and most **influential** political parties are the «Unity», the





Communist party, the «Fatherland-All Russia», «The Union of the Right Forces», «The Apple», Liberal-Democratic and some others.

The **foreign policy** of the Russian Federation is that of international cooperation, peace and friendship with all nations **irrespective** of their political and social systems.

*Vocabulary:*

**to occupy** ['ɔkjupaɪ] — занимать
**surface** ['sə:fɪs] — поверхность
**total** ['təutl] **area** ['ɛərɪə] — общая площадь
**to border on** — граничить с
**numerous** ['nju:mərəs] — многочисленные
**steppes** — степи
**taiga** — тайга
**highlands** — горные возвышенности
**the Urals** ['juərəlz] — Уральские горы
**the Caucasus** [kɔ:kəsəs] — Кавказ
**climate** ['klaɪmɪt] **conditions** [kən'dɪʃənz] — климатические условия
**moderate** ['mɔdərət] — умеренный
**ore** [ɔ:'] — руда
**ferrous and non-ferrous metals** — черные и цветные металлы
**state** — государство
**to comprise** — включать, охватывать
**banner** — знамя, флаг
**legislative** ['lɛʤɪslətɪv] законодательный
**executive** [ɪg'zɛkjutɪv] — исполнительная
**judicial** [ʤu:'dɪʃl] — судебная
**Federal Assembly** — Федеральное Собрание
**the Council** ['kaunsl] **of Federation** — Совет Федерации

**State Duma** — Государственная Дума
**Supreme** [su′pri:m] **Court** [kɔ:t] — Верховный суд
**influential** — влиятельный
**foreign** [′fɔrɪn] **policy** — международная политика
**irrespective** — независимо

***General understanding:***

1. Is Russia the largest country in the world?
2. What oceans wash the borders of the Russian Federation?
3. How many countries have borders with Russia?
4. Are Russian flora and fauna various?
5. What are the highest mountains in Russia?
6. What is Baikal famous for?
7. What is the climate in Russia like?
8. What is the national symbol of Russia?
9. What does the Federal Assembly consist of?
10. Who is the head of each Chamber of the Federal Assembly?

***Exercise 5.1.*** **Translate into English:**

1. Общая площадь Российской федерации составляет более 17 миллионов километров.
2. В мире вряд ли есть еще одна страна с такой разноообразной флорой и фауной.
3. Озеро Байкал — самое глубокое озеро на земном шаре и служит предметом гордости россиян.
4. На территории Российской федерации существует 11 часовых поясов.
5. Россия является конституционной республикой с президентской формой правления.
6. Законадательная власть принадлежит Федеральному Собранию, состоящему из двух палат.





7. В Российском парламенте представлены такие партии, как «Единство», КПРФ, «Отечество—Вся Россия», «Яблоко», СПС, ЛДПР.
8. Законодательная и судебная власти прямо не подчиняются Президенту.

***Exercise 5.2.*** **How well do you know your Homeland?**
***What is (are):***

- the biggest Russian lake?
- the longest Russian river (in European and Asian parts of the Russian Federation)?
- a city with subtropical climate?
- cities with arctic climate?
- agricultural regions?
- old historical cities?
- places of recreation and tourism?

## *Text B: «MOSCOW»*

Moscow is the capital and largest city of Russia. It is also the capital of Moscow Oblast, and it stands on the Moskva River. Moscow is the economic, political and cultural centre of Russia. Railways and numerous airlines link the city with all parts of Russia. Navigable waterways, including the Moscow Canal, Moscva River, and Volga-Don Canal, make the port areas of the city directly accessible to shipping from the Baltic, White, Black, and Caspian seas and the Sea of Azov.

Moscow covers an area of about 880 sq. km. Concentric boulevards divide the city into several sections. At the centre of the concentric circles (and semicircles) are the Kremlin, the former governmental seat of Russia,

and adjacent Red Square, which form the centre of a radial street pattern. Moscow has a modern underground system famous for its marble-walled stations.

Situated on the north bank of the Moskva River, the Kremlin is the dominant landmark of Moscow. A stone wall, up to 21 m in height and 19 towers, surrounds this triangular complex of former palaces, cathedrals, and other monuments of tsarist times, some of them dating from the Middle Ages. The Great Kremlin Palace, completed in 1849, is the most imposing structure within the Kremlin. Other notable Kremlin palaces are the Granovitaya Palace (1491) and the Terem (1636).

Among many cathedrals, now used mainly as museums, are the Cathedral of the Assumption (Успения) and the Archangel Cathedral, each with five gilded domes, and the Cathedral of the Annunciation (Благовещения) (13th–14th century), with nine gilded domes. Another landmark of the Kremlin is the Tower of Ivan the Great, a bell tower 98 m high. On a nearby pedestal is the Tsar's Bell (nearly 200 tons), one of the largest in the world. A recent addition to the Kremlin is the Palace of Congresses, completed in 1961. In this huge modern building were held meetings of the Supreme Soviet of the USSR and congresses of the Communist party of the Soviet Union; theatrical and other artistic performances have been held here as well.

St Basil's Cathedral, famous for its unique architecture and coloured domes, stands at one end of Red Square.

One of the best-known sections of Moscow is the Kitaigorod (Chinese City), the ancient commercial quarter lying to the east of the Kremlin. This section is now the site of many government office buildings.





Other points of interest in Moscow include the Central Lenin Stadium, comprising about 130 buildings for various sports and the tall Ostankino TV tower, which contains a revolving restaurant and an observation platform.

*General understanding:*

1. Where is Moscow located?
2. Is Moscow a port city?
3. How is Moscow divided into sections?
4. What is known about Moscow Underground system?
5. What are the places of interest in Moscow?
6. Why the Kremlin is the most important place of interest for tourists?
7. What Russian Orthodox cathedrals are sitiated inside the Kremlin?
8. What is Palace of Congresses used for at present time?

***Exercise 5.3.*** **Where are these places of interest situated?**

★ Granovitaya Palace
★ Terem
★ the Red Square
★ the Kremlin
★ the Great Kremlin Palace
★ the Cathedral of the Assumption
★ the Archangel Cathedral
★ the Cathedral of the Annunciation
★ the Tower of Ivan the Great
★ the Tsar's Bell
★ the Palace of Congresses
★ St Basil's Cathedral
★ the Central Lenin Stadium

***Exerscise 5.4.*** **Please, write a short story about your visit to Moscow. The following questions will certainly help you:**

1) Have you ever been to Moscow?
2) If yes, when was it?
3) Was it a business trip or a pleasure tour?
4) Did you fly, take a bus or a train to Moscow?
5) What railway station (airport) did you arrive at?
6) What was your first impression of Moscow?
7) What places of interest have you visited?
8) Where did you stay in Moscow?
9) How long did you stayed in Moscow?
10) Did you enjoy your visit to Moscow?

## GRAMMAR

### §1. Времена английского глагола.

**Таблица временных форм глагола**

| TENSE ВРЕМЯ | Indefinite (Simple) Простое | Continuous Длительное | Perfect Завершенное |
|---|---|---|---|
| Present Настоящее | I write Я пишу (вообще, обычно) | I am writing Я пишу (сейчас) | I have written Я (уже) написал |
| Past Прошедшее | I wrote Я (на) писал (вчера) | I was writing Я писал (в тот момент) | I had written Я написал (уже к тому моменту) |
| Future Будущее | I shall/will write Я напишу, буду писать (завтра) | I shall/will be writing Я буду писать (в тот момент) | I shall/will have written Я напишу (уже к тому моменту) |

Глаголы в формах **Indefinite (Simple)** описывают обычные, повторяющиеся действия как ***факт*** — безотносительно к их длительности или к результату действия:

***I go to school every day.*** — Я хожу в школу каждый день. В этом высказывании интересует не время, потраченное на дорогу, не процесс движения, не результат походов, а сам факт: я хожу в школу, а не на работу.

То же самое относится к прошедшему времени и к будущему:

***I went to school when I was a boy.*** — Я ходил в школу, когда был мальчиком.

***I shall go to school when I grow up.*** — Я буду ходить в школу, когда вырасту.

Отрицательная и вопросительная формы в Indefinite образуются при помощи вспомогательных глаголов **do, does, did** с частицей **not**, краткая форма: **don't, doesn't, didn't**. Порядок слов прямой. Вопросительные предложения образуются, как правило, простой перестановкой подлежащего и вспомогательного глагола. Вопросительные местоимения при этом стоят всегда впереди.

***He is a student. — Is he a student?***

***We do not write much. — Do we write much?***

***You have a computer. — What do you have?***

***She does not live in Moscow. — Does she live in Moscow?***

***He didn't like the film. — Did he like the film?***

Особую группу составляют разъединительные вопросы, которые переводятся как утверждения плюс «не так ли?» Они применимы к любому времени. Например:

***You speak English, don't you?*** Вы говорите по-английски, не так ли?

Но: ***Let us speak English, shall we?*** Давайте говорить по-английски, хорошо?

§2. **Правильные и неправильные глаголы.**

По способу образования прошедшего времени все глаголы в английском языке можно разделить на две группы: правильные и неправильные. У правильных глаголов вторая и третья формы (**Past Indefinite Tense** и **Past Participle** — простое прошедшее время и причастие прошедшего времени) совпадают между собой и образуются путем прибавления к основе глагола окончания ***-ed (-d):***

***to ask — asked*** ***to change — changed***
***to receive — received*** ***to work— worked***

При этом существует ряд особенностей:

а) если глагол оканчивается на ***-y*** с предшествующей согласной, то буква ***y*** меняется на ***i*** и добавляется окончание ***-ed***

***to supply — supplied*** ***to apply — applied***

если глагол оканчивается на ***-y*** с предшествующей гласной, то буква ***y*** не меняется и добавляется окончание ***–ed***

***to stay — stayed*** ***to play — played***

б) если глагол оканчивается на согласную с предшествующим кратким гласным звуком, то согласная на конце удваивается:

***to stop — stopped***

После звонких согласных и гласных звуков окончание ***-ed*** или ***-d*** произносится как [d] ***loved, said,*** а после глухих согласных как [t] ***looked.***

После звуков [d] и [t] на конце слова окончание ***-ed (-d)*** произносится как [id] ***landed, started.***

Неправильные глаголы образуют вторую и третью формы различными способами, без четких правил. Это





наиболее часто употребляемые глаголы. (В конце книги приведен список часто встречающихся неправильных глаголов.)

Глаголы в формах **Continuous** описывают действие как ***процесс***, как ***длительность*** — в соотнесенности с определенным моментом в прошлом, настоящем или будущем:

***I am reading a book now.*** — Я читаю книгу (сейчас, в настоящий момент).

***I was reading a book yesterday at 5 o'clock.*** — Я читал книгу вчера в 5 часов.

***I will be reading a book tomorrow at 7 o'clock.*** — Я буду читать книгу завтра в семь часов.

Помимо этой функции, глаголы **в *Present Continuous Tense*** выражают действие, отнесенное в ближайшее будущее:

***We are leaving for Moscow in July.*** —Мы уезжаем в Москву в июле.

Глаголы в формах **Perfect** выражают действие ***завершенное***, приведшее к определенному ***результату*** (или к отсутствию результата). Можно сказать, что с помощью форм ***Perfect*** мы ***подводим итоги*** определенному периоду времени, определенных действий. Время подведения итогов — либо настоящий момент ***Present Perfect,*** либо момент в прошлом ***Past Perfect***, либо — в будущем ***Future Perfect.***

***I have written the letter.(Present Perfect)*** — Я (только что) написал письмо (передо мной письмо как результат).

***I had written the letter when he came. (Past Perfect)*** — Я написал письмо, когда он пришел. (2 действия, одно завершилось раньше другого)

***I will have written the letter by 10 o'clock tomorrow. (Future Perfect)*** — Я напишу письмо к 10 часам завт-

ра. (действие завершится к определенному моменту времени в будущем).

*Exercise 5.5.* **Open the brackets:**

1. He (know) several foreign languages.
2. I (learn) English at school.
3. Usually the train (leave) at 10 o'clock.
4. Our grandparents (live) now in Moscow.
5. He (visit) them regularly last year.
6. As a rule I (go) to my Academy by bus.
7. She (work) abroad next year.
8. She (not like) poems.
9. Your children usually (ask) many questions.
10. At present he (work) at school.
11. My brother (like) music.
12. What you (do) yesterday?
13. His sister (go) to the seaside next July.
14. Soon we (leave) the school.
15. Who (take) his book yesterday?

*Exercise 5.6.* **Put the verb *to write* in the appropriate form:**

1. We often ... letters to our parents.
2. What ... you ... now?
3. Yesterday they ... ... tests from 10 till 12 o'clock.
4. Who ... ... this letter tomorrow?
5. I ... ... some letters last week.
6. What ... you ... tomorrow at 10?
7. When I came in she ... ... a letter.
8. Do you often ... letters to your parents?
9. I ...not ... this article now. I ... ...it in some days.
10. ... he ... his report at the moment?
11. What ... she ... in the evening yesterday?
12. As a rule he ... tests well.





*Exercise 5.7.* **Put the verbs in brackets in the right form:**

1. Peter and Ann (go) away five minutes ago. 2. I (write) the letter but I (not send) it. 3. He just (go) away. 4. She already (answer) the letter. 5. She (answer) it on Tuesday. 6. I just (tell) you the answer. 7. I (read) that book in my summer holidays. 8. The greengrocer (sell) now all his vegetables. 9. He (sell) all of them half an hour ago. 10. I (not see) him for three years. I (be) glad to see him again some time. 11. What you (do)? I (copy) the text from the text-book now. 12. He (go) to Moscow next week? 13. He (not smoke) for a month. He is trying to give it up. 14. When he (arrive)? — He (arrive) at 2:00. 15. You (switch off) the light before you left the house? 16. I (read) these books when I was at school. I (like) them very much. 17. I can't go out because I (not finish) my work. 18. I already (tell) you the answer yesterday. 19. What you (do) tomorrow In the morning? 20. I (not meet) him last week. 21. I usually (leave) home at seven and (get) here at twelve. 22. Here is your watch. I just (find) it. 23. You (not have) your breakfast yet?

*Exercise 5.8.* **Translate into English. Pay attention to the Tense used:**

1. Я никогда об этом не слышал. 2. Мальчику только четыре года, но он уже научился читать. 3. Вы уже переехали на новую квартиру? 4. Вы сделали много ошибок в диктанте. 5. Вы когда-нибудь видели этого писателя? 6. В этом месяце я прочитал две новых книги. 7. Мой приятель уехал в Киев неделю назад и еще не писал мне. 8. Я не видел своего брата за последнее время. 9. Вы читали сегодня в газете статью о нашем новом театре? 10. Вы были когда-нибудь в Лондоне? — Нет, я поеду туда в этом году. 11. Вы уже прочитали

эту книгу? — Как она вам понравилась? 12. Я хотел посмотреть этот фильм на прошлой неделе, но смог посмотреть его только вчера. 13. В этом году я собираюсь поступать в институт. 14. Ваш сын уже окончил институт? 15. Его дочь окончила школу в прошлом году.

✍ ***Exercise 5.9.*** **Translate into English:**

1. Он писал письмо, когда я пришел к нему. 2. Он делал свою работу, пока его братья играли в футбол. 3. Я упал, когда бежал за автобусом. 4. Мы делали уроки, когда пошел дождь. 5. Когда учитель давал урок, новая ученица вошла в класс. 6. Когда зазвонил телефон, я работал в саду. 7. Я увидел своих одноклассников, когда я шел по улице. 8. Начался дождь, когда мы наблюдали за игрой.

✍ ***Exercise 5.10.*** **Put the verbs in brackets in the right form. Use Past Tenses:**

1. When I (arrive) the lecture already (start). 2. Peter (sit) in a dark room with a book. I told him that he (read) in very bad light. 3. Mother (make) a cake when the light (go) out. She had to finish it in the dark. 4. When I arrived Jenny (leave), so we only had time for a few words. 5. John (have) a bath when the phone rang. He (get) out of the bath and (go) to answer it. 6. When we (come) to the airport, the plane already (land). 7. He suddenly (realize) that he (travel) in the wrong direction. 8. You looked very busy when I saw you last night. What you (do)? 9. I (call) Paul at 7.00 but it wasn't necessary because he already (get) up. 10. When I (see) him he (cross) the street. 11. While he (water) the flowers it (begin) to rain. 12. Ann said that she (be) on holiday. I (say) that I (hope) that she (enjoy) herself. 13. When I (look) through your books I (notice) that you (have) a copy of





Jack London. 14. She said that she (not like) her present flat and (try) to find another. 15. When Ann (finish) her homework she (turn) on TV.

✍ ***Exercise 5.11.*** **Define the Tense and translate into English:**

1. Вчера в 9 часов вечера я смотрел телевизор. 2. Она сказала, что еще не выполнила домашнее Exercise. 3. Когда пришел мой друг, я еще не кончил завтракать. 4. Когда я встретил ее впервые, она работала в школе. 5. Все студенты выполнили Exercise правильно после того, как преподаватель рассказал им, как его делать. 6. Когда мы вышли на улицу, ярко светило солнце. 7. Мой друг сказал, что его брат уже приехал. 8. Я читал книгу, когда услышал телефонный звонок. 9. После того, как врач осмотрел больного, он поговорил с его родственниками. 10. Когда мы пришли на остановку, автобус уже ушел. 11. Он смотрел телевизор, когда пришел его друг. 12. Почтальон обычно приходит в девять часов утра. Сейчас уже половина десятого, а он все еще не пришел. 13. Каждый вечер я смотрю телевизор. 14. Служащие заканчивают работу в шесть часов вечера. 15. Разве она не знала об этом? 16. Разве вы не видели этот фильм? 17. Она еще не брала своего маленького сына в театр, но уже водила его в кино в первый раз несколько дней назад. 18. Он обычно очень внимательно слушает учителя, но сейчас он не слушает, у него болит голова. 19. Я не играл в футбол с прошлого года. 20. Маленькая девочка часто помогает своей матери. 21. Автор еще молодой человек. Он написал свою первую книгу в 1989 году. 22. Сейчас 8 часов утра и ребенок уже проснулся. Вчера утром он проснулся раньше. 23. В школе он играл в футбол.

✍ ***Exercise 5.12.*** **Put in the appropriate words from the list:**

1. ... I go to the Institute by bus.
2. I do my morning exercises...
3. We shall have invited you...
4. Who has seen him ...?
5. He had worked here ...
6. ... the plant was producing new machines.
7. We have ... done our work.
8. What are you doing ...?
9. He was going home ...
10. Will you have read the book ...?
11. Did you see them ...?
12. We translated this text ... .

1) before the Institute
2) by **Tuesday**
3) during October
5) every day
6) just
7) last week
8) now
9) recently
10) usually
11) when we met
12) when he comes home
13) already

***Exercise 5.13.*** **Change the sentences into questions as in the example. Answer the questions.**

Example: ***He can play chess. — Can't he play chess? — Yes, he can. / No, he can't.***

1. They left for Moscow.
2. He has finished his work.
3. She will visit us on Monday.
4. She has many relatives.
5. His father works here.
6. You know his address.
7. We shall go home together.
8. They are at home.
9. I am listening to you.
10. His friends were working in the garden.
11. You have done the task.

# UNIT 6
# THE UNITED KINGDOM

I. **Дифтонги** [iə], [ai], **согласный** [h].
II. **Text A: «United Kingdom»,**
**Text B: «History of London».**
III. **Модальные глаголы и их заменители.**

**Дифтонг** [iə]

Ядро звука — гласный [i], а скольжение происходит в направлении нейтрального гласного, имеющего оттенок звука [ʌ].

**Дифтонг** [ai]

Ядро дифтонга — гласный звук, похожий на русский звук [а] в слове ***чай***. Скольжение происходит в направлении звука [i], однако его образование полностью не достигается, в результате чего слышится лишь начало звука [i].

**Согласный звук** [h].

Этого звука в русском языке нет. В английском языке он встречается только перед гласным и на слух представляет собой легкий, едва слышный выдох. В отличие от русского [х] английский [h] образуется без всякого участия языка, поэтому необходимо следить за тем, чтобы задняя спинка языка не поднималась близко к мягкому нёбу.

**Exercise A**

year — hear — ear
here — near — fear





tear — peer — beer
rear — leer — mere

**Exercise B**

mile — pile — kite
site — side — ride
height — light — fight
might — right — tight
pike — hike — hide

**Exercise C**

hope — heap — hat
heal — heel — heal
health — height — hear
hood — his — ham
her — here — hate

**Exercise D**

hit — heat — head
hall — hollow — hammer
hand — happy — hard
harm — hair — hazard

## Text A: «THE UNITED KINGDOM»

The United Kingdom, officially the United Kingdom of Great Britain and Northern Ireland, is **an island nation** and **constitutional monarchy** in north-western Europe, member of the European Union (EU).

Great Britain is the largest of the British Isles. It **comprises**, together with **numerous** smaller islands, England and Scotland, and the **principality** of Wales. Northern Ireland, also known as Ulster, occupies the north-eastern part of the island of Ireland.

The United Kingdom is bordered to the south by the **English Channel**, which separates it from continental Europe, to the east by the **North Sea**, and to the west by the Irish Sea and the Atlantic Ocean. The only land border is between Northern Ireland and the Republic of Ireland. The total area of the United Kingdom is 242 sq km. The capital and largest city is London.

The names «United Kingdom», «Great Britain», and «England» are often used **interchangeably**. The use of «Great Britain», often shortened to «Britain», to describe the whole kingdom is common and widely **accepted**, although **strictly** it does not **include** Northern Ireland.

However, the use of «England» to mean the «United Kingdom» is not acceptable to members of the other **constituent** countries, especially the Scots and the Welsh.

England and Wales were united **administratively**, politically, and **legally** by 1543. The crowns of England and Scotland were united in 1603, but the two countries remained separate political **entities** until the 1707 Act of Union, which formed the Kingdom of Great Britain with a **single** legislature. From 1801, when Great Britain and Ireland were united, until the formal establishment of the Irish Free State in 1922, the kingdom was officially named the United Kingdom of Great Britain and Ireland.

Hong Kong, which has 200,000 population, was returned to China in 1997.

The mainland of the island of Great Britain is 974 km at its longest and 531 km at its widest; however, the highly **indented** nature of the island's coastline means that nowhere is more than about 120 km from the sea.





The climate of the United Kingdom is mild relative to its **latitude**, which is the same as that of Labrador in Canada. The mildness is an effect of the warm Gulf Stream. This current brings the **prevailing** south-west winds that **moderate** winter temperatures and bring the **depressions** which have the main day-to-day influence on the weather. The western side of the United Kingdom tends to be warmer than the eastern; the south is warmer than the north. The **mean** annual temperature is 6 °C in the far north of Scotland; 11 °C in the south-west of England. Winter temperatures seldom are below –10 °C and summer temperatures rarely higher than 32 °C. The sea winds also bring plenty of moisture; **average annual precipitation** is more than 1,000 mm.

Rain tends to fall **throughout** the year, frequently turning to snow in the winter, especially in Scotland, the mountains of Wales, and northern England. The western side of Britain is much wetter than the eastern: average rainfall varies is from 5,000 mm in the western Highlands of Scotland, to less than 500 mm in parts of East Anglia in England.

The population of United Kingdom is more than 56 mln people, but it is one of the world's leading commercial and industrialized nations. **In terms of** gross national product (**GNP**) it ranks fifth in the world, with Italy, after the United States, Japan, Germany, and France.

*Vocabulary:*

**island nation** — островное государство

**constitutional monarchy** — конституционная монархия

**European Union** — Европейский союз

**to comprise** — включать

**numerous** — многочисленные
**principality** — княжество
**North Sea** — Северное море
**interchangeably** — взаимозаменяемо
**to accept** — принимать, допускать
**strictly** — строго, зд. строго говоря
**include** — включать
**constituent** — составляющий
**administratively** — административно
**entities** — зд. субъекты
**single** — зд. единая
**indented** — зд. изрезанная
**latitude** ['lætɪtju:d] — широта геогр.
**prevailing** [prɪ'veɪlɪŋ] — преобладающий
**moderate** — умеренный
**depressions** — зд. циклоны
**mean** — средний
**throughout** [θru:'ðut] — на всем протяжении
**average annual precipitation** — среднегодовое количество осадков
**in terms of** — говоря (о чем-либо)
**GNP (Gross National Product)** — валовой национальный продукт.

***Exercise 6.1.*** **Translate into English.**

1. Официальное название Великобритании — Соединенное Королевство Великобритании и Северной Ирландии.

2. Соединенное королевство является членом Европейского союза и конституционной монархией.

3. Северная Ирландия занимает северо-восточную часть острова Ирландия.

4. Пролив Ла-Манш отделяет Соединенное Королевство от континентальной Европы.





***Exercise 6.2.*** **Use the following phrases and word compinations to retell the text:**

1. As I understood from the text...
2. According to the text...
3. According to the author...
4. As it is described in the text...
5. As it is said in the text...
6. As the author puts it...
7. According to the figures (data, information, opinions) from the text...

***Exercise 6.3.*** **Discuss the following statements. Use the following phrases to express your opinion:**

1. It seems to me (that)...
2. I would like to say that...
3. As I see it...
4. I think that...
5. I guess...
6. I suppose...
7. I (strongly) believe that...
8. I am (absolutely) sure that...

Statement A: The United Kongdom is a small country. It is one of the leading countries now because it had many rich colonies in the past.

Statement B: UK will loose Northern Ireland soon and Wales and Scotland later, like it lost Hong Kong in 1997, because of the differences in languages, culture and history.

Statement C: British people don't travel much because they live not too far from the sea (ocean).

**Table: Modern history of Great Britain**

| | |
|---|---|
| 1914 | World War I begins. |
| 1918 | World War I ends. |
| 1919 | First regular London-Paris air service instituted. |
| 1926 | John Logie Baird demonstrates television system. |
| 1927 | British Broadcasting Corporation chartered. |
| 1928 | Alexander Fleming discovers penicillin. |
| 1936 | First regular television broadcasts from Alexandra Palace. |
| 1947 | Independence for India and Pakistan. Nationalization of coal mines and railways. |
| 1949 | Foundation of North Atlantic Treaty Organization. |
| 1952 | Britain explodes atomic bomb in Australia. |
| 1955 | Irish Republican Army begins terrorist campaign. |
| 1960 | Independence for Cyprus and Nigeria. «The Beatles» form. |
| 1969 | Oil discovered off Scottish coast. |
| 1980 | North Sea oil makes Britain self-sufficient in certain petroleum products. |
| 1986 | Trident ballistic missile system ordered from US. |

***Exercise 6.4.*** **Which events in the modern history of Great Britain had an impact on world science and technology. Choose five the most important and briefly describe them.**

***Exercise 6.5.*** **What inventions in UK made life more convinient and safer? What inventions have become dangerous for the mankind?**

***Exercise 6.6.*** **Use the information below to be able to make a report on the following:**

1) Land, 2) Climate, 3) Population, 4) Ethnic groups, 5) Economy.





**LAND**

**Area**
241,752 sq km

**Highest Point**
Ben Nevis
1,343 m above sea level

**Lowest Point**
Holme Fen 3 m below sea level

**CLIMATE**

**Average Temperatures**

| | |
|---|---|
| London | |
| January | 4 °C |
| July | 18 °C |
| Edinburgh | |
| January | 3 °C |
| July | 15 °C |

**Average Annual Precipitation**

| | |
|---|---|
| London | 590 mm |
| Edinburgh | 680 mm |

**POPULATION**

**Population**
58,395,000 (1994 estimate)

**Population Density**
242 persons/sq km (1994 estimate)

**Urban/Rural population**
92% Urban
8% Rural

**Largest Cities**

| | |
|---|---|
| London (Greater) | 6,933,000 |
| Birmingham | 1,017,000 |
| Leeds | 724,500 |
| Glasgow | 681,000 |

**Ethnic Groups**

94,5% English, Scottish, Welsh, or Irish

5,5% Other

**Languages**

*Official Language*

English

*Other Languages*

Welsh, Scots-Gaelic, other minority languages

**Religions**

54% Anglicanism

13% Roman Catholicism

33% Other

*including other Protestant denominations, Islam, Judaism, Hinduism, and Sikhism*

**ECONOMY**

**Gross Domestic Product**

US $1,023,900,000,000 (1994)

**Chief Economic Products**

*Agriculture*

Wheat, barley, potatoes, sugar beets, oilseed rape, livestock, animal products.

*Fishing*

Mackerel, herring, cod, plaice

*Mining*

Coal, limestone, petroleum and natural gas.

*Manufacturing*

Machinery and transport equipment, food products, chemical products, minerals and metal products.





**Employment Statistics**

58% Trade and Services

23% Manufacturing and Industry

16% Business and Finance

2% Agriculture, Forestry, and Fishing

1% Military and Defence

**Major Exports**

Industrial and electrical machinery, automatic data processing equipment, road vehicles, petroleum.

**Major Imports**

Road vehicles, industrial and electrical machinery, automatic data processing equipment, petroleum, paper and paperboard, textiles, food.

**Major Trading Partners**

Germany, the United States, France, the Netherlands, Italy, Japan

## Text B: «HISTORY OF LONDON»

The Romans were the first to settle and occupy the Celtic fortress of Londinium. Construction of a bridge in 100 A.D. made London an important junction: it soon became a busy commercial and administrative settlement, and in the 2nd century A.D. a wall was built round the city.

The Roman Empire fell in the 5th century. London have maintained its trading activity. In the 9th century Danish invaders destroyed much of the city. They were followed by the Saxons led by King Alfred the Great, who entered the city in 886. The Danes remained a powerful force in England, however, and it was not until the reign

of Edward the Confessor, which began in 1042, that civic stability was re-established, to be cemented by the Norman Conquest in 1066.

William the Conqueror centred his power at the Tower of London, and his White Tower is still the heart of this impressive monument.

The City soon united its economic power with political independence. Late in the 12th century it elected its own Lord Mayor. From 1351 it elected its own council, and by the end of the 14th century the reigning sovereign could not enter the City without permission.

In the reign of Elizabeth I had the arts a renaissance with such great dramatists as Shakespeare, Marlowe, and Ben Jonson.

In 1665, London had been devastated first by the Great Plague, and then by the Fire of London, which destroyed most of the city the following year. During the reconstruction of the city, following the original street pattern, the architect Sir Christopher Wren was given responsibility for the design of a number of State-funded buildings, including St. Paul's Cathedral.

The western part of London was developed under the Hanoverian Kings: great squares were laid out such as those of Grosvenor, Cavendish, Berkeley, and Hanover, and more bridges were built across the river. Public services were improved, such as the water supply and sewerage systems, and the streets were paved.

In the 19th century London's population began to rise still more rapidly: it increased sixfold over the century as a whole, thanks to influx from all over the British Isles, from Britain's colonies, and from continental Europe. The Industrial Revolution was creating huge numbers of jobs, but never enough to satisfy the hopes of all





the poor people who came to the capital. The novels of Charles Dickens tell us about the social problems of that period.

The First World War had little effect on London, but the Depression that followed in the late 1920s and early 1930s hit the whole country, including the capital. There were hunger marches and riots. London was to pay far more dearly during World War II. The intensive bombing of London (The Blitz) in 1940–1941 took the lives of 10,000 people and left 17,000 injured. Countless historic buildings were damaged, including the Houses of Parliament.

After the war London was to re-emerge as a radically different city. The docks had been so severely damaged that reconstruction, a very expensive process, was not reasonable. By the end of the 1950s most of the war damage had been repaired. New skyscrapers were built, outdoing each other in height and spectacular design. The 30-storey Post Office Tower was built in 1965. It is 189 m high. Other significant post-war developments include the 183 m National Westminster Bank Building (1979); and Britain's highest building, the 244 m Canary Wharf Tower on the Docklands site, near to a new City airport.

***General understanding:***

1) What was the original name of London? Why was it so important for Romans?

2) Who was King Alfred the Great? When did he enter the city?

3) What is still the reminder of William the Conqueror?

4) How was Britain governed in $12^{th}$–$14^{th}$ centuries?

5) How did plague influenc the history of London?

6) Who was in charge of the reconstruction of the city? Why did it need reconstruction?

7) Why did the population of London grow in the 19th century?

8) How did the First World War affect the history of London? What about the WWII?

9) How did London change after the WWII?

10) What are the names of skyscraper buildings in London?

## GRAMMAR

Модальные глаголы и их эквиваленты.

Модальные глаголы показывают отношение говорящего к действию, выраженному инфинитивом. Например, сравните:

***You can speak English.*** Вы можете (умеете) говорить по-английски.

***You must speak English.*** Вы должны говорить по-английски. ***You may speak English.*** Вы можете говорить по-английски. (Вас поймут.)

Как видим, в одном и том же предложении изменение модального глагола меняет смысл всего предложения, т. е. меняется отношение к действию, выраженному инфинитивом.

Модальные глаголы не имеют форм во всех временах, для этого употребляются их эквиваленты (заменители).

Вопросительные и отрицательные предложения с модальными глаголами строятся без вспомогательных глаголов: ***Can you help me? — Yes, I can. — No, I can't.*** Вы можете помочь мне? — Да. — Нет.

К основным модальным относятся глаголы:





***can*** — мочь, быть в состоянии, ***could*** — прошедшее время

предполагает наличие физической, умственной и прочих возможностей, позволяющих сделать что-либо:

***I can swim.*** — Я могу (я умею) плавать.

***I could translate this text.*** (Я мог, был в состоянии) перевести этот текст.

В будущем времени у глагола ***can*** есть заменитель — конструкция ***to be able to*** (быть в состоянии что-либо сделать): ***I shall be able to help you when I am free.*** — Я смогу помочь тебе, когда освобожусь.

***may*** — иметь возможность, получить разрешение (делать что-либо),

прошедшее время — ***might*** — ***May I help you?*** — Можно вам помочь? — ***Yes, you may.*** — Да, можно.

В будущем времени у модального глагола ***may*** есть заменитель — конструкция ***to be allowed to*** (получить разрешение сделать что-либо).

***He will be allowed to take the book.*** Ему разрешат взять книгу.

***must*** — должен, обязан.

***You must write it down now.*** — Вы должны написать это сейчас.

Заменителями глагола ***must*** являются глаголы ***to have to*** и ***to be to***, которые имеют некоторые дополнительные оттенками значения. Глагол to ***have to*** означает долженствование, вызванное обстоятельствами, вынужденную необходимость, в то время как глагол ***to be to*** — долженствование, связанное с расписанием, планом или заранее сделанной договоренностью.

***She had to stay at home.*** — Она вынуждена была (ей пришлось) остаться дома.

***The train was to arrive at 8 in the evening*** — Поезд должен был прибыть в 8 вечера. (По расписанию).

После модальных глаголов и некоторых их эквивалентов инфинитив употребляется без частицы to.

Заменителями модального глагола ***must*** являются также модальные глаголы ***ought to, should*** (в значении совета, рекомендации, упрека) и ***shall*** (испрашивается разрешение на совершение действия).

***You should enter the Institute.*** Вам следует поступить в институт (рекомендация, совет),

В сочетании с перфектным инфинитивом глагол ***should*** выражает сожаление о невыполненном действии и переводится «следовало бы».

***You should have helped them.*** Вам следовало бы помочь им. (Но вы не сделали этого).

***Shall I read?*** Мне следует читать?

Модальный глагол ***would*** может иметь следующие значения:

1) Вежливая просьба. ***Would you help me?*** Не поможете ли вы мне?

2) Повторяемость действия в прошлом. ***He would often help me.*** Он, бывало, часто помогал мне.

3) Стойкое нежелание совершать какие-либо действия. ***He wouldn't listen to me.*** Он никак не хотел слушать меня.

Модальный глагол ***need*** — «нужно, надо» употребляется, в основном, в отрицательных предложениях. ***You needn't do it now.*** Вам не нужно делать это сейчас.

***Exercise 6.7.*** **Analyse the use of modal verbs and translate the following sentences:**

1. Who can answer my question?
2. Nobody could translate this text.





3. He ought to do this task at once.
4. Must I attend this meeting? — No, you needn't.
5. You should have shown your notes to the teacher.
6. I asked him, but he wouldn't listen to me.
7. They should visit her, she is in the hospital.
8. Last summer we would often go to the country.
9. Your son can do this work himself.
10. Would you tell me the way to the station?
11. Your friend might have informed us.
12. May I leave for a while? — Yes, you may.
13. She should be more attentive at the lessons.
14. You needn't come so early.

***Exercise 6.8.*** **Insert necessary modal verbs:**

1. I... not go to the theatre with them last night, I... revise the grammar rules and the words for the test. 2. My friend lives a long way from his office and... get up early. 3. All of us... be in time for classes. 4. When my friend has his English, he... stay at the office after work. He (not)... stay at the office on Tuesday, Thursday and Saturday and... get home early. 5.... you... work hard to do well in your English? 6. «... we discuss this question now?» «No, we.... We... do it tomorrow afternoon.» 7. I'm glad you... come. 8. «... you... come and have dinner with us tomorrow?» «I'd love to.» 9. «Please send them this article.» «Oh,... I do it now?»

***Exercise 6.9.*** **Translate into English using modal verbs:**

1. Мы обязательно должны писать диктант сегодня? — Да, завтра мы будем учить новые слова. 2. Вчера мне пришлось ответить на все эти письма. 3. Виктора тоже пригласить на обед? — Да, сделайте это, пожалуйста. 4. Вам пришлось остаться дома, потому что

была плохая погода? 5. Вы обязательно должны прийти и посмотреть нашу новую квартиру.— С удовольствием. 6. Я рад, что мне не пришлось заканчивать эту работу вчера. 7. Я не люблю поздно ложиться спать, но иногда мне приходится. 8. Можно мне пойти погулять сейчас? — Нет, нельзя. Ты должен скоро ложиться спать. 9. Вам следует навестить вашего друга. Он вчера не пришел на урок. 10. Почему ты не пришла? — Я не могла, я должна была помочь маме по дому. 11. Вам не нужно идти в библиотеку, у нас много книг дома, и вы можете взять любую, какую хотите.

# UNIT 7
# THE UNITED STATES OF AMERICA

**I. Согласные звуки** [θ], [ð].
**II. Text A: «The USA»,**
**Text B: «Transport Sustem of the USA».**
**III. §1. Согласование времен в главном и придаточном предложениях,**
**§2. Страдательный залог.**

**Согласный звук [θ]**

В русском языке подобного звука нет. Звук [θ] — глухой. При его произнесении язык распластан и ненапряжен, кончик языка образует узкую плоскую щель, неплотно прижимаясь к нему. В эту щель с силой проходит струя воздуха. Кончик языка не должен сильно выступать за верхние зубы или слишком плотно прижиматься к губам. Зубы должны быть обнажены, особенно нижние, так, чтобы нижняя губа не касалась верхних зубов и не приближалась к ним.

**Согласный звук [ð]**

При произнесении звука [ð] органы речи занимают такое же положение, как и при произнесении звука [θ]. Звук [ð] отличается от звука [ð] только звонкостью.

**Exercise A**

through — fifth — myth
thief — booth — tooth

thank — think — thought
theatre — theory — theft

**Exercise B**
thermometer — thick — thin
thirst — thirty — thorough
threat — three — thunder
threw — throat — thumb
faith — hearth — path
bath — booth — broth

**Exercise C**
this — that — these — those
there — though
them — they — the

## Text A: «THE UNITED STATES OF AMERICA»

The United States of America is the 4th largest country in the world after Russia, Canada and China. It occupies the central part of the North American continent.

The United States of America is a federal republic, consisting of 50 states including the states of Alaska and Hawaii. **Outlying areas** include Puerto Rico, American Samoa, Guam, and the US Virgin Islands.

The northern boundary is partly formed by the Great Lakes and the St Lawrence River; the southern boundary is partly formed by the Rio Grande. United States also has a sea-border with Russia.

The total area of the United States (including the **District of Columbia)** is about 9,809,000 sq km.

The country is washed by 3 oceans: the Arctic, the Atlantic and the Pacific. The country has many lakes, with the Great Lakes **included**. There are also many rivers on the US territory. The longest of them are the Mississippi, the Missouri, the Columbia, the Rio Grande and some others. On the US territory there are mountains and lowlands. The highest mountains are the Rocky Mountains, the Cordillera and the Sierra Nevada. The highest **peak**, Mount McKinley, is **located** in Alaska.





The climate conditions are rather different. The country is rich in natural and mineral resources: oil, gas, iron ore, coal and various metals.

The USA is a highly developed industrial and agricultural country. The main industrial branches are **aircraft**, rocket, automobile, electronics, radio-engineering and others.

Americans are **made up** from nearly all races and nations. The country population is over 250 mln. The national symbol of the USA is its national flag «Stars and **Stripes**», having 50 white stars and 13 white and red stripes on its field, **symbolising** the number of the original and present day states.

Officially the country comprises 50 states and one District of Columbia. The states differ in size, population and economic development. Each state has its own capital. The capital of the USA is Washington. It is situated in the District of Columbia on the banks of the Potomac river and is named after the 1st US President - George Washington. There are many large cities in the country: New York, Los Angeles, Chicago, Philadelphia, Detroit, San-Francisco, Cleveland and some others.

The United States of America is a federal state, headed by the President. According to the US Constitution the powers of the Government are divided into 3 branches: legislative, executive and judicial.

The **legislative power** belongs to the Congress consisting of the Senate and the House of Representatives. The

Senate **represents** the states while the House of Representatives — the population. The executive power belongs to the President and his Administration (Vice-President and Cabinet of Ministers). The judicial power **belongs** to the Supreme Court and the system of Federal, state and district courts.

There are several political parties in the USA, the largest of them are the Republican (symbolised by a **donkey**) and the Democratic (symbolised by an elephant).

*Vocabulary:*

**outlying areas** — внешние территории
**District of Columbia** — округ Колумбия
**to pass** — проходить через
**frontier** — граница
**to include** — включать
**lowlands** — низины
**peak** — вершина, пик
**to be located** — располагаться
**aircraft** — воздушное судно
**to be made up from** — быть составленным, состоять из
**stripe** — полоса
**to symbolize** — символизировать
**legislative power** — законодательная власть
**to represent** — представлять
**to belong** — принадлежать
**donkey** — осел

*ADD TO YOUR ACTIVE VOCABULARY:*

a) **Great Plains** — Великие равнины
**Appalachian mountains** — Аппалачские горы
**Rocky mountains** — Скалистые горы
**Add to your vocabulary:**





b) **driveway** — проезд, выезд
**sidewalk** — тротуар
**drive-thru shop** — магазин, покупки в котором производятся через окно автомобиля
**toll-road** — платная дорога (магистраль)
**toll-free road** — бесплатная дорога
**highway, parkway, thruway** — автомагистрали
**turnpike** — главная магистраль
**shopping-mall** — торговый центр
**shopping plaza** — открытая торговая площадь, торговый ряд
**free delivery** — бесплатная доставка
**telephone order** — телефонный заказ
**sale** — распродажа
**discount** — скидка
**seasons sale** — сезонная распродажа
**clearance sale** — распродажа залежей товаров
**discount coupon** — купон на скидку
**free gift** — бесплатный подарок

*Exercise 7.1.* **Translate into English:**

1. США — четвертая по размеру страна после России, Канады и Китая.

2. Внешние границы включают в себя Пуэрто Рико, Американское Самоа и Виргинские острова.

3. 48 Штатов граничат на севере с Канадой, а на юге с Мексикой.

4. США имеет морскую границу с Российской Федерацией.

6. США омывается тремя океанами: Северным Ледовитым, Атлантическим и Тихим.

7. США — высокоразвитое промышленное государство со множеством отраслей.

8. Аэрокосмическая и электронные отрасли промышленности США занимают особое место в экономике США.

9. Каждый штат имеет свою столицу.

## Text B: «TRANSPORT SYSTEM OF THE USA»

The development of transport facilities was very important in the growth of the United States. The first travel routes were natural waterways. No surfaced roads existed until the 1790s, when the first turnpikes were built. Besides the overland roads, many canals were constructed between the late 18th century and 1850 to link navigable rivers and lakes in the eastern United States and in the Great Lakes region. Steam railways began to appear in the East in the 1820s. The first transcontinental railway was constructed between 1862 and 1869 by the Union Pacific and Central Pacific companies, both of which received large subsidies from the federal government. Transcontinental railways were the chief means of transport used by European settlers who populated the West in the latter part of the 19th century. The railways continued to expand until 1917, when their length reached a peak of about 407,000 km. Since then motor transport became a serious competitor to the railway both for passengers and freight.

Air transport began to compete with other modes of transport after World War I. Passenger service began to gain importance in 1920s, but not until the beginning of commercial jet craft after World War II did air transport become a leading mode of travel.

During the early 1990s railways annually handled about 37.5 per cent of the total freight traffic; trucks carried 26 per cent of the freight, and oil pipelines conveyed 20 per cent. Approximately 16 per cent was shipped on inland waterways. Although the freight handled by airlines amounted to only 0.4 per cent of the total, much of the cargo consisted of high-priority or high-value items.





Private cars about 81 per cent of passengers. Airlines are the second leading mover of people, carrying more than 17 per cent of passengers. Buses are responsible for 1.1 per cent, and railways carry 0.6 per cent of passengers.

### Roads and Railways

The transport network spreads into all sections of the country, but the web of railways and highways is much more dense in the eastern half of the United States.

In the early 1990s the United States had about 6.24 million km of streets, roads, and highways. The National Interstate Highway System, 68,449 km in length in the early 1990s, connected the nation's principal cities and carried about one-fifth of all the road and street traffic.

More than 188 million motor vehicles were registered in the early 1990s. More than three-quarters were cars — one for every two persons in the country. About one-fifth of the vehicles were lorries. Amtrak (the National Railroad Passenger Corporation), a federally subsidized concern, operates almost all the inter-city passenger trains in the United States; it carried more than 22 million passengers annually in the early 1990s.

*General understanding:*

1. What were the first routes in the US?
2. When was the first transcontinental railway constructed?
3. What was the length of railroads in 1917?

4. When did air transport start to gain importance?

5. How many motor vehicles were registered in US in early 90s?

6. What is Amtrak? How many passengers did it carry annually in the early 90s?

## GRAMMAR

**§1. Согласование времен в главном и придаточном предложениях.**

В английском сложноподчиненном предложении с придаточным дополнительным (вопрос «что?», «кто?», «чего?» и т. д.) соблюдаются ***правила согласования времен*** в главном и придаточном предложениях. Эти правила сводятся к следующему:

1. Если глагол-сказуемое главного предложения стоит в ***настоящем*** или ***будущем*** времени, то глагол-сказуемое придаточного дополнительного предложения может стоять в ***любой*** временной форме, требуемой смыслом, например:

***He says you are right.*** –Он говорит, что ты прав.

***He will tell why he was not at school yesterday.*** — Он скажет, почему он не был в школе вчера.

2. Если глагол-сказуемое главного предложения стоит в ***прошедшем*** времени (обычно — в ***Past Indefinite***), то и глагол дополнительного придаточного предложения должен стоять в одном из прошедших времен, в том числе — в будущем с точки зрения прошедшего (***Future in the Past***).

***He said he would not go to school tomorrow.*** — Он сказал, что не пойдет в школу завтра.

При этом для обозначения действия, ***одновременного*** с действием, выраженным сказуемым главного предложения, употребляется ***Past Continuous*** (в





русском языке — настоящее время) или ***Past Indefinite.***

***He told me he was preparing for his exam.*** — Он сказал мне, что готовится к экзамену.

Для обозначения действия, ***предшествующего*** действию, выраженному сказуемым главного предложения, обычно употребляется ***Past Perfect.*** На русский язык глагол-сказуемое придаточного в данном случае переводится глаголом в прошедшем времени:

***I didn't know he had left for Moscow.*** — Я не знал, что он уехал в Москву.

При указании определенного времени (in 1980, yesterday) предшествующее время выражается при помощи ***Past Indefinite.*** Например: ***I thought you were born in 1980.***

Для выражения будущего времени с точки зрения прошедшего времени употребляется форма ***Future in the Past*** где вспомогательный глагол ***will*** меняется на ***would,*** которая на русский язык переводится будущим временем:

***He told me that he would meet me at the Institute.*** — Он сказал мне, что встретит меня в институте.

✍ ***Exercise 7.2.*** **Open the brackets. Pay attention to the Sequence of Tenses. Translate the sentences into English.**

1. I did not know that you already (to read) this book 2. He did it better than I (to expect). 3. He said that the bus (to be) here soon. 4. I think it all happened soon after the meeting (to end). 5. They decided that they (to bring) us all the necessary books. 6. He said that he (can) not do it without my help. 7. He asked the students whether they ever (to see) such a book. 8. It was decided that we (to start) our work at eight o'clock. 9. I told you that I (to

leave) for Minsk on the following day. 10. The boy did not know that he already (receive) a good mark. 12. He wanted to know what (to become) of the books. 13. The visitors were told that the secretary just (to go out) and (to come back) in half an hour. 14. He said we (may) keep the books as long as we (to like). 15. We thought that he not (to be able) to make his work in time and therefore (to offer) to help her. 16. When I came they (to tell) me that he (to leave) half an hour before. 17. It was soon clear to the teacher that the control work (to be) a difficult one. 18. I decided that next year I (to go) to see my old friend again. I not (to see) him since he (to go) to Moscow.

## §2. Страдательный залог (Passive Voice).

Формы страдательного залога английских глаголов образуются с помощью вспомогательного глагола **to be** в соответствующем времени, лице и числе и **причастия II** (Participle II) смыслового глагола:

| | |
|---|---|
| Present Indefinite: | The letter **is written.** |
| Past Indefinite: | The letter **was written.** |
| Future Indefinite: | The letter **will be written.** |
| Present Continuous: | The letter **is being written.** |
| Past Continuous: | The letter **was being written.** |
| Future Continuous: | The letter **will be being written.** |
| Present Perfect: | The letter **has been written.** |
| Past Perfect: | The letter **had been written.** |
| Future Perfect: | The letter **will have been written.** |

Глагол-сказуемое в страдательном залоге показывает, что подлежащее предложения является объектом действия со стороны другого лица или предмета.





Сравните: ***I bought a book.*** — Я купил книгу.
***The book was bought (by me).*** — Книга была куплена (мной).

Глаголы в страдательном залоге на русский язык переводятся

1. глаголом быть + краткая форма причастия страдательного залога:

***The letter was sent yesterday.*** Письмо было послано вчера.

2. глаголом с частицей -ся (-сь):

***This problem was discussed last week.*** Эта проблема обсуждалась на прошлой неделе.

3. неопределенно-личным оборотом, т. е. глаголом в действительном залоге 3 лица множественного числа, типа «говорят», «сказали»:

***English is spoken in many countries.*** На английском языке говорят во многих странах.

4. глаголом в действительном залоге (при наличии исполнителя действия):

***Pupils are taught at school by the teachers.*** Учеников учат в школе учителя.

***Exercise 7.3.*** **Translate into English. Determine the Tense and Voice of the verb:**

1. He left for Moscow. 2. The news will be of great interest. 3. They were speaking to him. 4. She studied many subjects. 5. He was much spoken about. 6. New subjects will be studied next term. 7. I am working now. 8. The text has already been written by them. 9. He studies at our school. 10. You are playing chess, aren't you? 11. The text is being translated at the moment. 12. Do you work at this lab? 13. When I saw him, he was going home. 14. They will have passed

their exams by 3 o'clock. 15. This book was written by our teacher. 16. We shall be writing our tests at 10 o'clock. 17. The work will have been done when he comes. 18. We translated this text. 19. The letter had been written before we came. 20. We shall inform you. 21. These toys are made in Japan. 22. Does he work here? 23. Is he working now? 24. The conference will be held in May. 25. Rostov was named after Dmitry Rostovsky. 26.What are you doing here? 27. This work must be done at once. 28. You may take my book. 29. I am often asked at the lessons. 30. This article was being translated when I came.

✍ ***Exercise 7.4.*** **Translate into English. Determine the Tense and Voice of the verb:**

1.They can be seen in our library every day. 2. The delegation is headed by the Prime Minister. 3. The child was often left home alone. 4. These houses were built last year. 5. All letters had been written when we came. 6. This film is much spoken about. 7. The machine is being tested now. 8. His work has been already finished. 9. I was told to wait for him. 10.Your letter will have been answered by Monday. 11. The experiment was being carried out from ten till twelve o'clock. 12.Children under sixteen will not be admitted here.

✍ ***Exercise 7.5.*** **Put the verbs in brackets in the right form:**

1. I'm not reading these books today. They (return) to the library. 2. The paintings (exhibit) till the end of the month. 3. Why your home task (not do)? 4. She was taken to the hospital today, and (operate) tomorrow morning. 5. This room (use) only on special occasions. 6. Bicycles





must not (leave) here. 7. This newspaper (not read). The pages (not cut). 8. Dictionaries may not (use) at the examination. 9. Usually this street (sweep) every day, but it (not sweep) yesterday. 10. This book (leave) in the classroom yesterday; it (find) by the teacher. 11. Thousands of new houses (build) every year. 12. This room (not use) for a long time. 13. The children are very excited this morning. They (take) to the circus this afternoon.

✍ ***Exercise 7.6.*** **Translate into English:**

1. Эта книга была прочитана всеми. 2. Письмо будет отправлено завтра. 3. Ее часто спрашивают? 4. На ваш вопрос ответят завтра. 5. Текст переводился вчера с двух до трех. 6. Работа только что завершена нами. 7. Эти книги уже будут опубликованы к концу года. 8. Наша контрольная работа сейчас проверяется? 9. О новой книге будут много говорить. 10. В нашем городе сейчас строится много новых зданий. 11. Ключи были утеряны вчера. 12. Мальчика возьмут в кино. 13. Вам сказали об этом? 14. Телеграмма уже получена?

✍ ***Exercise 7.7.*** **Translate into English:**

1. Он сказал мне, что текст будет переведен к 10 часам завтра. 2. Все картины, которые вы здесь видите, написаны одним и тем же художником. 3. Письмо будет отправлено завтра. 4. Работа будет закончена в срок. 5. За доктором послали? Сделайте это как можно скорее. У ребенка высокая температура. 6. Эта книга была написана до того, как автор стал знаменитым. 7. Сотни новых домов будут построены к концу этого года. 8. Эта история давно забыта всеми. 9. Мне предложили очень интересную работу. 10. Он серьезный человек. На него всегда можно положиться. 11. За ста-

рой женщиной ухаживает ее младшая дочь. 12. На вечере нам показали прекрасный фильм. 13. Его ударили мячом. 14. С ним необходимо немедленно поговорить по этому вопросу. 15. Вам зададут несколько вопросов на экзамене. 16. Ей был дан список участников собрания. 17. Речь была заслушана с большим вниманием. 18. Вам объяснят, как добраться до железнодорожного вокзала. 19. Об этой пьесе сейчас много говорят. 20. Делегацию нужно встретить завтра в 9 часов утра в аэропорту.

# UNIT 8
# HIGHER EDUCATION IN THE UK

I. **Согласные звуки** [w], [ŋ].
II. **Text A: «Text: Higher Education in the UK».**
III. **§1. Сложное дополнение (Complex object).**
**§2. Причастие и герундий.**

## Phonetic warm-up

**Согласный звук** [w]. При произнесении губы округлены и значительно выдвинуты вперед, а задняя часть языка занимает примерно такое же положение, как при произнесении русского [у]. Струя выдыхаемого воздуха с силой проходит через образованную между губами круглую щель. Губы энергично раздвигаются.

**Согласный звук** [ŋ]. При произнесении согласного задняя спинка языка смыкается с опущенным мягким нёбом, и воздух проходит через носовую полость.

**Exercise A**
what — why — where
whip — wheat — while

**Exercise B**
war — wharf — water
wedding — wage — wait

waitress — waist — waste
weather — woman — wind

**Exercise C**
wall — wallet — walk
walnut — waltz — won

**Exercise D**
wing — king — sting
sing — nothing — something
everything — anything — ring

## Text A: «HIGHER EDUCATION IN THE UK»

Education after 16 is **voluntary** in United Kingdom. Students, who live in England, Wales, and Northern Ireland must take at the age of 16 the examinations for the General Certificate of Secondary Education (GCSE). In Scotland students receive the Scottish Certificate of Education. After this exam students can choose to stay on in school or **attend** colleges of further education.

British universities are **self-governing** and are guaranteed academic independence. **Funding** for education and research is provided by **funding councils set up** by Parliament. The number of universities jumped in 1992 when **polytechnics** and some other higher **education establishments** were given the right to become universities. By the end of 1994, there were some 90 universities, almost half of them former polytechnics, including the Open University.

Many of the colleges of Oxford and Cambridge universities were founded in the 12th and 13th centuries.





All other universities in Britain were founded in the 19th and 20th centuries. The Open University, based in Milton Keynes, England, was founded in 1969. It uses **extension techniques** of correspondence courses, television and radio programmes, and video cassettes, supported by local study centres and summer schools, to provide higher education opportunities to a wide variety of people.

During the 1960s there was a significant increase in the number of new universities, **reflecting** a fast growth in student numbers. During the 1980s, an expansion in higher education places led to another large jump in student numbers. In the 1992–1993 academic year there were more than 1.4 million students in full or part-time higher education in Great Britain, compared with just under 850,000 a **decade** earlier. About one quarter of young people are in higher education in England, Wales, and Scotland; one third in Northern Ireland. About 90 per cent of students get **state grants** to cover **tuition fees** and living costs.

The size of the grant is determined by **parents income**. Since the late 1980s, however, grants have been frozen; students can apply for a **student loan**.

*Vocabulary:*

**voluntary** ['vɔləntərɪ] — добровольное
**attend** — посещать
**self-governing** — самоуправляемый
**funding** — финансирование
**funding councils** — советы по финансированию
**to set up** — основывать
**significant** — значительный
**polytechnics** — политехнические институты

**extension techniques** — технологии дистанционного образования
**to reflect** — отражать
**decade** — десятилетие
**state grants** — государственные гарантии
**tuition fee** — плата за обучение
**parents income** — доход родителей
**student loan** [ləun] — студенческий заём

*ADD TO YOUR ACTIVE VOCABULARY:*

a) **high-school diploma** — школьный аттестат
**graduation ceremony** — выпускной экзамен
**Bachelor of Science (B.S.)** — бакалавр естественных наук
**Bachelor of Art (B.A.)** — бакалавр гуманитарных наук
**Master of Art (M.A.)** — магистр искусств
**Master of Science (M.S.)** — магистр естественных наук
**Doctor of Philosophy (Ph.D.)** — доктор философии
**undergraduate student** — студент 1–4(5) курсов
**graduate student** — студент 5–6 курсов
**graduate school of robotics** — магистратура (аспирантура) по специальности робототехника
b) **room (lodging) and board** — проживание и питание
**personal expenses** — личные расходы
**books and supplies** — книги и материалы
**to be eligible for admission** — быть подходящей кандидатурой для поступления
**to enrol** — зачислять
**enrollment** — зачисление
**admissions office** — приемная комиссия
**student services office** — департамент по работе со студентами





**university bursar's** [ˈbɔːsəˈ] (казначей) **office** — бухгалтерия университета (офис казначея)

*Exercise 8.1.* **Translate into English:**

1) В возрасте 16 лет каждый житель Великобритании обязан сдать экзамены на получение Сертификата о среднем образовании.

2) Британские университеты являются полностью самоуправляемыми.

3) В 1992 году Политехническим институтам была предоставлено право стать университетами.

4) Открытый университет, широко известный своими технологиями дистанционного обучения, был основан в 1969 году.

5) В 60-е годы в Соединенном королевстве наметился значительный рост числа университетов.

6) Размер гранта на обучение определяется исходя из дохода родителей.

## GRAMMAR

**§1. Сложное дополнение (Complex object).**

Сложное дополнение — это сочетание существительного или местоимения в объектном падеже (напр. *me, him, us, them*) с инфинитивом или причастием I. Существует в трех основных вариантах:

1. С инфинитивом **без частицы *to*** или с причастием 1 после глаголов восприятия

**see** *I saw him drive the car. I saw them working in the lab.*
**watch** *We watched the plane land. We watched the children playing in the yard.*
**notice** *Nobody noticed him go out. He didn't notice that happen.*

| | |
|---|---|
| **feel** | *She felt somebody touch her hand. They didn't feel the train start.* |
| **hear** | *I didn't hear you come into the room. I heard her playing piano.* |

В первом случае (вышеперечисленные глаголы с инфинитивом без частицы ***to***) подчеркивается факт действия, во втором (эти же глаголы с причастием I) — процесс действия.

***I saw him enter the house.*** — Я видел, как он вошел в дом.

***I saw him entering the house.*** — Я видел, как он входил в дом.

2. С инфинитивом **без частицы *to*** после глаголов

**to let:** *Don't let them play in the street.*

**to make:** *Don't make me laugh.*

3. С инфинитивом ***с частицей to*** после глаголов

| | |
|---|---|
| **to want** | *I want you to find me a place in the first row.* |
| **to expect** | *I expect you to come in time.* |
| **to believe** | *I believe her to be a very good teacher.* |
| **to know** | *I know him to be a good student.* |
| **to advise** | *I advise you to enter the institute.* |
| **to consider** | *The climate in England is considered to be mild.* |
| **to order** | *He is ordered not to be late.* |
| **to allow** | *They allow to use dictionaries at the exam.* |
| **to like** | *I would like you to finish your work.* |
| **to find** | *I find your story to be very interesting.* |

***Exercise 8.2.*** **Put the verbs in brackets in the right form:**

1. He made me (do) it all over again. 2. Her father made her (learn) the lessons. 3. If you want us (make) the work quickly you should let us (start) at once.





4. Would you like me (read) now? 5. They won't let us (leave) the classroom till our control work has been checked. 6. He wouldn't let the children (play) in his study. 7. Please let me (know) the results of your exam as soon as possible. 8. He made us (wait) for two hours. 9. I let him (go) early as he had done his task. 10. I'd like him (enter) the university but I can't make him (do) it. 11. I want her (learn) English. 12. I heard the door (open) and saw my friend (come) into the room. 13. I heard her (play) the piano. 14. I saw him (go out) of the house. 15. The teacher advised us (use) dictionaries. 16. Her father doesn't allow her (go) to the cinema alone. 17. We expect our basketball team (win) next game. 18. We don't want you (tell) anything. 19. I saw them (open) the window. 20. That is too difficult for you to do, let me (help) you.

***Exercise 8.3.*** **Translate into English:**

1. Вы хотите, чтобы дети играли здесь? 2. Вы хотите, чтобы мы встретились сегодня? 3. Вы ожидаете, работа будет сделана скоро? 4. Мы ожидаем, что они хорошо проведут у нас время. 5. Я хочу, чтобы он закончил эту работу. 6. Мы слышали, что она знает, когда мы сдаем экзамен. 7. Вы хотите, чтобы мы обсудили этот вопрос сегодня? 8. Мы ожидаем, что на этом месте будет построен новый дом. 9. Вы хотели бы, чтобы работа была сделана сегодня?

## §2. Причастие и герундий. Их отличие.

### (Participle I)

Причастие I (причастие настоящего времени), образованное при помощи окончания ***-ing***, имеет активную и страдательную формы:

*активная* (несовершенный вид) — ***asking,***
*активная* (совершенный вид) — ***having asked.***
*страдательная* (несовершенный) — ***being asked,***
*страдательная* (совершенный) — ***having been asked.***

**Причастие I употребляется в функции:**

1. ***Определения:***

***The man sitting at the table is our teacher.*** — Человек, сидящий за столом — наш учитель.

***The houses being built in our town are not very high.*** — Дома, строящиеся в нашем городе, невысоки.

2. ***Обстоятельства:***

***Going home I met an old friend.*** — Идя домой, я встретил старого друга.

***Having finished work I went home.*** — Закончив работу, я пошел домой.

### Причастие II (ParticipleII)

Причастие II (причастие прошедшего времени) всегда ***пассивно.*** Образуется оно прибавлением суффикса *-ed* к основе правильного глагола или путем чередования звуков в корне неправильного глагола.

**Причастие II употребляется в функции:**

1. ***Определения.***

***The book translated from English is interesting.*** — Книга, переведенная с английского языка, интересная.

2. ***Обстоятельства*** (причины и времени):

***Given the task he began to work.*** — Когда ему дали задание он начал работать.

### Употребление герундия и его отличие от причастия I

Причастие — неличная форма глагола, промежуточная между глаголом и прилагательным:

***The boy playing in the yard is my brother.*** — Мальчик (какой?) играющий во дворе, — мой брат.





Герундий также является неличной формой глагола, промежуточной между существительным и глаголом:

***Smoking is harmful.*** — Курение (что?) вредно.

Иными словами, причастие—в большей степени «прилагательное» по своим функциям, герундий — «существительное».

***Герундий*** **употребляется:**

1. в качестве подлежащего:

***Reading is useful.***

2. как часть сказуемого после глаголов *to finish, to start, to continue, to go on, to keep* и др.

***He started reading the book.***

3. как предложное дополнение: ***I am fond of reading.***

4. как прямое дополнение: ***Do you mind my reading here?***

5. как обстоятельство времени: ***After reading he closed the book.***

6. как обстоятельство образа действия: ***Instead of reading he went to the movies.***

Активная форма герундия: ***giving, beating.***

Пассивная форма герундия: ***being given, being beaten.***

✍ ***Exercise 8.4.*** **Open the brackets using the gerund:**

1. The grass in the garden is very dry, it needs (water). 2. It's very warm outside. You don't need (put on) your coat. 3. The house is old, and it wants (repair). 4. Famous people don't need (introduce) themselves. 5. The carpet is covered with dust, it needs (sweep). 6. The shoes are very dirty, they need (polish). 7. These shoes have a hole, they want (mend). 8. The table cloth is quite clean, it doesn't want (wash) yet. 9. The room needed (clean).

10. (learn) foreign languages is very useful. 12. I know my hair wants (cut) but I never have time to go to the hairdresser's. 13. John needed (cheer up) when he heard that he'd failed his exams. 14. You should tidy up the garden. — Yes, it needs (tidy). The roses want (water), the peaches want (pick), the grass wants (cut).

# UNIT 9
## MY FUTURE PROFESSION

**I.** [au], [dr], [br], [gr], [tr], [fr], [θr].
**II. Text A: «My future profession»,**
**Text B: «The Future of the engineering profession»**
**III. §1. Придаточные предложения условия и времени, действие которых отнесено к будущему.**
**§2. Сослагательное наклонение в условных предложениях.**

### Exercise A
now — how — brown
out — now — house
louse — mouse — cows
out — loud — without

### Exercise B
draw — dribble — draft
drag — drab — drank
drain — dragon — drama
drape — dreadful — drugs
Dresden — dress — dry
drill — drop — drink
drive — drown — drum
drift — drier — droopy

### Exercise C
brown — bread — brace
brain — brakes — brand

brunch — branch — brave
Brazil — breach — breast
breath — broth — breathe

**Exercise D**
treasure — trainer — trench
track — trade — traffic
troops — trend — trail
translate — transmit — trance

**Exercise E**
France — French — fruit
fry — frame — free
three — thread — throat
threat — through — thrill
thirty — throne — threaten

## Text A: «MY FUTURE PROFESSION»

Hi, there ! Here is Ann Sokolova again. I am afraid this will be my last meeting with you because I need to pack my suitcase. I am leaving for Sochi tonight. I have passed all the exams successfully and I'm free till the 1st of September.

As I have already told you, I was always good in mathematics and physics. My parents bought me a computer when I was in the 10th form. Since then I knew that I would become a specialist in computer technologies — a computer engineer.

Computer industry is developing so fast, that it **comprises** almost all spheres of professional life. No business now is possible without computers. This is especially true about **automated manufacturing of products** and **robotics**. Computer control of automated production





opens new **horizons** for the **cheap** and quality production of goods. Information is now **generated, transmitted,** received, and **stored** electronically through computer networks **on a scale unprecedented in history**, and there is every **indication** that the **explosive** rate of growth in this field will continue.

Computer engineering is a general field. It **deals with** both electric and electronic industries.

Electronic engineering deals with the research, design, **integration,** and **application** of **circuits** and **devices** used in the **transmission** and **processing** of information.

Engineers in the field of electric and electronic engineering are concerned with all aspects of electrical communications, from fundamental questions such as «What is information?» to the highly practical, such as the design of telephone systems. In designing communication systems, engineers **rely** on various branches of advanced mathematics, such as **Fourier analysis, linear systems theory, linear algebra, differential equations,** and **probability theory.**

Engineers work on control systems which are used **extensively** in automated manufacturing and in robotics.

Major developments in the field of communications and control have been the **replacement** of analogue systems with digital systems; **fibre optics** are used now instead of **copper** cables. **Digital** systems offer far greater **immunity** to electrical noise. Fibre optics are likewise immune to interference; they also have great **carrying capacity**, and are extremely **light** and inexpensive to manufacture.

Computer engineering is now the most **rapidly growing** field. The electronics of computers is the design and manufacture of memory systems, of central processing units, and of peripheral devices. The most prospective

industry now is the Very Large Scale Integration (VLSI) and new computer architectures. The field of computer science is closely related to computer engineering; however, the task of making computers more «intelligent» (**artificial intelligence**), through creation of **sophisticated** programs or development of higher level machine languages or other means, is generally regarded as the dream of computer science.

One current trend in computer engineering is microminiaturization. Engineers continue to work to fit greater and greater numbers of circuit elements onto smaller and smaller chips.

Another trend is towards increasing the speed of computer operations through the use of parallel processors and **superconducting** materials.

So, as you see, there are a lot of employment opportunities in my field. I don't worry about finding a job. The most important thing for me now is to study well and to graduate from the Academy.

*Vocabulary:*

**to comprise** — включать в себя
**automated manufacturing of products** — автоматизированное производство товаров
**robotics** — робототехника
**horizons** — горизонты
**cheap** — дешевый
**to generate** — генерировать, производить
**to transmit** — передавать
**to store** — хранить
**scale** — масштаб
**unprecedented in history** — не имеющий прецедентов в истории
**indication** — указание, свидетельство





**explosive** — взрывной
**to deal with** — иметь дело с, заниматься чем-либо
**integration** — интеграция
**application** — приложение, использование
**circuits** — электрические схемы, цепи
**device** — устройство
**transmission** — передача
**processing** — обработка
**to rely** — полагаться
**Fourier analysis** — анализ Фурье
**linear systems theory** — теория линейных систем
**linear algebra** — линейная алгебра
**differential equations** — дифференциальные уравнения
**probability theory** — теория вероятности
**extensively** — широко
**replacement** — замещение
**fibre optics** — оптоволоконные технологии
**copper** — медь
**digital** — цифровой
**immunity** — защищенность, невосприимчивость
**carrying capacity** — пропускная способность
**light** — легкий
**rapidly growing** — быстрорастущий
**artificial intelligence** — искусственный разум
**sophisticated** — сложный
**superconducting** — сверхпроводимость

*ADD TO YOUR ACTIVE VOCABULARY:*

a) **mechanical engineer** — инженер-механик
**electric engineer** — инженер-электрик
**electronic engineer** — инженер электроник
**computer engineer** — инженер-компьютерщик
**military engineer** — военный инженер

b) **prestigious job (work)** — престижная работа
**well-paid job** — высокооплачиваемая работа
**employee** — наемный рабочий
**employer** — наймодатель
**businessman** — предприниматель, бизнесмен
**state-employed** — государственный служащий
**white-collar worker** — «белый воротничок», работник умственного труда
**blue-collar worker** — «синий воротничок», работник физического труда
**skilled worker** — квалифицированный рабочий
**unskilled worker** — неквалифицированный рабочий
**experienced worker** — опытный работник

c) **to be hired for a job** — быть нанятым на выполнение работы
**to look for a new job (work, position)** — искать новую работу
**to apply for a new job** — претендовать на какую-либо должность
**application for a position of** — заявление на какую-либо должность
**resume** — резюме
**C.V. (curriculum vitae)** — автобиография
**to be fired** — быть уволенным
**to retire** — уходить на пенсию
**to be unemployed** — быть безработным

*Exercise 9.1.* **Translate into English:**

1. Родители купили мне компьютер, когда я училась(ся) в десятом классе.

2. Никакой современный бизнес не возможен без компьютерной техники.

3. Компьютерная индустрия — наиболее быстроразвивающеся производство.





4. Компьютерное управление автоматизированными производственными линиями открывает новые горизонты дешевого и качественного производства товаров.

5. Крупным достижением в сфере коммуникации является замена аналоговых систем на цифорвые.

6. В настоящее время опто-волоконные цифровые технологии обеспечивают более качественную и доступную связь, чем аналоговые системы.

*Exercise 9.2.* **How do you see your future profession? Please answer the following questions:**

1) **What kind of work are you interested in?**
a) well paid
b) interesting
c) in a large and famous company
d) quiet
e) in an industry which has a future
f) prestigious
g) not to sit the whole day in the office
h) to travel a lot

2) **What position would you like to have?**
a) to manage people — manager
b) to work for someone else — an employee
c) to be your own boss — self-employed, businessman
d) be responsible for everything — top manager, director
e) to work for the state — state employee

*Exercise 9.3.* **Please discuss with your group advantages and disadvantages of your future profession. Do you think that engineering profession is prestigious? Is it well-paid? How difficult is it to find a good work in this field?**

## Text B: «THE FUTURE OF THE ENGINEERING PROFESSION»

Among various recent trends in the engineering profession computerization is the most widespread. The trend in modern engineering offices is also towards computerization. Computers are increasingly used for solving complex problems as well as for handling, storing, and generating the enormous volume of data modern engineers must work with.

Scientific methods of engineering are applied in several fields not connected directly to manufacture and construction. Modern engineering is characterized by the broad application of what is known as systems engineering principles.

Engineers in industry work not only with machines but also with people, to determine, for example, how machines can be operated most efficiently by workers. A small change in the location of the controls of a machine or of its position with relation to other machines or equipment, or a change in the muscular movements of the operator, often results in greatly increased production. This type of engineering work is called time-study engineering.

A related field of engineering, human-factors engineering, also known as ergonomics, received wide attention in the late 1970s and 1980s when the safety of nuclear reactors was questioned following serious accidents that were caused by operator errors, design failures, and malfunctioning equipment.

Human-factors engineering seeks to establish criteria for the efficient, human-centred design of, among other things, the large, complicated control panels that monitor and govern nuclear reactor operations.





*General understanding:*

1. What is the most widespread trend in the engineering profession?
2. What are computers used for in modern engineering?
3. What approaches are used in modern engineering?
4. What is «ergonomics»?
5. What does human-factors engineering deal with?

## GRAMMAR

§1. **Придаточные предложения условия и времени, действие которых отнесено к будущему.**

В придаточных предложениях условия и времени с союзами

***if*** (если),
***when*** (когда),
***after*** (после),
***before*** (перед тем, как),
***as soon as*** (как только),
***unless*** (если не),
***until*** (до тех пор, пока не),

будущее время заменяется формой настоящего времени, но на русский язык переводится будущим, например:

***If you help me, I shall do this work.*** — Если ты поможешь мне, я сделаю эту работу.

***As soon as I get free, I'll come to you.*** — Как только я освобожусь, я приду к тебе.

***We shall not begin until you come.*** — Мы не начнем, пока ты не придешь.

*Exercise 9.4.* **Open the brackets and put the verbs in the right form:**

1. He (go) out when the weather (get) warmer. 2. I (wait) for you until you (come) back from school. 3. I'm

afraid the train (start) before we (come) to the station. 4. We (go) to the country tomorrow if the weather (to be) fine. 5. We (not pass) the examination next year if we not (work) harder. 6. If you (not drive) more carefully you (have) an accident. 7. You (be) late if you (not take) a taxi. 8. I (finish) reading this book before I (go) to bed. 9. You must (send) us a telegram as soon as you (arrive). 10. We (have) a picnic tomorrow if it (be) a fine day. 11. We (go) out when it (stop) raining. 12. We (not to have) dinner until you (come). 13. I'm sure they (write) to us when they (know) our new address.

Прочитайте примеры и запомните наиболее употребительные суффиксы существительных

**-er/or** — teacher, writer, actor, doctor
**-ist** — scientist, artist, dentist
**-ment** — government, movement, development
**-(t)ion** — revolution, translation, operation
**-ity/ty** — popularity, honesty, ability
**-sion/ssion** — revision, session, discussion,
**-ness** — happiness, illness, darkness

Прочитайте примеры и запомните наиболее употребительные суффиксы и префиксы глаголов.

**re-** — rewrite, rebuild, reconstruct,
**mis-** — misprint, misunderstand, miscount.

Прочитайте примеры и запомните наиболее употребительные суффиксы и префиксы прилагательных.

**un-** — unhappy, unable, uncomfortable
**dis-** — dishonest, discouraging, disconnectng

Прочитайте примеры и запомните основные суффиксы числительных.

**-teen** — fifteen, sixteen, eighteen
**-ty** — twenty, thirty, sixty, ninety
**-th** — fourth, seventh, eighteenth





Список наиболее употребительных суффиксов и префиксов существительных, прилагательных и глаголов приводится в приложении С.

✍ *Exercise 9.5.* **Make up adjectives from the following words:**

colour, beauty, peace, use, hope, truth, rain, help, power, pain, care.

§2. Сослагательное наклонение в условных предложениях.

Сослагательное наклонение выражает возможность, нереальность, предположительность действия.

Изъявительное наклонение.

***If I learn his address I shall write to him.*** — Если я узнаю его адрес, я ему напишу.

Сослагательное наклонение:

***If I knew his address I would write to him.*** — Если бы я знал его адрес **(сейчас)**, я написал бы ему (сейчас или в ближайшем будущем). Глагол в придаточном предложении — в форме Past Indefinite, в главном — в форме Future in the Past.

В случае, если действие, описываемое сослагательным наклонением, относится к прошедшему времени, в главном предложении используется форма будущего совершенного с точки зрения прошедшего Future Perfect in the Past, а в придаточном — прошедшее совершенное Past Perfect.

***If I had known his address I would have written to him.*** — Если бы я знал его адрес **(в прошлом)**, я написал бы ему (в прошлом же).

***I wish I lived not far from here.*** **(настоящее время).** —Жаль, что я не живу поблизости.

***I wish I had lived not far from here*** **(прошедшее время).** — Жаль, что я не жил поблизости.

✍ *Exercise 9.6.* **Translate into Russian:**

1. If I came later I would be late for the lesson. 2. If he had known the time-table he wouldn't have missed the train. 3. It would be better if you learned the oral topics. 3. I wish I had known this before the examination. 4. I would have come to you if you had not lived so far away. 5. If I had seen you yesterday I would have given you my text-book. 6. If I were in your place I wouldn't buy the tickets beforehand. 7. If I had known that you needed help I would have helped you.

# Part II

# UNIT 1
# METALS

I. **Text A: «Metals»**
   **Text B: «Steel»**
   **Text C: «Methods of steel heat treatment»**
II. **Famous Scientists. Dmitry Ivanovich Mendeleyev.**

## Text A: «METALS»

Metals are materials most widely used in industry because of their properties. The study of the production and **properties** of metals is known as **metallurgy.**

The **separation** between the atoms in metals is small, so most metals are **dense.** The atoms are **arranged regularly** and can **slide** over each other. That is why metals are **malleable** (can be deformed and **bent** without **fracture**) and **ductile** (can be **drawn** into **wire**). Metals vary greatly in their properties. For example, **lead** is soft and can be bent by hand, while **iron** can only be worked by hammering at red heat.

The regular arrangement of atoms in metals gives them a crystalline structure. Irregular crystals are called **grains.** The properties of the metals **depend** on the **size, shape,** orientation, and **composition** of these grains. In general, a metal with small grains will be harder and stronger than one with **coarse** grains.

Heat **treatment** such as **quenching, tempering,** or **annealing** controls the nature of the grains and their size in the metal. Small amounts of other metals (less than





1 per cent) are often added to a pure metal. This is called alloying (легирование) and it changes the grain structure and properties of metals.

All metals can be formed by drawing, **rolling, hammering** and **extrusion,** but some require hot-working. Metals are subject to metal **fatigue** and to **creep** (the slow increase in length under **stress**) causing deformation and **failure.** Both effects are taken into account by engineers when designing, for example, airplanes, gas-turbines, and pressure **vessels** for high-temperature chemical processes. Metals can be worked using machine-tools such as **lathe, milling machine, shaper** and **grinder.**

The ways of working a metal depend on its properties. Many metals can be **melted** and **cast in moulds,** but special conditions are required for metals that react with air.

*Vocabulary:*

**property** [ˈprɔpətɪ] — свойство
**metallurgy** [mɛˈtælədʒɪ] — металлургия
**separation** [sɛpəˈreɪʃən] — разделение, отстояние
**dense** [dɛns] — плотный
**arrangement** [əˈreɪndʒmənt] — расположение
**regularly** [ˈrɛgjuləlɪ] — регулярно, правильно
**to slide** [slaɪd] — скользить
**malleable** [ˈmælɪəbl] — ковкий, податливый, способный деформироваться
**bent** [bɛnt] *pp of* **bend** — гнуть
**to fracture** [ˈfræktʃəˈ] — ломать
**ductile** [dʌkˈtail] — эластичный, ковкий
**to draw** [drɔ:] — волочить, тянуть
**wire** [ˈwaɪəˈ] — проволока
**lead** [lɛd] — свинец
**iron** [ˈaɪən] — железо, чугун
**grain** [greɪn] — зерно

**to depend** [dɪ′pɛnd] — зависеть
**size** [saɪz] — размер, величина
**shape** [ʃeɪp] — форма, формировать
**composition** [kɔmpə′zɪʃən] — состав
**coarse** [kɔ:s] — грубый, крупный
**treatment** [′tri:tmənt] — обработка
**quenching** [kwɛntʃɪŋ] — закалка
**tempering** [′tɛmpərɪŋ] — отпуск после закалки, нормализация
**annealing** [ə′ni:lɪŋ] — отжиг, отпуск
**rolling** [′rəulɪŋ] — прокатка
**to hammer** [′hæmə′] — ковать (напр. молотом)
**extrusion** [′ɛkstr′u:ʒn] — экструзия
**metal fatigue** [fə′ti:g] — усталость металла
**creep** [kri:p] — ползучесть
**stress** [strɛs] — давление, напряжение
**failure** [′feɪljə′] — повреждение, разрушение
**vessel** [′vɛsl] — сосуд, котел, судно
**lathe** [leɪð] — токарный станок
**milling machine** [mɪ′lɪŋ] — фрезерный станок
**shaper** [ʃeɪpə] — строгальный станок
**grinder** [′graɪndə′] — шлифовальный станок
**to melt** [mɛlt] — плавить, плавиться расплавить
**to cast** [kɑ:st] — отливать, отлить
**mould** [məuld] — форма (*для отливки*)

*General understanding:*

1. What are metals and what do we call metallurgy?
2. Why are most metals dense?
3. Why are metals malleable?
4. What is malleability?
5. What are grains?
6. What is alloying?
7. What is crystalline structure?





8. What do the properties of metals depend on?
9. What changes the size of grains in metals?
10. What are the main processes of metal forming?
11. How are metals worked?
12. What is creeping?

🗣 ✍ ***Exercise 1.1.*** **Find the following words and word combinations in the text:**

1. Свойства металлов
2. расстояние между атомами
3. правильное расположение
4. сильно отличаются по своим свойствам
5. кристаллическая структура
6. размер зерен
7. форма зерен
8. закалка
9. отжиг
10. волочение
11. прокатка
12. ковка
13. экструзия
14. структура и свойства зерна
15. горячая обработка
16. усталость металла
17. ползучесть металла
18. плавка и отливка в формы
19. способы обработки металлов

✍ ***Exercise 1.2.*** **Complete the following sentences:**

1. Metals are...
2. Metallurgy is...
3. Most metals are...
4. The regular arrangement of atoms in metals...
5. Irregular crystals...
6. The properties of the metals depend...

7. Metals with small grains will be...
8. ...controls the nature of the grains in the metal.
9. Alloying is...
10. All metals can be formed by...
11. Creep is...
12. Metals can be worked using...

***Exercise 1.3.*** **Explain in English the meaning of the following words:**

1. malleability
2. crystalline structure
3. grains
4. heat treatment
5. alloying
6. creep

***Exercise 1.4.*** **Translate into English:**

1. Металлы — плотные материалы потому, что между атомами в металлах малое расстояние.
2. Металлы имеют кристаллическую структуру из-за правильного расположения атомов.
3. Чем меньше зерна, тем тверже металл.
4. Закалка и отжиг изменяют форму и размер зерен в металлах.
5. Легирование изменяет структуру зерен и свойства металлов.
6. Металл деформируется и разрушается из-за усталости и ползучести.

## *Text B: «STEEL»*

The most important metal in industry is iron and its **alloy** — steel. Steel is an alloy of iron and **carbon**. It is strong and **stiff**, but **corrodes** easily through **rusting**,





although **stainless** and other special steels **resist** corrosion. The amount of carbon in a steel influences its properties **considerably**. Steels of low carbon **content** (mild steels) are quite ductile and are used in the manufacture of sheet iron, wire, and pipes. Medium-carbon steels containing from 0.2 to 0.4 per cent carbon are **tougher** and stronger and are used as structural steels. Both mild and medium-carbon steels are suitable for **forging** and **welding**. High-carbon steels contain from 0.4 to 1.5 per cent carbon, are hard and **brittle** and are used in **cutting tools, surgical instruments**, razor **blades** and **springs**. Tool steel, also called silver steel, contains about 1 per cent carbon and is strengthened and toughened by quenching and tempering.

The **inclusion** of other elements **affects** the properties of the steel. **Manganese** gives extra strength and toughness. Steel containing 4 per cent **silicon** is used for transformer **cores** or electromagnets because it has large grains acting like small magnets. The addition of chromium gives extra strength and corrosion resistance, so we can get **rust-proof** steels. Heating in the presence of carbon or **nitrogen**-rich materials is used to form a hard surface on steel (case-hardening). High-speed steels, which are extremely important in machine-tools, contain chromium and **tungsten** plus smaller amounts of vanadium, molybdenum and other metals.

***Vocabulary:***

**alloy** [ˈælɔɪ] — сплав
**carbon** [ˈkɑːbən] — углерод
**stiff** [stɪf] — жесткий
**to corrode** [kəˈrəud] — разъедать, ржаветь
**rusty** [ˈrʌstɪ] — ржавый
**stainless** — нержавеющий

**to resist** [rɪ′zɪst] — сопротивляться
**considerably** [kən′sɪdərəblɪ] — значительно, гораздо
**tough** [tʌf] — крепкий, жесткий, прочный, выносливый
**forging** [fɔ:ʤɪŋ] — ковка
**welding** [′wɛldɪŋ] — сварка
**brittle** [′brɪtl] — хрупкий, ломкий
**cutting tools** — режущие инструменты
**surgical instruments** [′sə:ʤɪkl] — хирургические инструменты
**blade** [bleɪd] — лезвие
**spring** [sprɪŋ] — пружина
**inclusion** [in′kluʒən] — включение
**to affect** [ə′fɛkt] — влиять
**manganese** [mæŋgə′ni:z] — марганец
**silicon** [′sɪlɪkən] — кремний
**rust-proof** — нержавеющий
**nitrogen** [′naɪtrəʤən] — азот
**tungsten** [tʌŋsten] — вольфрам

***General understanding:***

1. What is steel?
2. What are the main properties of steel?
3. What are the drawbacks of steel?
4. What kinds of steel do you know? Where are they used?
5. What gives the addition of manganese, silicon and chromium to steel?
6. What can be made of mild steels (medium-carbon steels, high-carbon steels)?
7. What kind of steels can be forged and welded?
8. How can we get rust-proof (stainless) steel?
9. What is used to form a hard surface on steel?
10. What are high-speed steels alloyed with?





***Exercise 1.5.*** **Find the following words and word combinations in the text:**

1. сплав железа и углерода
2. прочный и жесткий
3. легко коррозирует
4. нержавеющая сталь
5. низкое содержание углерода
6. ковкость
7. листовое железо, проволока, трубы
8. конструкционные стали
9. пригодны для ковки и сварки
10. твердый и хрупкий
11. режущие инструменты
12. хирургические инструменты
13. инструментальная сталь
14. упрочнять
15. добавление марганца (кремния, хрома, вольфрама, молибдена, ванадия)

## *Text C: «METHODS OF STEEL HEAT TREATMENT»*

Quenching is a heat treatment when metal at a high temperature is rapidly cooled by **immersion** in water or oil. Quenching makes steel harder and more brittle, with small grains structure.

Tempering is a heat treatment **applied** to steel and certain alloys. Hardened steel after quenching from a high temperature is too hard and brittle for many applications and is also brittle. Tempering, that is re-heating to an **intermediate** temperature and cooling slowly, reduces this hardness and brittleness. Tempering temperatures depend on the composition of the steel but are frequently between 100 and 650 °C. Higher temperatures usually give a softer, tougher product. The colour of the

**oxide film** produced on the surface of the heated metal often serves as the indicator of its temperature.

**Annealing** is a heat treatment in which a material at high temperature is cooled slowly. After cooling the metal again becomes malleable and ductile (capable of being bent many times without **cracking**).

All these methods of steel heat treatment are used to obtain steels with certain mechanical properties for certain needs.

*Vocabulary:*

**to immerse** [ɪ′mə:s] — погружать
**to apply** [ə′plaɪ] — применять
**intermediate** [ɪntə′mi:dɪət] — промежуточный
**oxide film** [′ɔksaɪd] — оксидная пленка
**annealing** [ˌæ′nɪlɪŋ] — отжиг, отпуск
**cracking** — растрескивание

*General understanding:*

1. What can be done to obtain harder steel?
2. What makes steel more soft and tough?
3. What makes steel more malleable and ductile?
4. What can serve as the indicator of metal temperature while heating it?
5. What temperature range is used for tempering?
6. What are the methods of steel heat treatment used for?

***Exercise 1.6.*** **Translate into English the following words and word combinations:**

1. температура нормализации
2. мелкозернистая структура
3. быстрое охлаждение
4. закаленная сталь





5. состав стали
6. окисная пленка
7. индикатор температуры
8. медленное охлаждение

## FAMOUS PEOPLE OF SCIENCE

### Dmitry Ivanovich Mendeleyev

Dmitry Ivanovich Mendeleyev is a famous Russian chemist. He is best known for his development of the periodic table of the properties of the chemical elements. This table displays that elements' properties are changed periodically when they are arranged according to atomic weight.

Mendeleyev was born in 1834 in Tobolsk, Siberia. He studied chemistry at the University of St. Petersburg, and in 1859 he was sent to study at the University of Heidelberg. Mendeleyev returned to St. Petersburg and became Professor of Chemistry at the Technical Institute in 1863. He became Professor of General Chemistry at the University of St. Petersburg in 1866. Mendeleyev was a well-known teacher, and, because there was no good textbook in chemistry at that time, he wrote the two-volume «Principles of Chemistry» which became a classic textbook in chemistry.

In this book Mendeleyev tried to classify the elements according to their chemical properties. In 1869 he published his first version of his periodic table of elements. In 1871 he published an improved version of the periodic table, in which he left gaps for elements that were not known at that time. His table and theories were proved later when three predicted elements: gallium, germanium, and scandium were discovered.

Mendeleyev investigated the chemical theory of solution. He found that the best proportion of alcohol and water in vodka is 40%. He also investigated the thermal expansion of liquids and the nature of petroleum.

In 1893 he became director of the Bureau of Weights and Measures in St. Petersburg and held this position until his death in 1907.

# UNIT 2
# METALWORKING

**I. Text A: Metalworking processes:Rolling. Extrusion,**
**Text B: Drawing. Forging. Sheet metal forming,**
**Text C: Metalworking and Metal Properties.**
**II. Famous scientists. Mikhail Vasilyevich Lomonosov.**

## *Text A: «METALWORKING PROCESSES»*

Metals are important in industry because they can be easily deformed into **useful shapes.** A lot of metalworking processes have been developed for certain applications. They can be divided into five broad groups:

1. **rolling,**
2. **extrusion,**
3. **drawing,**
4. **forging,**
5. **sheet-metal forming.**

During the first four processes metal is **subjected** to large **amounts** of strain (deformation). But if deformation goes at a high temperature, the metal will recrystallize — that is, new strain-free grains will grow instead of deformed grains. For this reason metals are usually rolled, extruded, drawn, or forged above their recrystallization temperature. This is called hot working. Under these **conditions** there is no limit to the compressive plastic strain to which the metal can be subjected.

Other processes are **performed** below the recrystallization temperature. These are called cold working. Cold

working **hardens** metal and makes the part stronger. However, there is a limit to the strain before a cold part cracks.

### Rolling

Rolling is the most common metalworking process. More than 90 percent of the aluminum, steel and copper produced is rolled **at least** once in the course of production. The most **common** rolled product is **sheet**. Rolling can be done either hot or cold. If the rolling is finished cold, the surface will be smoother and the product stronger.

### Extrusion

Extrusion is pushing the **billet** to flow through the **orifice** of a **die**. Products may have either a simple or a complex **cross section**. Aluminium **window frames** are the examples of complex extrusions.

**Tubes** or other **hollow** parts can also be extruded. The **initial** piece is a **thick-walled** tube, and the extruded part is shaped between a die on the outside of the tube and a **mandrel** held on the inside.

In **impact** extrusion (also called back-extrusion) (штамповка выдавливанием), the workpiece is placed in the bottom of a hole and a **loosely fitting ram** is pushed against it. The ram **forces** the metal to flow back around it, with the **gap** between the ram and the die **determining** the wall thickness. The example of this process is the manufacturing of aluminium beer cans.

***Vocabulary:***

**useful** ['ju:sful] — полезный
**shape** [ʃeɪp] — форма, формировать
**rolling** — прокатка
**extrusion** [ɪks'tru:ʒən] — экструзия, выдавливание





**drawing** [drɔ:ɪŋ] — волочение
**forging** ['fɔ:ʤɪŋ] — ковка
**sheet** [ʃi:t] — лист
**to subject** [ˌsʌbʤ'ekt] — подвергать
**amount** [ə'maunt] — количество
**condition** [kən'dɪʃən] — состояние, условие
**perform** [pə'fɔ:m] — выполнять, проводить
**to harden** ['hɑ:dn] — делаться твердым, упрочняться
**at least** — по крайней мере
**common** ['kɔmən] — общий
**billet** ['bɪlɪt] — заготовка, болванка
**orifice** ['ɔrɪfɪs] — отверстие
**die** [dai] — штамп, пуансон, матрица, фильера, волочильная доска
**cross section** — поперечное сечение
**window frame** [freɪm] — рама окна
**tube** [tju:b] — труба
**hollow** ['hɔləu] — полый
**initial** [ɪ'nɪʃl] — первоначальный, начальный
**thick-walled** — толстостенный
**mandrel** ['mændrɪl] — оправка, сердечник
**impact** ['ɪmpækt] — удар
**loosely** — свободно, с зазором
**fitting** — зд. посадка
**ram** [ræm] — пуансон, плунжер
**force** [fɔ:s] — сила
**gap** [gæp] — промежуток, зазор
**to determine** [dɪ'tə:mɪn] — устанавливать, определять

***General understanding:***

1. Why are metals so important in industry?
2. What are the main metalworking processes?

3. Why are metals worked mostly hot?
4. What properties does cold working give to metals?
5. What is rolling? Where is it used?
6. What is extrusion? What shapes can be obtained after extrusion?
7. What are the types of extrusion?

***Exercise 2.1.*** **Find the following in the text:**

1. могут легко деформироваться
2. нужные формы
3. подвергать большим деформациям
4. зерна свободные от деформации
5. температура перекристаллизации
6. пластическая деформация сжатия
7. самый обычный процесс обработки металла
8. самое обычное изделие проката
9. отверстие фильеры
10. первоначальный
11. сложное сечение
12. пустотелые детали
13. свободно входящий плунжер
14. зазор между плунжером (пуансоном) и штампом
15. толщина стенки

***Exercise 2.2.*** **Translate into English:**

1. Способность металла перекристаллизовываться при высокой температуре используется при горячей обработке.

2. Перекристаллизация — это рост новых, свободных от деформации зерен.

3. Во время горячей обработки металл может подвергаться очень большой пластической деформации сжатия.





4. Холодная обработка делает металл тверже и прочнее, но некоторые металлы имеют предел деформации.

5. Листовой прокат может производиться горячим или холодным.

6. Поверхность холоднокатаного листа более гладкая и он прочнее.

7. Поперечное сечение фильеры для экструзии может быть простым или сложным.

8. Алюминиевые и медные сплавы являются наилучшими для экструзии из-за их пластичности при деформации.

9. Алюминиевые банки, тюбики для зубной пасты являются примерами использования штамповки выдавливанием.

10. Толщина стенки алюминиевой банки определяется зазором между пунсоном и штампом.

## *Text B: «DRAWING»*

Drawing consists of **pulling** metal through a die. One type is wire drawing. The diameter **reduction** that can be **achieved** in one die is limited, but several dies in **series** can be used to get the desired reduction.

### Sheet metal forming

Sheet metal forming (штамповка листового металла) is widely used when parts of certain shape and size are needed. It includes forging, bending and shearing. One characteristic of sheet metal forming is that the thickness of the sheet changes little in processing. The metal is stretched just **beyond** its **yield point** (2 to 4 percent strain) in order to **retain** the new shape. **Bending** can be done by pressing between two dies. **Shearing** is a cutting operation similar to that used for cloth.

Each of these processes may be used alone, but often all three are used on one part. For example, to make the roof of an automobile from a flat sheet, the edges are **gripped** and the piece pulled in tension over a **lower die**. Next an **upper die** is pressed over the top, finishing the **forming operation** (штамповку), and finally the edges are sheared off to give the final **dimensions**.

### Forging

Forging is the shaping of a piece of metal by pushing with open or closed dies. It is usually done hot in order to reduce the **required** force and **increase** the metal's plasticity.

**Open-die forging** is usually done by **hammering** a part between two flat faces. It is used to make parts that are too big to be formed in a closed die or in cases where only a few parts are to be made. The earliest forging machines lifted a large hammer that was then dropped on the workpiece, but now air or steam hammers are used, since they allow greater control over the force and the rate of forming. The part is shaped by moving or turning it between **blows**.

Closed-die forging is the shaping of hot metal **within** the walls of two dies that come together to **enclose** the workpiece on all sides. The process starts with a **rod** or **bar** cut to the length needed to fill the die. Since large, complex shapes and large strains are **involved**, several dies may be used to go from the initial bar to the final shape. With closed dies, parts can be made to close **tolerances** so that little finish machining is required.

Two closed-die forging operations are given special names. They are **upsetting** and **coining**. Coining takes its name from the final stage of forming metal coins, where the desired **imprint** is formed on a metal disk that is pressed in a closed die. Coining involves small strains





and is done cold. Upsetting involves a flow of the metal back upon itself. An example of this process is the pushing of a short length of a rod through a hole, **clamping** the rod, and then **hitting** the exposed length with a die to form the head of a **nail** or **bolt**.

*Vocabulary:*

**to pull** [pul] — тянуть
**reduction** [rɪ'dʌkʃən] — сокращение
**to achieve** [ə'tʃi:v] — достигать
**in series** ['sɪərɪz] — серия, последовательно
**beyond** [bɪ'jɔnd] — выше, свыше
**yield point** [ji:ld] — точка текучести металла
**to retain** [rɪ'teɪn] — сохранять, удерживать
**to bend** [bɛnd] — гнуть
**shearing** [ʃɪərɪŋ] — обрезка, отрезание
**edge** [ɛʤ] — край
**to grip** [grɪp] — схватывать
**lower die** — нижний штамп
**upper die** — верхний штамп
**forming operation** — операция штампования
**dimension** [daɪ'mɛnʃən] — измерение, размеры
**required** [rɪ'kwaɪəd] — необходимый
**increase** ['ɪnkri:s] — увеличение
**open-die forging** — ковка в открытом штампе (подкладном)
**hammering** ['hæmərɪŋ] — ковка, колотить
**within** [wɪð'ɪn] — внутри, в пределах
**to enclose** [ɪn'kləuz] — заключать
**rod** [rɔd] — прут, стержень
**bar** [bɑ:'] — прут, брусок
**involved** [ɪn'vɔlvd] — включенный
**tolerance** ['tɔlərns] — допуск
**upsetting** — высадка, выдавливание

**blow** [bləu] — удар
**coining** [ˈkɔɪnɪŋ] — чеканка
**imprint** [ˈɪmprɪnt] — отпечаток
**clamp** [klæmp] — зажим
**to hit** [hɪt] — ударять

*General understanding:*

1. How can the reduction of diameter in wire drawing be achieved?
2. What is sheet metal forming and where it can be used?
3. What is close-die forging?
4. What is forging?
5. What are the types of forging?
6. What types of hammers are used now?
7. Where are coining and upsetting used?
8. What process is used in wire production?
9. Describe the process of making the roof of a car.

***Exercise 2.3.*** **Find the following word combinations in the text:**

1. протягивание металла через фильеру
2. волочение проволоки
3. уменьшение диаметра
4. толщина листа
5. растягивать выше точки текучести
6. сохранить новую форму
7. края отрезаются
8. конечные размеры
9. уменьшить необходимое усилие
10. увеличить пластичность металла
11. воздушные или паровые молоты
12. сила и скорость штампования
13. внутри стенок двух штампов





14. отделочная обработка
15. малые допуски

***Exercise 2.4.*** **Translate into English:**

1. При волочении проволоки диаметр отверстия волочильной доски каждый раз уменьшается.
2. Штамповка листового металла включает в себя ковку, изгиб и обрезку.
3. Небольшая деформация листа при растяжении помогает сохранить новую форму детали.
4. Изменение формы при штамповке производится путем сжатия между двумя штампами.
5. Края листа при штамповке отрезаются для получения конечных размеров.
6. При проковке деталь должна быть горячей для уменьшения необходимых усилий и увеличения пластичности металла.
7. После ковки в закрытых штампах детали не требуют большой механической обработки.
8. При чеканке деформация металла невелика и отпечаток формируется на поверхности металла.
9. Высадка используется для изготовления головок гвоздей и болтов.

## *Text C: «METALWORKING AND METAL PROPETIES»*

An important **feature** of hot working is that it **provides** the **improvement** of mechanical **properties** of metals. Hot-working (hot-rolling or hot-forging) **eliminates porosity, directionality,** and **segregation** that are usually present in metals. Hot-worked products have better ductility and toughness than the unworked **casting**. During the forging of a bar, the grains of the metal become

greatly **elongated** in the direction of flow. As a result, the toughness of the metal is greatly improved in this direction and **weakened** in directions **transverse** to the **flow**. Good forging makes the flow lines in the **finished** part oriented so as to lie in the direction of maximum stress when the part is placed in service.

The ability of a metal to resist **thinning** and **fracture** during cold-working operations plays an important role in alloy selection. In operations that involve stretching, the best alloys are those which grow stronger with strain (are **strain hardening**) — for example, the copper-zinc alloy, **brass**, used for cartridges and the aluminum-magnesium alloys in **beverage cans**, which **exhibit** greater strain hardening.

Fracture of the workpiece during forming can result from **inner flaws** in the metal. These flaws often consist of nonmetallic **inclusions** such as oxides or sulfides that are **trapped** in the metal during **refining**. Such inclusions can be **avoided** by proper manufacturing procedures.

The ability of different metals to **undergo** strain varies. The change of the shape after one forming operation is often limited by the **tensile ductility** of the metal. Metals such as copper and aluminum are more ductile in such operations than other metals.

*Vocabulary*

**feature** [ˈfi:tʃəˈ] — черта, особенность
**to provide** [prəˈvaɪd] — обеспечивать
**improvement** [ɪmˈpru:vmənt] — улучшение
**property** [ˈprɔpətɪ] — свойство
**eliminate** [ɪˈlɪmɪneɪt] — ликвидировать, исключать
**porosity** [ˈpɔ:rəs] — пористость





**directional** [dɪˈrɛkʃənl] — направленный
**to segregate** [ˈsɛgrɪgeɪt] — разделять
**casting** [kɑ:stɪŋ] — отливка
**elongated** [ˈi:lɔŋˈgeɪtɪd] — удлиненный
**to weaken** [ˈwi:kn] — ослабевать, ослаблять
**transverse** [ˈtrænzvə:s] — поперечный
**flow** [fləu] — течение, поток
**finished** [ˈfɪnɪʃt] — отделанный
**thinning** — утончение
**fracture** [frækʧə] — разрушение
**strain hardening** — деформационное упрочнение
**brass** [brɑ:s] — латунь
**beverage** [ˈbɛvərɪʤ] — напиток
**can** [kæn] — консервная банка
**to exhibit** [ɪgˈzɪbɪt] — проявлять
**inner** [ˈɪnə] — внутренний
**flaws** [flɔ:z] — недостатки, дефекты кристаллической решетки
**inclusion** [ɪnˈklu:ʒən] — включение
**trapped** — зд. заключенный
**refining** [rɪˈfaɪn] — очищать,очистка
**to avoid** [əˈvɔɪd] — избегать
**to undergo** [ʌndəˈgəu] — подвергаться
**tensile ductility** — пластичность при растяжении

*General understanding:*

1. What process improves the mechanical properties of metals?
2. What new properties have hot-worked products?
3. How does the forging of a bar affect the grains of the metal? What is the result of this?
4. How are the flow lines in the forged metal oriented and how does it affect the strength of the forged part?

5. What are the best strain-hardening alloys? Where can we use them?

6. What are the inner flaws in the metal?

7. Can a metal fracture because of the inner flaw?

8. What limits the change of the shape during forming operations?

*Exercise 2.5.* **Find the following in the text:**

1. важная особенность горячей обработки
2. улучшение механических свойств металла
3. необработанная отливка
4. направление максимального напряжения
5. способность сопротивляться утончению и разрушению
6. проявлять большее деформационное упрочнение
7. разрушение детали при штамповке
8. внутренние дефекты в металле
9. неметаллические включения
10. способность металлов подвергаться деформации
11. ограничивается пластичностью металла при растяжении

*Exercise 2.6.* **Translate into English:**

1. Горячая обработка металла улучшает его механические свойства и устраняет пористость и внутренние дефекты.

2. Удлинение зерен в направлении текучести при ковке значительно улучшает прочность металла в этом направлении и уменьшает его прочность в поперечном.

3. Хорошая проковка ориентирует линии текучести в направлении максимального напряжения.

4. Деформационное упрочнение металла при холодной обработке очень важно для получения металлов с улучшенными свойствами.





5. Внутренние дефекты металла — это неметаллические включения типа окислов или сульфидов.

6. Изменение формы при штамповании металлических деталей ограничивается пластичностью металла при растяжении.

## FAMOUS SCIENTISTS

**Mikhail Vasilyevich Lomonosov** was a famous Russian writer, chemist, and astronomer who made a lot in literature and science.

Lomonosov was born on November 19, 1711, in Denisovka (now Lomonosov), near Archangelsk, and studied at the University of the Imperial Academy of Sciences in St. Petersburg. After studying in Germany at the Universities of Marburg and Freiberg, Lomonosov returned to St. Petersburg in 1745 to teach chemistry and built a teaching and research laboratory there four years later.

Lomonosov is often called the founder of Russian science. He was an innovator in many fields. As a scientist he rejected the phlogiston theory of matter commonly accepted at the time and he anticipated the kinetic theory of gases. He regarded heat as a form of motion, suggested the wave theory of light, and stated the idea of conservation of matter. Lomonosov was the first person to record the freezing of mercury and to observe the atmosphere of Venus during a solar transit.

Interested in the development of Russian education, Lomonosov helped to found Moscow State University in 1755, and in the same year wrote a grammar that reformed the Russian literary language by combining Old

Church Slavonic with modern language. In 1760 he published the first history of Russia. He also revived the art of Russian mosaic and built a mosaic and coloured-glass factory. Most of his achievements, however, were unknown outside Russia. He died in St. Petersburg on April 15, 1765.

# UNIT 3
## MATERIALS SCIENCE AND TECHNOLOGY

I. Text A: «Materials science and technology».
   Text B: «Mechanical Properties of Materials».
II. Famous people of science and technology: Igor Sikorskiy, Andrey Tupolev.

### Text A: «MECHANICAL PROPERTIES OF MATERIALS»

Materials Science and Technology is the study of materials and how they can be fabricated **to meet the needs** of modern technology. Using the laboratory **techniques** and knowledge of physics, chemistry, and metallurgy, scientists are finding new ways of using metals, plastics and other materials.

Engineers must know how materials **respond** to **external forces**, such as **tension, compression, torsion, bending, and shear.** All materials respond to these forces by **elastic deformation.** That is, the materials return their original size and form when the **external** force disappears. The materials may also have **permanent deformation** or they may **fracture.** The results of external forces are **creep** and **fatigue.**

Compression is a pressure causing a **decrease** in **volume.** When a material is subjected to a **bending, shearing,** or **torsion (twisting)** force, both tensile and compressive forces are **simultaneously** at work. When a metal **bar** is bent, one side of it is stretched and subjected to a tensional force, and the other side is compressed.

**Tension** is a pulling force; for example, the force in a cable holding a weight. Under tension, a material usually **stretches**, returning to its original length if the force does not **exceed** the material's **elastic limit**. Under larger tensions, the material does not return **completely** to its original condition, and under greater forces the material **ruptures**.

**Fatigue** is the growth of cracks under stress. It occurs when a mechanical part is subjected to a repeated or **cyclic stress**, such as vibration. Even when the maximum stress never exceeds the elastic limit, failure of the material can **occur** even after a short time. No deformation is seen during fatigue, but small localised cracks develop and **propagate** through the material until the **remaining cross-sectional area** cannot support the maximum stress of the cyclic force. Knowledge of tensile stress, elastic limits, and the resistance of materials to creep and fatigue are of basic importance in engineering.

**Creep** is a slow, permanent deformation that results from a **steady** force acting on a material. Materials at high temperatures usually **suffer** from this deformation. The gradual **loosening** of bolts and the deformation of components of machines and engines are all the examples of creep. In many cases the slow deformation stops because deformation **eliminates** the force causing the creep. Creep **extended over** a long time finally leads to the rupture of the material.

*Vocabulary*

**bar** [bɑ:ˊ] — брусок, прут
**completely** [kəmˊpli:tlɪ] — полностью, совершенно
**compression** [kəmˊprɛʃən] — сжатие
**creep** [kri:p] — ползучесть
**cross-sectional area** — площадь поперечного сечения





**cyclic stress** [ˊsaiklik] — циклическое напряжение
**decrease** [ˊdi:kri:s] — уменьшение
**elastic deformation** — упругая деформация
**elastic limit** — предел упругости
**exceed** [ɪkˊsi:d] — превышать
**external forces** [ɛksˊtə:nl] — внешние силы
**fatigue** [fəˊti:g] — усталость металла
**fracture** [ˊfræktʃəˊ] — перелом, излом
**loosen** [ˊlu:sn] — ослаблять, расшатывать
**permanent deformation** [ˊpə:mənənt] — постоянная деформация
**remaining** [rɪˊmeɪnɪŋ] — оставшийся
**shear** [ʃɪəˊ] — срез
**simultaneously** [sɪməlˊteɪnɪəslɪ] — одновременно
**to stretch** [strɛʧ] — растягивать
**technique** [tɛkˊni:ks] — методы
**tension** [ˊtɛnʃən] — напряженность
**to propagate** [ˊprɔpəgeɪt] — распространять(ся)
**to bend** [bɛnd] — гнуть, согнуть
**to extend** [ɪksˊtɛnd] — расширять, продолжаться
**to meet the needs** — отвечать требованиям
**to occur** [əˊkə:ˊ] — происходить
**to respond** [rɪsˊpɔnd] — отвечать реагировать
**to suffer** [ˊsʌfəˊ] — страдать
**torsion** [ˊtɔ:ʃən] — кручение
**twisting** [twɪstɪŋ] — закручивание, изгиб
**volume** [ˊvɔlju:m] — объем, количество
**rupture** [ˊrʌpʧəˊ] — разрыв

*General understanding:*

1. What are the external forces causing the elastic deformation of materials? Describe those forces that change the form and size of materials.
2. What are the results of external forces?

3. What kinds of deformation are the combinations of tension and compression?

4. What is the result of tension? What happens if the elastic limit of material is exceeded under tension?

5. What do we call fatigue? When does it occur? What are the results of fatigue?

6. What do we call creep? When does this type of permanent deformation take place? What are the results of creep?

***Exercise 3.1.*** **Find the following in the text:**

1. отвечать требованиям современной технологии
2. используя лабораторные методы
3. новые способы использования металлов
4. сжатие, растяжение, изгиб, кручение, срез
5. возвращать первоначальный размер и форму
6. внешняя сила
7. постоянная деформация
8. уменьшение объема
9. растягивающие и сжимающие силы
10. превышать предел упругости материала
11. повторяющиеся циклические напряжения
12. разрушение материала
13. развитие и распространение мелких трещин
14. сопротивление материалов ползучести и усталости

***Exercise 3.2.*** **Translate into English the following sentences:**

1. Упругая деформация — это реакция всех материалов на внешние силы, такие, как растяжение, сжатие, скручивание, изгиб и срез.

2. Усталость и ползучесть материалов являются результатом внешних сил.





3. Внешние силы вызывают постоянную деформацию и разрушение материала.

4. Растягивающие и сжимающие силы работают одновременно, когда мы изгибаем или скручиваем материал.

5. Растяжение материала выше предела его упругости дает постоянную деформацию или разрушение.

6. Когда деталь работает долгое время под циклическими напряжениями в ней появляются небольшие растущие трещины из-за усталости металла.

7. Ползучесть — это медленное изменение размера детали под напряжением.

## *Text B: «Mechanical Properties of Materials»*

**Density** (specific weight) is the **amount** of mass in a unit **volume.** It is measured in kilograms per cubic metre. The density of water is 1000 kg/ $m^3$ but most materials have a higher density and **sink** in water. Aluminium alloys, with typical densities around 2800 kg/ $m^3$ are considerably less dense than steels, which have typical densities around 7800 kg/ $m^3$. Density is important in any **application** where the material must not be heavy.

**Stiffness** (rigidity) is a measure of the resistance to deformation such as stretching or bending. The **Young modulus** is a measure of the resistance to simple stretching or compression. It is the ratio of the applied force per unit area **(stress)** to the fractional elastic deformation **(strain).** Stiffness is important when a **rigid** structure is to be made.

**Strength** is the force per unit area (stress) that a material can support without failing. The units are the same as those of stiffness, $MN/m^2$, but in this case the deformation is irreversible. The **yield strength** is the

stress at which a material first deforms plastically. For a metal the yield strength may be less than the fracture strength, which is the stress at which it breaks. Many materials have a higher strength in compression than in tension.

Ductility is the ability of a material to deform without breaking. One of the great advantages of metals is their **ability** to be formed into the shape that is needed, such as **car body** parts. Materials that are not ductile are **brittle**. Ductile materials can **absorb** energy by deformation but brittle materials cannot.

Toughness is the resistance of a material to breaking when there is a **crack** in it. For a material of given toughness, the stress at which it will fail is **inversely** proportional to the **square root** of the size of the largest defect present. Toughness is different from strength: the toughest steels, for example, are different from the ones with highest **tensile strength**. Brittle materials have low toughness: glass can be broken along a chosen line by first scratching it with a diamond. Composites can be designed to have considerably greater toughness than their **constituent materials**. The example of a very tough composite is fiberglass that is very flexible and strong.

Creep resistance is the resistance to a **gradual permanent** change of shape, and it becomes especially important at higher temperatures. A successful research has been made in materials for machine parts that operate at high temperatures and under high tensile forces without gradually extending, for example the parts of plane engines.

*Vocabulary*

**ability** [ə′biliti] — способность
**amount** [ə′maunt] — количество





**absorb** [əb′zɔ:b] — поглощать
**amount** [ə′maunt] — количество
**application** [æplɪ′keɪʃən] — применение
**brittle** [′brɪtl] — хрупкий, ломкий
**car body** — кузов автомобиля
**constituent** [kən′stɪtjuənt] — компонент
**crack** [kræk] — трещина
**creep resistance** — устойчивость к ползучести
**definition** [dɛfɪ′nɪʃən] — определение
**density** [′dɛnsɪtɪ] — плотность
**ductility** [dʌk′tɪlɪtɪ] — ковкость, эластичность
**failure** [′feɪljə′] — повреждение
**gradual** [′grædjuəl] — постепенный
**permanent** [′pə:mənənt] — постоянный
**rigid** [′rɪʤɪd] — жесткий
**to sink** [sɪŋk] — тонуть
**square root** [′skwɛə ′ru:t] — квадратный корень
**stiffness** [′stɪfnɪs] — жесткость
**strain** [streɪn] — нагрузка, напряжение, деформация
**strength** [strɛŋθ] — прочность
**stress** [strɛs] — давление, напряжение
**tensile strength** — прочность на разрыв
**toughness** [′tʌfnɪs] — прочность, стойкость
**yield strength** [ji:ld] — прочность текучести
**Young modulus** — модуль Юнга

*General understanding:*

1. What is the density of a material?
2. What are the units of density? Where low density is needed?
3. What are the densities of water, aluminium and steel?
4. A measure of what properties is stiffness? When stiffness is important?

5. What is Young modulus?
6. What is strength?
7. What is yield strength? Why fracture strength is always greater than yield strength?
8. What is ductility? Give the examples of ductile materials. Give the examples of brittle materials.
8. What is toughness?
9. What properties of steel are necessary for the manufacturing of: a) springs, b) car body parts, c) bolts and nuts, d) cutting tools?
10. Where is aluminium mostly used because of its light weight?

***Exercise 3.3.*** **Find the following words and word combinations in the text:**

1. количество массы в единице объема
2. килограмм на кубический метр
3. мера сопротивления деформации
4. отношение приложенной силы на единицу площади к частичной упругой деформации
5. жесткая конструкция
6. прочность на сжатие
7. способность материала деформироваться не разрушаясь
8. поглощать энергию путем деформации
9. обратно пропорционально квадрату размера дефекта
10. постепенное изменение формы
11. повышенные температуры
12. высокие растягивающие усилия

***Exercise 3.4.*** **Translate into English the following:**

1. Плотность измеряется в килограммах на кубический метр.





2. Большинство материалов имеют более высокую плотность, чем вода и тонут в воде.
3. Плотность материала очень важна, особенно в авиации.
4. Модуль Юнга — отношение приложенной силы к упругой деформации данного материала.
5. Чем более металл жесткий, тем менее он деформируется под нагрузкой.
6. Когда металл растягивают, он сначала течет, то есть пластически деформируется.
7. Свинец, медь, алюминий и золото — самые ковкие металлы.
8. Сопротивление ползучести является очень важным свойством материалов, которые используются в авиационных моторах.

## «FAMOUS PEOPLE OF SCIENCE AND ENGINEERING»

**Sikorsky Igor Ivanovich** was a well-known aircraft engineer and manufacturer.

Sikorsky was born in 1889 in Kiev, in the Ukraine, and got his education at the naval college in St. Petersburg, and later in Kiev and Paris. He was the first to make experiments in helicopter design. In 1913 he designed, built, and flew the first successful aeroplane. Later he built military aircrafts for Russia and France.

In 1919 Sikorsky moved to the United States and later helped to organize an aircraft company that produced a series of multiengine flying boats for commercial service. Sikorsky became an American citizen in 1928. In the late 1930s he returned to developing helicopters and produced the first successful helicopter in the west. Helicopters designed by Sikorsky were used mostly by the US

Army Air Forces during World War II. He died in 1972 at the age of 83.

**Tupolev Andrey Nikolayevich,** famous aircraft designer, was born in1888. He graduated from the Moscow Higher Technical School, where he designed the first Russian wind tunnel. He helped to found the Central Aerohydrodynamics Institute in 1918 and later worked as the head of its design bureau. During his career he directed the design of more than 100 military and commercial aircraft, including the TU-2 and TU-4 bombers used in the World War II. In 1955 he designed the TU-104, the first passenger jet airliner. His TU-144 supersonic jet liner began its commercial passenger flights in 1977.

# UNIT 4
# MACHINE-TOOLS

I. **Text A: «Machine-tools»**
   **Text B: «Lathe»**
   **Text C: «Milling, boring, drilling machines. Shapers and Planers»**
   **Text D: «Dies»**
II. **Famous people of science and technology: George Stephenson, Robert Stephenson.**

## Text A: «MACHINE-TOOLS»

Machine-tools are used to **shape** metals and other materials. The material to be shaped is called the **workpiece.** Most machine-tools are now **electrically driven.** Machine-tools with electrical drive are faster and more **accurate** than hand tools: they were an important element in the **development** of mass-production processes, as they **allowed** individual parts to be made in large numbers so as to be **interchangeable.**

All machine-tools have **facilities** for holding both the workpiece and the tool, and for accurately controlling the movement of the cutting tool **relative** to the workpiece. Most machining operations generate large **amounts** of heat, and use cooling **fluids** (usually a mixture of water and oils) for cooling and **lubrication.**

Machine-tools usually work materials mechanically but other machining methods have been developed

lately. They include chemical machining, **spark erosion** to machine very hard materials to any shape by means of a continuous high-voltage **spark (discharge)** between an electrode and a workpiece. Other machining methods include **drilling** using ultrasound, and cutting **by means of** a laser **beam**. Numerical control of machine-tools and **flexible** manufacturing systems have made it possible for complete systems of machine-tools to be used flexibly for the manufacture of a **range** of products.

*Vocabulary:*

**machine-tools** — станки
**electrically driven** — с электроприводом
**shape** [ʃeɪp] — форма
**workpiece** — деталь
**accurate** [ˈækjurɪt] — точный
**development** [dɪˈvɛləpmənt] — развитие
**to allow** [əˈlau] — позволять, разрешать
**interchangeable** [ɪntəˈʧeɪnʤəbl] — взаимозаменяемый
**facility** [fəˈsɪlɪtɪ] — приспособление
**relative** [ˈrɛlətɪv] — относительный
**amount** [əˈmaunt] — количество
**fluid** [ˈfluːɪd] — жидкость
**to lubricate** [ˈluːbrɪkeɪt] — смазывать
**spark erosion** [spɑːk ɪˈrəuʒən] — электроискровая обработка
**discharge** — разряд
**by means of** — посредством
**beam** [biːm] — луч
**drilling** — сверление
**flexible** [ˈflɛksəbl] — гибкий
**range** [reɪnʤ] — ассортимент, диапазон





## Text B: «LATHE»

Lathe is still the most important machine-tool. It produces parts of **circular cross-section** by turning the workpiece on its axis and cutting its surface with a sharp **stationary** tool. The tool may be moved **sideways** to produce a cylindrical part and moved towards the workpiece to control the **depth** of cut. Nowadays all lathes are power-driven by electric motors. That allows continuous rotation of the workpiece at a variety of speeds. The modern lathe is driven by means of a **headstock** supporting a hollow **spindle** on accurate bearings and carrying either a **chuck** or a **faceplate**, to which the workpiece is clamped. The movement of the tool, both along the **lathe bed** and at right angle to it, can be accurately controlled, so **enabling** a part to be machined to close **tolerances**. Modern lathes are often under numerical control.

*Vocabulary:*

**lathe** [leɪð] — токарный станок
**circular cross-section** [ˈsəːkjuləˈ] — круглое поперечное сечение
**surface** [ˈsəːfɪs] — поверхность
**stationary** [ˈsteɪʃnərɪ] — неподвижный, стационарный
**sideways** [ˈsaɪdweɪz] — в сторону
**variety** [vəˈraɪətɪ] — разнообразие, разновидность
**depth** [dɛpθ] — глубина
**headstock** [ˈhɛdstɔk] — передняя бабка
**spindle** [spɪndl] — шпиндель
**chuck** [ʧʌk] — зажим, патрон
**faceplate** — планшайба

**lathe bed** — станина станка
**to enable** [ɪ'neɪbl] — давать возможность
**tolerance** ['tɔlərns] — допуск

*General understanding:*

1. What are machine-tools used for?
2. How are most machine-tools driven nowadays?
3. What facilities have all machine-tools?
4. How are the cutting tool and the workpiece cooled during machining?
5. What other machining methods have been developed lately?
6. What systems are used now for the manufacture of a range of products without the use of manual labour?
7. What parts can be made with lathes?
8. How can the cutting tool be moved on a lathe?
9. How is the workpiece clamped in a lathe?
10. Can we change the speeds of workpiece rotation in a lathe?
11. What is numerical control of machine tools used for?

*Exercise 4.1.* **Find English equivalents in the text:**

1. обрабатываемый материал
2. электропривод
3. более точный
4. отдельные детали
5. процесс массового производства
6. приспособления для держания резца и детали
7. операции по механической обработке детали
8. высоковольтный разряд
9. сверление ультразвуком
10. резание с помощью лазерного луча





11. гибкие производственные системы
12. детали круглого сечения
13. поворачивать деталь вокруг ее оси
14. двигать в сторону, двигать по направлению к детали
15. глубина резания
16. непрерывное вращение детали
17. движение резца вдоль станины

*Exercise 4.2.* **Translate into English:**

1. Токарный станок позволяет производить детали круглого сечения.
2. Деталь зажимается в патроне или на планшайбе токарного станка.
3. Резец может двигаться как вдоль станины, так и под прямым углом к ней.
4. Современные токарные станки часто имеют цифровое управление.

## *Text C: «MILLING MACHINE»*

In a **milling machine** the **cutter** (фреза) is a circular device with a **series** of cutting **edges** on its **circumference**. The workpiece is held on a table that controls the **feed** against the cutter. The table has three possible movements: **longitudinal, horizontal,** and **vertical**; in some cases it can also rotate. Milling machines are the most **versatile** of all machine tools. **Flat** or **contoured** surfaces may be machined with excellent finish and accuracy. **Angles, slots, gear teeth** and cuts can be made by using various shapes of cutters.

**Drilling and Boring Machines**

**To drill a hole** usually hole-making machine-tools are used. They can drill a hole according to some specifica-

tion, they can **enlarge** it, or they can cut **threads** for a screw or to create an accurate size or a smooth finish of a hole.

Drilling machines (сверлильные станки) are different in size and function, from **portable drills** to radial drilling machines, multispindle **units**, automatic production machines, and deep-hole-drilling machines.

Boring (расточка) is a process that enlarges holes **previously** drilled, usually with a rotating single-point cutter held on a boring bar and fed against a stationary workpiece.

### Shapers and Planers

The shaper (поперечно-строгальный станок) is used mainly to produce different flat surfaces. The tool **slides** against the stationary workpiece and cuts on one **stroke**, returns to its starting position, and then cuts on the next stroke after a slight **lateral displacement.** In general, the shaper can make any surface having **straight-line** elements. It uses only one cutting-tool and is relatively slow, because the return stroke is **idle.** That is why the shaper is seldom found on a mass production line. It is, however, valuable for tool production and for **workshops** where flexibility is important and relative slowness is unimportant.

The **planer** (продольно-строгальный станок) is the largest of the reciprocating machine tools. It differs from the shaper, which moves a tool past a fixed workpiece because the planer moves the workpiece to expose a new section to the tool. Like the shaper, the planer is intended to produce vertical, horizontal, or diagonal cuts. It is also possible to **mount** several tools at one time in any or all tool **holders** of a planer to **execute multiple simultaneous** cuts.





### Grinders

**Grinders** (шлифовальные станки) **remove** metal by a rotating abrasive **wheel.** The wheel is composed of many small grains of abrasive, **bonded** together, with each grain acting as a miniature cutting tool. The process gives very smooth and accurate finishes. Only a small amount of material is **removed** at each **pass** of the wheel, so grinding machines require **fine** wheel regulation. The pressure of the wheel against the workpiece is usually very light, so that grinding can be carried out on **fragile** materials that cannot be machined by other **conventional devices.**

*Vocabulary:*

**milling machine** — фрезерный станок
**series** [ˈsɪəɾɪz] — серия, ряд
**cutting edge** — режущий край, острие
**circumference** [səˈkʌmfərəns] — окружность
**to feed** [fi:d] — подавать
**longitudinal** [ˌlɔndʒɪˈtju:dɪnl] — продольный
**horizontal** [hɔrɪˈzɔntl] — горизонтальный
**vertical** [ˈvə:tɪkl] — вертикальный
**versatile** [ˈvə:sətaɪl] — универсальный
**flat** [flæt] — плоский
**contoured** [ˈkɔntuəd] — контурный
**angle** [ˈæŋgl] — угол
**slot** [slɔt] — прорезь, паз
**gear teeth** [gɪəˈ] — зубы шестерни
**drill** [drɪl] — дрель, сверло, сверлить
**hole** [həul] — отверстие
**to enlarge** [ɪnˈlɑ:ʤ] — увеличивать
**thread** [θrɛd] — резьба
**portable** [ˈpɔ:təbl] — портативный
**unit** [ˈju:nɪt] — единица, целое, узел
**previously** [ˈpri:vɪəslɪ] — ранее

**to slide** [slaɪd] — скользить
**stroke** [strəuk] — ход
**lateral** [ ˈlætərl] — боковой
**displacement** [dɪsˈpleɪsmənt] — смещение
**straight** [streɪt] — прямой
**idle** [ˈaɪdl] — на холостом ходу
**workshop** [ˈwəːkʃɔp] — цех, мастерская
**to mount** [maunt] — крепить
**holder** — держатель
**to execute** [ˈɛksɪkjuːt] — выполнять
**simultaneous** [sɪməlˈteɪnɪəs] — одновременный
**multiple** [ˈmʌltɪpl] — многочисленный
**grinder** [ˈgraɪndəˈ] — шлифовальный станок
**wheel** [wiːl] — круг, колесо
**bonded** — скрепленый
**to remove** [rɪˈmuːv] — удалять
**pass** [pɑːs] — проход
**fine** [faɪn] — точный
**conventional** [kənˈvɛnʃənl] — обычный
**device** [dɪˈvaɪs] — устройство, прибор
**fragile** [ˈfrædʒaɪl] — хрупкий

*General understanding:*

1. What is the shape of a cutter in a milling machine?
2. What moves in a milling machine, a table or a cutter?
3. What possible movements has the table of a milling machine?
4. What kind of surfaces and shapes may be machined by a milling machine?
5. What can we use a drilling machine for?
6. What kinds of drilling machines exist?
7. What is rotated while boring, a cutter or a workpiece?
8. Describe the work of a shaper (planer).





9. What must be done to execute multiple simultaneous cuts on a planer?
10. What is the working tool in a grinder?
11. Can we obtain a very smooth surface after grinding and why?
12. Can we grind fragile materials and why?

***Exercise 4.3.*** **Translate into English:**

1. Токарный станок все еще остается самым важным станком.
2. Все современные токарные станки оборудованы элетроприводами.
3. Движение инструмента контролируется с высокой точностью.
4. Электропривод позволяет обрабатывать заготовку на различных скоростях.

## *Text C: «DIES»*

**Dies** are tools used for the shaping solid materials, especially those employed in the pressworking of cold metals.

In presswork, dies are used in pairs. The smaller die, or **punch**, fits inside the larger die, called the **matrix** or, simply, the die. The metal to be formed, usually a sheet, is placed over the matrix on the press. The punch is mounted on the press and moves down by hydraulic or mechanical force.

A number of different forms of dies are **employed** for different operations. The simplest are **piercing dies** (пробивной штамп), used for **punching** holes. Bending and folding dies are designed to make single or compound bends. A combination die is designed to perform more than one of the above operations in one stroke of the

press. A progressive die permits successive forming operations with the same die.

In coining, metal is forced to flow into two **matching** dies, each of which bears a engraved design.

### Wiredrawing Dies

In the manufacture of **wire**, a drawplate (волочильная доска) is usually **employed**. This tool is a metal plate containing a number of holes, successively less in diameter and known as wire dies. A piece of metal is pulled through the largest die to make a **coarse** wire. This wire is then **drawn** through the smaller hole, and then the next, until the wire is reduced to the desired measurement. Wiredrawing dies are made from extremely hard materials, such as tungsten carbide or diamonds.

### Thread-Cutting Dies

For cutting **threads** on **bolts** or on the outside of pipes, a thread-cutting die (резьбонарезная плашка) is used. It is usually made of **hardened** steel in the form of a round plate with a hole in the centre. The hole has a thread. To cut an **outside** thread, the die is **lubricated** with oil and simply **screwed** onto an unthreaded bolt or piece of pipe, the same way a **nut** is screwed onto a bolt. The corresponding tool for cutting an **inside** thread, such as that inside a **nut**, is called a **tap** (метчик).

*Vocabulary:*

**chip** [ʧɪp] — стружка
**sharp** [ʃɑ:p] — острый
**friction** [ˈfrɪkʃən] — трение
**content** [ˈkɔntɛnt] — содержание
**range** [reɪnʤ] — диапазон
**inexpensive** [ɪnɪkˈspɛnsɪv] — недорогой
**to permit** [pəˈmɪt] — позволять, разрешать
**common** [ˈkɔmən] — обычный





**tungsten** [ˈtʌŋstn] — вольфрам
**ingredient** [ɪnˈgri:dɪənt] — ингредиент
**diamond** [ˈdaɪəmənd] — алмаз
**tips** — наконечники
**ceramic** [sɪˈræmɪk] — керамический
**truing** [ˈtruɪŋ] — правка, наводка, заточка
**die** [daɪ] — матрица, штамп
**matrix** [ˈmeɪtrɪks] — матрица
**to employ** [ɪmˈplɔɪ] — применять
**to pierce** [ˈpɪəs] — протыкать, прокалывать
**to punch** [pʌnʧ] — пробивать отверстие
**matching** [ˈmæʧɪŋ] — сочетающийся, парный
**coarse** [kɔ:s] — грубый
**wire** [ˈwajə] — проволока
**to draw** [drɔ:] — тащить, волочить
**thread** [θrɛd] — резьба
**hardened** [ˈhɑ:dnd] — закаленный
**to lubricate** [ˈlu:brɪkeɪt] — смазывать
**to screw** [skru:] — привинчивать
**nut** [nʌt] — гайка
**outside** [autˈsaɪd] — наружный, внешний
**inside** [ˌɪnˈsaɪd] — внутри, внутренний

***Exercise 4.4.*** **Find English equivalents in the text:**

1. удалять металлическую стружку
2. острый режущий край
3. содержание углерода
4. режущая способность
5. сталь для скоростного резания
6. правка шлифовальных кругов
7. гидравлическое или механическое давление
8. различные формы штампов

***Exercise 4.5.*** **Translate the following sentences into Russian:**

1. Все резцы и фрезы должны иметь острую режущую кромку.

2. Во время резания режущий инструмент и деталь имеют высокую температуру и должны охлаждаться.

3. Углеродистые стали часто используются для изготовления резцов потому, что они недорогие.

4. Быстрорежущие стали содержат вольфрам, хром и ванадий.

5. Алмазы используются для резания абразивных материалов и чистовой обработки поверхности твердых материалов.

6. Для различных операций используют различные штампы.

7. Волочильные доски для проволоки делаются из очень твердых материалов.

8. Резьбонарезные плашки и метчики используются для нарезки резьбы снаружи и внутри.

## FAMOUS PEOPLE OF SCIENCE AND ENGINEERING

### George Stephenson

George Stephenson was a British inventor and engineer. He is famous for building the first practical railway locomotive.

Stephenson was born in 1781 in Wylam, near Newcastle upon Tyne, Northumberland. During his youth he worked as a fireman and later as an engineer in the coal mines of Newcastle. He invented one of the first miner's safety lamps independently of the British inventor Humphry Davy. Stephenson's early locomotives were used to carry loads in coal mines, and in 1823 he established a factory at Newcastle for their manufacture. In 1829 he designed a locomotive known as the Rocket, which could carry both loads and passengers at a greater





speed than any locomotive constructed at that time. The success of the Rocket was the beginning of the construction of locomotives and the laying of railway lines.

**Robert Stephenson,** the son of George Stephenson was a British civil engineer. He is mostly well-known known for the construction of several notable bridges.

He was born in 1803 in Willington Quay, near Newcastle upon Tyne, and educated in Newcastle and at the University of Edinburgh. In 1829 he assisted his father in constructing a locomotive known as the Rocket, and four years later he was appointed construction engineer of the Birmingham and London Railway, completed in 1838. Stephenson built several famous bridges, including the Victoria Bridge in Northumberland, the Britannia Bridge in Wales, two bridges across the Nile in Damietta in Egypt and the Victoria Bridge in Montreal, Canada. Stephenson was a Member of Parliament from 1847 until his death in 1859.

# UNIT 5
# PLASTICS

I. **Text A: «Plastics»**
   **Text B: «Types of plastics»**
   **Text C: «Composite Materials»**
II. **Famous People of Science: Alfred Bernhard Nobel.**

## Text A: «PLASTICS»

Plastics are non-metallic, synthetic, **carbon-based** materials. They can be **moulded** ['məuldɪd], shaped, or extruded into **flexible** sheets, films, or **fibres**. Plastics are synthetic polymers. Polymers consist of long-**chain** molecules made of large numbers of **identical** small **molecules** (monomers). The chemical nature of a plastic is defined by the monomer (repeating unit) that makes up the chain of the polymer. Polyethene is a polyolefin; its monomer unit is ethene (formerly called ethylene). Other categories are acrylics (such as polymethylmethacrylate), styrenes [staɪ'ri:nz] (such as polystyrene), vinys (such as polyvinyl chloride (PVC) ['pɔlɪ'vaɪnl 'klɔ:raɪd]), polyesters, polyurethanes [pɔlɪ'juərɪθeɪn], polyamides (such as nylons), polyethers, acetals, phenolics, cellulosics, and amino resins. The molecules can be either natural — like **cellulose**, **wax**, and natural **rubber** — or synthetic — in polyethene and nylon. In co-polymers, more than one monomer is used.

The giant molecules of which polymers consist may be linear, **branched**, or cross-linked, depending on the





plastic. Linear and branched molecules are thermoplastic (soften when heated), whereas cross-linked molecules are **thermosetting** (harden when heated).

Most plastics are **synthesized** from organic **chemicals** or from natural gas or coal. Plastics are light-weight compared to metals and are good electrical insulators. The best insulators now are epoxy resins and teflon. Teflon or polytetrafluoroethene (PTFE) was first made in 1938 and was produced commercially in 1950.

Plastics can be classified into several broad types.

**1. Thermoplastics** ['θə:məplæstiks] **soften** on heating, then **harden** again when cooled. Thermoplastic molecules ['mɔlɪkju:lz] are also **coiled** and because of this they are flexible and easily **stretched.**

Typical example of thermoplastics is polystyrene [pɔlɪ'staɪri:n]. Polystyrene resins are characterized by high resistance to chemical and mechanical stresses at low temperatures and by very low absorption of water. These properties make the polystyrenes especially suitable for radio-frequency insulation and for parts used at low temperatures in refrigerators and in airplanes. PET (polyethene terephthalate) is a **transparent** thermoplastic used for **soft-drinks** bottles. Thermoplastics are also viscoelastic, that is, they flow (creep) under stress. Examples are polythene, polystyrene and **PVC.**

**2. Thermosetting plastics** (thermosets) do not soften when heated, and with strong heating they decompose. In most thermosets final cross-linking, which fixes the molecules, takes place after the plastic has already been formed.

Thermosetting plastics have a higher density than thermoplastics. They are less flexible, more difficult to stretch, and are less **subjected** to creep. Examples of thermosetting plastics include urea-formaldehyde ['juərɪə

fɔ:ˈmældıhaıd] or polyurethane [pɔlıˈjuərıθeın] and epoxy **resins**, most polyesters, and phenolic polymers such as phenol-formaldehyde resin.

**3. Elastomers** are similar to thermoplastics but have **sufficient cross-linking** between molecules to **prevent** stretching and creep.

*Vocabulary:*

**carbon** [ˈkɑ:bən] — углерод
**flexible** [ˈflɛksəbl] — гибкий.
**fibre** [ˈfaıbəˈ] — волокно, нить
**chain** [ʧeın] — цепь
**identical** [aıˈdɛntıkl] — одинаковый, идентичный
**molecule** [ˈmɔlıkju:l] — молекула
**branch** [brɑ:nʧ] — разветвленный
**to synthesize** [ˈsınθəsaız] — синтезировать
**chemicals** [ˈkemıklz] — химические вещества
**to soften** [ˈsɔfn] — смягчать
**cellulose** [ˈsɛljuləus] — клетчатка, целлюлоза
**wax** [wæks] — воск
**thermosetting plastics** — термореактивные пластмассы
**to harden** [ˈhɑ:dn] — делать твердым
**coil** [kɔıl] — спираль
**stretched** [strɛʧt] — растянутый
**transparent** [træns ˈpærnt] — прозрачный
**rubber** [ˈrʌbəˈ] — резина, каучук
**to decompose** [di:kəmˈpəuz] — разлагать(ся)
**soft-drink** — безалкогольный напиток
**to subject** [sʌbˈʤekt] — подвергать
**polyurethane** [pɔlıˈjuərıθeın] — полиуретан
**resin** [ˈrɛzın] — смола
**similar** [ˈsımıləˈ] — сходный, подобный





**sufficient** [səˈfıʃənt] — достаточный
**to prevent** [prıˈvɛnt] — предотвращать

*General understanding.*

1. What is the definition of plastics?
2. What is the basic chemical element in plastics formula?
3. What do polymers consist of?
4. What are long-chain molecules made of?
5. What are the main types of polymers?
6. Give examples of plastics belonging to these types.
7. What plastics are the best electrical insulators?
8. Describe the difference between thermoplastics and thermosets.
9. What are the main types of structures of polymers?
10. What are the most important properties of plastics?
11. Give the examples of various uses of plastics because of their characteristic properties.

*Exercise 5.1.* **Find English equivalents in the text:**

1. синтетические полимеры
2. молекулы с длинными цепями
3. характерные свойства полимера
4. синтезируются из органических химических веществ
5. хороший электрический изолятор
6. размягчаться при нагревании
7. затвердевать при охлаждении
8. гибкий и легко растяжимый
9. течь под нагрузкой
10. более высокая плотность
11. менее подвержены ползучести
12. достаточная взаимосвязь между молекулами

*Exercise 5.2.* **Translate into English:**

1. Длинные цепи молекул полимеров состоят из одинаковых небольших молекул мономеров.
2. Сополимеры состоят из двух и более мономеров.
3. Пластмассы можно получать в виде листов, тонких пленок, волокон или гранул.
4. Молекулы полимеров могут быть линейными, ветвящимися или с поперечными связями.
5. Малый вес пластмасс и хорошие электроизоляционные свойства позволяют использовать их в радиоэлектронике и электроприборах, а также вместо металлов.
6. Молекулы термопластов имеют извитую форму и, поэтому, они гибкие и легко растяжимы.
7. Эластомеры имеют большое число поперечных связей между молекулами.

## *Text B: «TYPES OF PLASTICS»*

**1. Epoxy resin.**

**Epoxy resin is** a thermoset plastic containing epoxy groups. Epoxy resin hardens when it is mixed with solidifier and plasticizer. Plasticizers make a polymer more flexible.

Epoxy resins have outstanding **adhesion**, toughness, and resistance to attack from chemicals. They form strong **bonds** and have excellent electrical **insulation** properties. Large, complex, **void**-free **castings** can be made from them. They are also used as adhesives, and in composites for boat building and sports equipment.

**2. PVC** (polyvinyl chloride)

**PVC (polyvinyl chloride)** [ˈpɔlɪˈvaɪnl ˈklɔːraɪd] is a thermoplastic polymer made from vinyl chloride is a colourless **solid** with outstanding resistance to water,





alcohols, and concentrated **acids** and **alkalis.** It is **obtainable** as **granules, solutions, lattices,** and **pastes.** When compounded with plasticizers, it **yields** a flexible material more **durable** than **rubber.** It is widely used for cable and wire **insulation,** in chemical plants, and in the manufacture of protective **garments.** Blow moulding of unplasticized PVC produces clear, tough bottles which do not affect the flavour of their contents. PVC is also used for production of tubes or pipes.

**3. Polystyrene.**

**Polystyrene** [pɔlɪˈstaɪriːn] is a thermoplastic produced by the polymerization of styrene. The electrical insulating properties of polystyrene are outstandingly good and it is relatively unaffected by water. Typical applications include light **fixtures,** toys, bottles, **lenses, capacitor** dielectrics, medical **syringes,** and **light-duty** industrial components. Extruded sheets of polystyrene are widely used for packaging, **envelope** windows, and photographic film. Its resistance to **impact** can be **improved** by the **addition** of rubber **modifiers.** Polystyrene can be **readily foamed;** the resulting foamed polystyrene is used **extensively** for packaging.

**4. Polythene** (polyethene, polyethylene)

**Polythene** [ˈpɔlɪθiːn] (polyethene, polyethylene) is a plastic made from ethane [eˈθeɪn]. It is one of the most widely used important thermoplastic polymers. It was first developed by the polymerization of ethane at a pressure of 2,000 bar at 200°C. This produced low-density polythene (LDPE). A relatively high-density form (HDPE) was synthesized in the 1950s using a complex **catalyst.** Polythene is a white **waxy** solid with very low density, **reasonable** strength and toughness, but low stiffness. It is easily moulded and has a wide range of uses in containers, packaging, **pipes, coatings,** and insulation.

*Vocabulary:*

**adhesion** [əd′hi:ʒən] — прилипание
**adhesive** [əd′hi:zɪv] — клей
**bond** [bɔnd] — связи, узы
**insulation** [ɪnsju′leɪʃən] — изоляция
**casting** [kɑ:stɪŋ] — литье
**void** [vɔɪd] — пустота
**solid** [′sɔlɪd] — твердое тело, твёрдый
**acid** [′æsɪd] — кислота
**alkali** [′ælkəlaɪ] — щелочь
**to obtain** [əb′teɪn] — доставать, получать
**granule** [′grænju:l] — гранула
**solution** [sə′lu:ʃən] — раствор
**lattices** [′lætisiz] — латексы
**paste** [peɪst] — паста
**yield** [ji:ld] — выход
**durable** [′djuərəbɪ] — прочный
**rubber** [′rʌbə′] — резина, каучук
**garment** [′gɑ:mənt] — предметы одежды
**lens** [′lenz] — линза
**capacitor** — эл. конденсатор
**syringe** [sɪ′rɪnʤ] — шприц
**light-duty** — неответственный
**envelope** — зд. обрамление
**impact** [′ɪmpækt] — удар
**improved** — улучшенный
**modifiers** [′mɔdɪ′faɪəz] — модификаторы
**addition** [ə′dɪʃən] — добавление
**readily** [′redɪlɪ] — легко, с готовностью
**foam** [fəum] — пена
**catalyst** [′kætəlɪst] — катализатор
**wax** [wæks] — воск
**reasonable** [′ri:znəbl] — приемлемый, неплохой
**coating** [′kəutɪŋ] — слой, покрытие





*General understnding:*

1. What are the types of plastics?
2. What are the features of the epoxy resin?
3. What is epoxy resin used for?
4. What is PVC usually used for?
5. What are the typical applications of polystyrene?
6. When was polyethylen synthesized?
7. Under what conditions is polyethylen synthesized?
8. What sorts of polyethylen can be synthesized?

*Exercise 5.3.* **Translate into Russian:**

1. Polythene is a plastic made from ethane.
2. Epoxy resins have outstanding adhesion, toughness and resistance to attack from chemicals.
3. PVC is a colourless solid with outstanding resistance to water, alcohols, and concentrated acids and alkalis.
4. Polystyrene is a thermoplastic produced by the polymerization of styrene.
5. Polythene is a white waxy solid with very low density, reasonable strength and toughness but low stiffness.

*Exercise 5.4.* **Translate into English:**

1. Эпоксидная смола затвердевает когда смешивается с отвердителем и пластификатором.
2. Эпоксидные смолы используются в качестве клея, а с добавками — в строительстве лодок и спортивного снаряжения.
3. ПВХ — бесцветное твердое вещество с выдающейся устойчивостью к воздействию воды, спиртов, концентрированных кислот и щелочей.
4. ПВХ широко используется при производстве изоляции для проводов.

5. Выдувка непластифицированного ПВХ используется при производстве прозрачных бутылок для напитков.

6. Полистирол легко вспенивается и используется для упаковки.

7. Полиэтилен — воскообразное вещество белого цвета с очень низкой плотностью и малой жесткостью.

## Text C: «COMPOSITE MATERIALS»

The combinations of two or more different materials are called composite materials. They usually have unique mechanical and physical properties because they combine the best properties of different materials. For example, a **fibre-glass reinforced** plastic combines the high strength of thin glass **fibres** with the ductility and chemical resistance of plastic. Nowadays composites are being used for structures such as bridges, boat-building etc.

Composite materials usually consist of synthetic fibres within a **matrix,** a material that surrounds and is tightly bound to the fibres. The most widely used type of composite material is **polymer matrix composites** (PMCs). PMCs consist of fibres made of a ceramic material such as carbon or glass embedded in a plastic matrix. Usually the fibres make up about 60 per cent by volume. Composites with metal matrices or ceramic matrices are called **metal matrix composites** (MMCs) and **ceramic matrix composites** (CMCs), respectively.

Continuous-fibre composites are generally required for structural applications. The **specific strength** (strength-to-density ratio) and **specific stiffness** (elastic modulus-to-density ratio) of continuous carbon fibre PMCs, for example, can be better than metal alloys have. Composites can also have other attractive properties,





such as high thermal or electrical conductivity and a low coefficient of thermal **expansion.**

Although composite materials have certain advantages over conventional materials, composites also have some disadvantages. For example, PMCs and other composite materials tend to be highly **anisotropic**—that is, their strength, stiffness, and other engineering properties are different depending on the orientation of the composite material. For example, if a PMC is fabricated so that all the fibres are lined up parallel to one another, then the PMC will be very stiff in the direction parallel to the fibres, but not stiff in the perpendicular direction. The designer who uses composite materials in structures subjected to multidirectional forces, must take these anisotropic properties into account. Also, forming strong connections between separate composite material components is difficult.

The advanced composites have high manufacturing costs. Fabricating composite materials is a complex process. However, new manufacturing techniques are developed. It will become possible to produce composite materials at higher volumes and at a lower cost than is now possible, accelerating the wider exploitation of these materials.

*Vocabulary:*

**fibreglass** [ˈfaɪbəglɑːs] — стекловолокно
**fibre** [ˈfaɪbəˈ] — волокно, нить
**reinforced** [riːɪnˈfɔːst] — упрочненный
**expansion** [ɪksˈpænʃən] — расширение
**matrix** [ˈmeɪtrɪks] — матрица
**ceramic** [sɪˈræmɪk] — керамический
**specific strength** [spəˈsɪfɪkˈstrɛŋθ] — удельная прочность

**specific stiffness** — удельная жесткость
**anisotropic** [ˈænaɪsəˈtrəupɪk] — анизотропный

*General understanding:*

1. What is called «composite materials»?
2. What are the best properties of fibre-glass?
3. What do composite material usually consist of?
4. What is used as matrix in composites?
5. What is used as filler or fibers in composites?
6. How are the composite materials with ceramic and metal matrices called?
7. What are the advantages of composites?
8. What are the disadvantages of composites?
9. Why anisotropic properties of composites should be taken into account?

*Exercise 5.5.* **Find equivalents in the text:**

1. композитные материалы
2. уникальные механические качества
3. полимерные матричные композиты
4. составлять 60% объема
5. углепластик
6. привлекательные качества
7. структура, подвергающаяся воздействию разнонаправленных сил

*Exercise 5.6.* **Translate into Russian:**

1. PMC is fabricated so that all the fibres are lined up parallel to one another.
2. Forming strong connections between separate composite material components is difficult.
3. Fabricating composite materials is a complex process.
4. Composite materials have certain advantages over conventional materials





5. Nowadays, composites are being used for structures such as bridges, boat-building etc.
6. Continuous-fibre composites are generally required for structural applications.

## FAMOUS INVENTORS

**Alfred Bernhard Nobel** was a famous Swedish chemist and inventor. He was born in Stockholm in 1833. After receiving an education in St.Petersburg, Russia, and then in the United States, where he studied mechanical engineering, he returned to St. Petersburg to work with his father in Russia. They were developing mines, torpedoes, and other explosives.

In a family-owned factory in Heleneborg, Sweden, he developed a safe way to handle nitroglycerine [ˈnaɪtrəuˈglɪsəri:n], after a factory explosion in 1864 killed his younger brother and four other people. In 1867 Nobel achieved his goal: he produced what he called dynamite [ˈdaɪnəmaɪt] динамит. He later produced one of the first smokeless powders [ˈpaudəˈ] (порох). At the time of his death he controlled factories for the manufacture of explosives [ɪksˈpləusɪv] (взрывчатое вещество) in many parts of the world. In his will he wanted that the major portion of his money left became a fund for yearly prizes in his name. The prizes were to be given for merits (заслуги) in physics, chemistry, medicine and physiology, literature, and world peace. A prize in economics has been awarded since 1969.

# UNIT 6
# WELDING

I. Text A: «Welding»
   Text B: «Other types of welding»
II. Famous People of Science and Technology: James Prescott Joule.

## Text A: «WELDING»

Welding is a process when metal parts are **joined** together by the application of heat, pressure, or a combination of both. The processes of welding can be divided into two main groups:

- **pressure welding,** when the weld is **achieved** by pressure and
- **heat welding,** when the weld is achieved by heat.

Heat welding is the most common welding process used today.

Nowadays welding is used **instead** of **bolting** and **riveting** in the construction of many types of structures, including bridges, buildings, and ships. It is also a **basic** process in the **manufacture** of machinery and in the motor and aircraft industries. It is necessary almost in all productions where metals are used.

The welding process **depends** greatly on the properties of the metals, the **purpose** of their application and the **available equipment.** Welding processes are classified according to the **sources** of heat and pressure used.





The welding processes widely employed today include **gas welding, arc welding,** and **resistance welding.** Other joining processes are **laser welding,** and **electron-beam welding.**

### Gas Welding

Gas welding is a non-pressure process using heat from a gas **flame.** The flame is applied directly to the metal **edges** to be joined and **simultaneously** to a **filler metal** in the form of **wire** or **rod,** called the welding rod, which is **melted** to the **joint.** Gas welding has the **advantage** of using equipment that is portable and does not **require** an electric power source. The **surfaces** to be welded and the welding rod are **coated** with **flux,** a **fusible** material that **shields** the material from air, which would result in a defective weld.

### Arc Welding

Arc-welding is the most important welding process for joining steels. It requires a continuous supply of either direct or alternating electrical current. This current is used to **create** an electric arc, which generates enough heat to melt metal and create a weld.

Arc welding has several advantages over other welding methods. Arc welding is faster because the concentration of heat is high. Also, fluxes are not necessary in certain methods of arc welding. The most widely used arc-welding processes are **shielded metal arc, gas-tungsten arc, gas-metal arc,** and **submerged arc.**

### Shielded Metal Arc

In shielded metal-arc welding, a metallic electrode, which conducts electricity, is coated with flux and connected to a source of electric current. The metal to be welded is connected to the other end of the same source of current. An electric arc is formed by **touching** the **tip** of the electrode to the metal and then drawing it away.

The intense heat of the arc melts both parts to be welded and the point of the metal electrode, which supplies **filler** metal for the weld. This process is used mainly for welding steels.

*Vocabulary:*

**to join** [ʤɔɪn] — соединять
**pressure welding** — сварка давлением
**heat welding** — сварка нагреванием
**instead** [ɪn'stɛd] — вместо, взамен
**bolting** [bəultɪŋ] — скрепление болтами
**riveting** ['rɪvɪtɪŋ] — клепка
**basic** ['beɪsɪk] — основной
**to manufacture** [mænju'fækʧə'] — изготовлять
**to depend** [dɪ'pɛnd] — зависеть от
**purpose** ['pə:pəs] — цель
**available** [ə'veɪləbl] — имеющийся в наличии
**equipment** [ɪ'kwɪpmənt] — оборудование
**source** [sɔ:s] — источник
**gas welding** — газосварка
**arc welding** — электродуговая сварка
**resistance welding** — контактная сварка
**laser welding** — лазерная сварка
**electron-beam welding** — электронно-лучевая сварка
**flame** [fleɪm] — пламя
**edge** [ɛdʒ] — край
**simultaneously** [sɪməl'teɪnɪəslɪ] — одновременно
**filler** ['fɪlə] — наполнитель
**wire** ['waɪə'] — проволока
**rod** [rɔd] — прут, стержень
**to melt** [mɛlt] — плавить(ся)
**joint** [ʤɔɪnt] — соединение, стык
**advantage** [əd'vɑ:ntɪʤ] — преимущество





**to require** [rɪ'kwaɪə'] — требовать нуждаться
**surface** ['sə:fɪs] — поверхность
**coated** ['kəutɪd] — покрытый
**flux** [flʌks] — флюс
**fusible** [fju:zɪbl] — плавкий
**to shield** [ʃi:ld] — заслонять, защищать
**touching** ['tʌʧɪŋ] — касание
**tip** [tɪp] — кончик

*General understanding:*

1. How can a process of welding be defined?
2. What are the two main groups of processes of welding?
3. How can we join metal parts together?
4. What is welding used for nowadays?
5. Where is welding necessary?
6. What do the welding processes of today include?
7. What are the principles of gas welding?
8. What kinds of welding can be used for joining steels?
9. What does arc welding require?
10. What is the difference between the arc welding and shielded-metal welding?

***Exercise 6.1.*** **Find the following words and word combinations in the text:**

1. сварка давлением
2. тепловая сварка
3. болтовое (клепаное) соединение
4. процесс сварки
5. зависеть от свойств металлов
6. имеющееся оборудование
7. сварочный электрод
8. плавкий материал
9. дефектный сварной шов

10. непрерывная подача электрического тока
11. электрическая дуга
12. источник электрического тока

## Text B: «OTHER TYPES OF WELDING»

### Non-consumable Electrode Arc welding

As a non-consumable electrodes tungsten or carbon electrodes can be used. In gas-tungsten arc welding a tungsten electrode is used in place of the metal electrode used in shielded metal-arc welding. A chemically **inert** gas, such as argon, helium ['hi:lıəm], or **carbon dioxide** is used to shield the metal from oxidation. The heat from the arc formed between the electrode and the metal melts the **edges** of the metal. Metal for the weld may be added by placing a **bare** wire in the arc or the point of the weld. This process can be used with nearly all metals and produces a high-quality weld. However, the **rate** of welding is **considerably** slower than in other processes.

### Gas-Metal Arc

In gas-metal welding, a bare electrode is shielded from the air by **surrounding** it with argon or **carbon dioxide** gas and sometimes by coating the electrode with flux. The electrode is **fed** into the electric arc, and melts off in **droplets** that enter the **liquid** metal of the weld seam. Most metals can be joined by this process.

### Submerged Arc

**Submerged**-arc welding is similar to gas-metal arc welding, but in this process no gas is used to shield the weld. **Instead** of that, the arc and tip of the wire are **submerged beneath** a **layer** of granular, fusible material that covers the **weld seam**. This process is also called electroslag welding. It is very efficient but can be used only with steels.





### Resistance Welding

In resistance welding, heat is obtained from the resistance of metal to the flow of an electric current. Electrodes are **clamped** on each side of the parts to be welded, the parts are subjected to great pressure, and a heavy current is applied for a short period of time. The point where the two metals touch creates resistance to the flow of current. This resistance causes heat, which melts the metals and creates the weld. Resistance welding is widely employed in many fields of **sheet** metal or wire manufacturing and is often used for welds made by automatic or **semi-automatic** ['semı ˌɔ:tə'mætık] machines especially in automobile industry.

*Vocabulary*

**gas-tungsten** — сварка оплавлением вольфрамовым электродом в среде инертного газа
**inert** [ı'nə:t] — инертный
**edge** [edʒ] — край
**bare** [bɛə'] — голый
**rate** [reıt] — зд. скорость
**gas-metal arc** — аргоно-дуговая сварка
**considerably** [kən'sıdərəblı] — значительно, гораздо
**surrounding** [sə'raundıŋ] — окружающий
**carbon dioxide** ['kɑ:bən daı'ɔksaıd]— углекислый газ
**droplet** ['drɔplıt] — капелька
**liquid** ['lıkwıd] — жидкость, жидкий
**beneath** [bı'ni:θ] — под, ниже, внизу
**layer** ['leiə] — слой
**weld seam** [si:m] — сварной шов
**resistance** — сопротивление
**clamp** [klæmp] — зажим, зажимать
**sheet** [ʃi:t] — лист
**fusible** ['fju:zəbl] — плавкий

**granular** [ˈgrænjulə] — плавкий
**semi-automatic** [ˈsemɪ ˌɔːtəˈmætɪk] — полуавтоматическая
**to create** [kriːˈeɪt] — создавать
**to submerge** [səbˈməːdʒ] — погружать

***General understanding:***

1. What is the difference between the arc-welding and non-consumable electrode arc welding?
2. What are the disadvantages of the non-consumable electrode arc welding?
3. How is electrode protected from the air in gas-metal arc welding?
4. What is submerged arc welding?
5. What is the principle of resistance welding?
6. Where is semi-automatic welding employed?

***Exercise 6.2.*** **Translate into English:**

1. вольфрамовый электрод
2. инертный газ
3. окисление
4. высококачественный сварочный шов
5. скорость сварки
6. аргон, гелий, углекислый газ
7. жидкий металл
8. слой плавкого материала в виде гранул
9. листовой металл
10. полувтоматические сварочные станки

***Exercise 6.3.*** **Translate into Russian:**

1. In resistance welding, heat is obtained from the resistance of metal to the flow of an electric current.
2. The heat from the arc melts the edges of the metal.





3. A bare electrode is shielded from the air by surrounding it with argon or carbon dioxide gas.
4. Submerged-arc welding is similar to gas-metal arc welding.
5. Electrodes are clamped on each side of the parts to be welded.
6. Resistance causes heat which melts the metals and creates the weld.

## FAMOUS PEOPLE OF SCIENCE AND TECHNOLOGY

**James Prescott Joule**, famous British physicist, was born in 1818 in Salford, England.

Joule was one of the most outstanding physicists of his time. He is best known for his research in electricity and thermodynamics. In the course of his investigations of the heat emitted in an electrical circuit, he formulated the law, now known as Joule's law of electric heating. This law states that the amount of heat produced each second in a conductor by electric current is proportional to the resistance of the conductor and to the square of the current. Joule experimentally verified the law of conservation of energy in his study of the conversion of mechanical energy into heat energy.

Joule determined the numerical relation between heat and mechanical energy, or the mechanical equivalent of heat, using many independent methods, The unit of energy, called the joule, is named after him. It is equal to 1 watt-second. Together with the physicist Willian Thomson (Baron Kelvin), Joule found that the temperature of a gas falls when it expands without doing any work. This phenomenon, which became known as the Joule-Thomson effect, lies in the operation of modern refrigeration and air-conditioning systems.

# UNIT 7
## AUTOMATION AND ROBOTICS

I. **Text A: «Automation»**
   **Text B: «Types of automation»**
   **Text C: «Robots in manufacturing»**
II. **Famous people of science and technology: James Watt.**

### Text A: «AUTOMATION»

Automation is the system of manufacture performing certain tasks, **previously** done by people, by machines only. The **sequences** of operations are controlled automatically. The most familiar example of a highly automated system is an **assembly plant** for automobiles or other complex products.

The term automation is also used to describe **nonmanufacturing** systems in which automatic **devices** can operate independently of human control. Such devices as automatic pilots, automatic telephone equipment and automated control systems are used to perform various operations much faster and better than could be done by people.

Automated manufacturing had several steps in its development. Mechanization was the first step necessary in the development of automation. The simplification of work made it possible to design and build machines that **resembled** the motions of the worker. These specialized machines were motorized and they had better production **efficiency.**





Industrial robots, originally designed only to perform simple tasks in environments dangerous to human workers, are now widely used to transfer, manipulate, and position both light and heavy workpieces performing all the functions of a transfer machine.

In the 1920s the automobile industry for the first time used an integrated system of production. This method of production was adopted by most car manufacturers and became known as Detroit automation.

The feedback principle is used in all automatic-control mechanisms when machines have ability to correct themselves. The feedback principle has been used for centuries. An outstanding early example is the **flyball governor,** invented in 1788 by James Watt to control the speed of the **steam engine.** The common **household thermostat** is another example of a feedback device.

Using feedback devices, machines can start, stop, speed up, slow down, count, inspect, test, compare, and measure. These operations are commonly applied to a wide variety of production operations.

Computers have greatly **facilitated** the use of feedback in manufacturing processes. Computers gave rise to the development of numerically controlled machines. The motions of these machines are controlled by **punched** paper or magnetic tapes. In numerically controlled machining centres machine tools can perform several different machining operations.

More recently, the introduction of microprocessors and computers have made possible the development of computer-**aided** design and computer-aided manufacture (CAD and CAM) technologies. When using these systems a designer draws a part and indicates its **dimensions** with the help of a mouse, light pen, or other input device. After the drawing has been completed the computer auto-

matically gives the instructions that direct a machining centre to machine the part.

Another development using automation are the flexible manufacturing systems (FMS). A computer in FMS can be used to monitor and control the operation of the whole factory.

Automation has also had an influence on the areas of the economy other than manufacturing. Small computers are used in systems called word processors, which are rapidly becoming a standard part of the modern office. They are used to edit texts, to type letters and so on.

**Automation in Industry**

Many industries are highly automated or use automation technology in some part of their operation. In communications and especially in the telephone industry dialling and transmission are all done automatically. Railways are also controlled by automatic signalling devices, which have sensors that detect carriages passing a particular point. In this way the movement and location of trains can be monitored.

Not all industries require the same degree of automation. Sales, agriculture, and some service industries are difficult to automate, though agriculture industry may become more mechanized, especially in the processing and packaging of foods.

The automation technology in manufacturing and assembly is widely used in car and other consumer product industries.

Nevertheless, each industry has its own concept of automation that answers its particular production needs.

***Vocabulary:***

**automation** [ɔ:tə'meɪʃən] — автоматизация
**previously** ['pri:vɪəslɪ] — ранее





**sequence** ['si:kwəns] — последовательность
**assembly plant** — сборочный завод
**nonmanufacturing** — непроизводственный
**device** [dɪ'vaɪs] — устройство, прибор
**resemble** [rɪ'zembl] — походить
**efficiency** [ɪ'fɪʃənsɪ] — эффективность
**flyball governor** — центробежный регулятор
**steam engine** — паровоз
**household thermostat** — бытовой термостат
**facilitate** [fə'sɪlɪteɪt] — способствовать
**punched** [pʌntʃt] — перфорированный
**aid** [eɪd] — помощь
**dimension** [daɪ'menʃən] — измерение, размеры

***General understanding:***

1. How is the term automation defined in the text?
2. What is the most «familiar example» of automation given in the text?
3. What was the first step in the development of automaton?
4. What were the first robots originally designed for?
5. What was the first industry to adopt the new integrated system of production?
6. What is feedback principle?
7. What do the abbreviations CAM and CAD stand for?
8. What is FMS?
9. What industries use automation technologies?

***Exercise 7.1.*** **Find the following words and word combinations in the text:**

1. автоматические устройства
2. автоматизированное производство
3. выполнять простые задачи

4. как легкие, так и тяжелые детали
5. интегрированная система производства
6. принцип обратной связи
7. механизм может разгоняться и тормозить
8. компьютер автоматически посылает команды
9. высокоавтоматизированная система
10. непроизводственная система

## Text B: «TYPES OF AUTOMATION»

### Applications of Automation and Robotics in Industry

Manufacturing is one of the most important application area for automation technology. There are several types of automation in manufacturing. The examples of automated systems used in manufacturing are described below.

1. Fixed automation, sometimes called «hard automation» refers to automated machines in which the **equipment** configuration allows fixed **sequence** of processing operations. These machines are programmed by their design to make only certain processing operations. They are not easily changed over from one product style to another. This form of automation needs high **initial investments** and high production **rates**. That is why it is suitable for products that are made in large volumes. Examples of fixed automation are machining transfer lines found in the automobile industry, automatic **assembly machines** and certain chemical processes.

2. Programmable automation is a form of automation for producing products in large **quantities**, ranging from several dozen to several thousand units at a time. For each new product the production equipment must be reprogrammed and changed over. This reprogramming and changeover take a period of **non-productive** time. Production rates in programmable automation are generally lower than in fixed automation, because the equipment is designed to **facilitate** product **changeover** rather than for product specialization. A numerical-control machine-tool is a good example of programmable automation. The program is coded in computer memory for each different product style and the machine-tool is controlled by the computer programme.

3. Flexible automation is a kind of programmable automation. Programmable automation requires time to reprogram and change over the production equipment for each series of new product. This is lost production time, which is expensive. In flexible automation the number of products is limited so that the changeover of the equipment can be done very quickly and automatically. The reprogramming of the equipment in flexible automation is done at a computer terminal without using the production equipment itself. Flexible automation allows a mixture of different products to be produced one right after another.





*Vocabulary*

**equipment** [ɪ'kwɪpmənt] — оборудование
**sequence** ['si:kwəns] — последовательность
**initial** [ɪ'nɪʃl] — первоначальный, начальный
**investment** [ɪn'vestmənt] — инвестиция, вклад
**to facilitate** [fə'sɪlɪteɪt] — способствовать
**rate** [reɪt] — скорость, темп
**assembly machines** — сборочные машины
**quantity** ['kwɔntɪtɪ] — количество
**non-productive** — непроизводительный
**changeover** ['ʧeɪnʤ'əuvə] — переход, переналадка

*General understanding:*

1. What is the most important application of automation?
2. What are the types of automation used in manufacturing?
3. What is fixed automation?
4. What are the limitations of hard automation?
5. What is the best example of programmable automation?
6. What are the limitations of programmable automation?
7. What are the advantages of flexible automation?
8. Is it possible to produce different products one after another using automation technology?

*Exercise 7. 2.* **Find equivalents in English in the text:**

1. сфера применения
2. фиксированная последовательность операций
3. автоматические сборочные машины
4. определенные химические процессы
5. станок с числовым программным управлением
6. потерянное производственное время
7. разнообразная продукция

*Exercise 7.3.* **Explain in English what does the following mean:**

1. automation technology
2. fixed automation
3. assembly machines
4. non-productive time
5. programmable automation
6. computer terminal
7. numerical-control machine-tool





## Text C: «ROBOTS IN MANUFACTURING»

Today most robots are used in manufacturing operations. The applications of robots can be divided into three categories:

1. material **handling**
2. processing operations
3. assembly and inspection.

Material-handling is the **transfer** of material and loading and unloading of machines. Material-transfer applications require the robot to move materials or work parts from one to another. Many of these tasks are relatively simple: robots **pick up** parts from one conveyor and place them on another. Other transfer operations are more complex, such as placing parts in an **arrangement** that can be calculated by the robot. Machine loading and unloading operations **utilize** a robot to load and unload parts. This requires the robot to be equipped with a **gripper** that can **grasp** parts. Usually the gripper must be designed specifically for the particular part geometry.

In robotic processing operations, the robot manipulates a tool to perform a process on the work part. Examples of such applications include **spot welding**, **continuous arc welding** and **spray painting**. Spot welding of automobile bodies is one of the most common applications of industrial robots. The robot positions a spot welder against the automobile panels and **frames** to join them. Arc welding is a continuous process in which robot moves the welding rod along the welding seam. Spray painting is the manipulation of a **spray-painting gun** over the surface of the object to be coated. Other operations in this category include **grinding** and **polishing** in which a rotating **spindle** serves as the robot's tool.

The third application area of industrial robots is assembly and inspection. The use of robots in assembly is expected to increase because of the high cost of **manual labour**. But the design of the product is an important aspect of robotic assembly. Assembly methods that are satisfactory for humans are not always suitable for robots. Screws and nuts are widely used for fastening in manual assembly, but the same operations are extremely difficult for a one-armed robot.

Inspection is another area of factory operations in which the utilization of robots is growing. In a typical inspection job, the robot positions a sensor with respect to the work part and determines whether the part answers the quality specifications. In nearly all industrial robotic applications, the robot provides a substitute for human labour. There are certain characteristics of industrial jobs performed by humans that can be done by robots:

1. the operation is repetitive, involving the same basic work motions every cycle,
2. the operation is **hazardous** or uncomfortable for the human worker (for example: spray painting, spot welding, arc welding, and certain machine loading and unloading tasks),
3. the workpiece or tool are too heavy and difficult to handle,
4. the operation allows the robot to be used on two or three **shifts**.

*Vocabulary:*

**handling** [ˈhændlɪŋ] — обращение
**transfer** [ˈtrænsfəˈ] — передача, перенос
**location** [ləuˈkeɪʃən] — местонахождение
**pick up** — брать, подбирать
**arrangement** [əˈreɪnʤmənt] — расположение





**to utilize** [ˈju:tɪlaɪz] — утилизировать, находить применение
**gripper** [ˈgrɪpə] — захват
**to grasp** [grɑ:sp] — схватывать
**spot welding** — точечная сварка
**continuous** [kənˈtɪnjuəs] — непрерывный
**arc welding** — электродуговая сварка
**spray painting** — окраска распылением
**frame** [freɪm] — рама
**spray-painting gun** — распылитель краски
**grinding** — шлифование
**polishing** — полирование
**spindle** — шпиндель
**manual** [ˈmænjuəl] — ручной
**labour** [ˈleɪbəˈ] — труд
**hazardous** [ˈhæzədəs] — опасный
**shift** [ʃɪft] — смена

*General understanding:*

1. How are robots used in manufacturing?
2. What is «material handling»?
3. What does a robot need to be equipped with to do loading and unloading operations?
4. What does robot manipulate in robotic processing operation?
5. What is the most common application of robots in automobile manufacturing?
6. What operations could be done by robot in car manufacturing industry?
7. What are the main reasons to use robots in production?
8. How can robots inspect the quality of production?
9. What operations could be done by robots in hazardous or uncomfortable for the human workers conditions?

*Exercise 7.4.* **Translate into English:**

1. Существует несколько различных сфер использования автоматизации в производстве.
2. Для использования жесткой автоматизации необходимы большие инвестиции.
3. Жесткая автоматизация широко используется в химической промышленности.
4. Станки с числовым программным управлением — хороший пример программируемой автоматизации.
5. Гибкая автоматизация делает возможным перепрограммирование оборудования.
6. Время простоя оборудования оборачивается большими убытками.
7. Использование гибкой автоматизации делает возможным проиводство разнообразной продукции.

## FAMOUS PEOPLE OF SCIENCE AND ENGINEERING

### James Watt

James Watt was a Scottish inventor and mechanical engineer, known for his improvements of the steam engine.

Watt was born on January 19, 1736, in Greenock, Scotland. He worked as a mathematical-instrument maker from the age of 19 and soon became interested in improving the steam engine which was used at that time to pump out water from mines.

Watt determined the properties of steam, especially the relation of its density to its temperature and pressure, and designed a separate condensing chamber for the steam engine that prevented large losses of steam in the cylinder. Watt's first patent, in 1769, covered this device and other improvements on steam engine.





At that time, Watt was the partner of the inventor John Roebuck, who had financed his researches. In 1775, however, Roebuck's interest was taken over by the manufacturer Matthew Boulton, owner of the Soho Engineering Works at Birmingham, and he and Watt began the manufacture of steam engines. Watt continued his research and patented several other important inventions, including the rotary engine for driving various types of machinery; the double-action engine, in which steam is admitted alternately into both ends of the cylinder; and the steam indicator, which records the steam pressure in the engine. He retired from the firm in 1800 and thereafter devoted himself entirely to research work.

The misconception that Watt was the actual inventor of the steam engine arose from the fundamental nature of his contributions to its development. The centrifugal or flyball governor, which he invented in 1788, and which automatically regulated the speed of an engine, is of particular interest today. It embodies the feedback principle of a servomechanism, linking output to input, which is the basic concept of automation. The **watt**, the unit of power, was named in his honour. Watt was also a well-known civil engineer. He invented, in 1767, an attachment that adapted telescopes for use in the measurement of distances. Watt died in Heathfield, near Birmingham, in August 1819.

# UNIT 8
# COMPUTERS

I. **Text A: «What is a computer?»**
   **Text B: «Hardware»**
   **Text C: «Types of software»**
II. **Famous people of science and engineering: Charles Babbage.**

## *Text A: «WHAT IS A COMPUTER?»*

The term **computer** is used to describe a device made up of a combination of electronic and electromechanical (part electronic and part mechanical) components. Computer has no intelligence by itself and **is referred to as hardware**. A computer system is a combination of five elements:

- Hardware
- Software
- People
- Procedures
- Data/information

When one computer system is set up to communicate with another computer system, **connectivity** becomes the sixth system element. In other words, the manner in which the various individual systems are connected — for example, by phone lines, **microwave transmission**, or satellite — is an element of the total computer system.

**Software** is the term used to describe the instructions that tell the hardware how to perform a task. Without





software instructions, the hardware doesn't know what to do. **People**, however, are the most important component of the computer system: they **create** the computer software instructions and respond to the procedures that those instructions present.

The basic job of the computer is the processing of information. Computers accept information in the form of **instruction** called a **program** and **characters** called **data** to perform mathematical and logical operations, and then give the results. The data is **raw** material while **information** is organized, processed, refined and useful for decision making. Computer is used to convert data into information. Computer is also used to store information in the digital form.

***Vocabulary:***

**characters** [ˈkærɪktəˈz] — символы
**data** [ˈdeɪtə] — данные
**decision** — решение
**device** — устройство
**hardware** — оборудование
**instruction** — команда
**intelligence** [ɪnˈtɛlɪʤəns] — разум
**manner** — манера, способ
**microwave** [ˈmaɪkrəuweɪv] — микроволновая
**procedures** [prəˈsi:ʤəˈ] — процедуры, операции
**purpose** [ˈpə:pəs] — цель
**raw** [rɔ:] — необработанный, сырой
**to come to life** — оживать
**to connect** — соединять
**to convert** — превращать, преобразовывать
**to create** [kri:ˈeɪt] — создавать
**to evaluate** [ɪˈvæljueɪt] — оценивать
**to refer to as** — называть что-либо

**to refine** — очищать
**to respond** — отвечать
**transmission** [trænz′mɪʃən] — передача
**various** [′vɛərɪəs] — различные

***General understanding:***

1) What does the term «computer» describe?
2) Is computer intelligent?
3) What are five components of computer system?
4) What is connectivity?
5) What is software? What's the difference between hardware and software?
6) Why people are the most important component of a computer system?
7) In what way terms «data» and «information» differ?
8) How does computer convert data into information?

***Exercise 8.1.*** **Which of the listed below terms have Russian equivalents:**

computer, diskette, metal, processor, scanner, information, data, microphones, printer, modem, Internet.

***Exercise 8.2.*** **Which of the listed above statements are true/false. Specify your answer using the text.**

1) Computer is made of electronic components so it is referred to as electronic device.
2) Computer has no intelligence until software is loaded.
3) There are five elements of computer system: hardware, software, people, diskettes and data.
4) The manner in which computers are connected is the connectivity.





5) Without software instructions hardware doesn't know what to do.
6) The software is the most important component because it is made by people.
7) The user inputs data into computer to get information as an output.
8) Computer is used to help people in decision making process.

***Exercise 8.3.*** **Match the following:**

1) ... doesn't come to life until it is connected to other parts of a system.
2) ... is the term used to describe the instructions that tell the hardware how to perform a task.
3) ... create the computer software instructions and respond to the procedures that those instructions present
4) Information in the form of instruction is called a...
5) The manner in which the various individual systems are connected is...
6) ... is organized, processed and useful for decision making
7) The basic job of the computer is the...

a) **program**
b) **information**
c) **processing of information**
d) **software**
e) **connectivity**
f) **computer**
g) **people**

***Exercise 8.4.*** **Translate the text. Retell the text, using the vocabulary.**

*Exercise 8.5.* **Questions for group discussion:**

1) Why so many people are still «computer illiterate»?

2) What are the most important applications of computer? (Are computer games just a «waste of time» or it is a nice hobby and a lot of fun?)

3) Who has a computer in your group? Ask them what do they use it for?

## *Text B: «HARDWARE»*

What is hardware? Webster's dictionary gives us the following definition of the hardware — **the mechanical, magnetic, electronic, and electrical devices composing a computer system.**

Computer hardware can be divided into four categories:

1) **input hardware**
2) **processing hardware**
3) **storage hardware**
4) **output hardware.**

**Input hardware**

The purpose of the input hardware is to collect data and convert it into a form suitable for computer processing. The most common input device is a **keyboard.** It looks very much like a typewriter. The **mouse** is a hand held device connected to the computer by small cable. As the mouse is rolled across the mouse pad, the cursor moves across the screen. When the cursor reaches the desired location, the user usually pushes a button on the mouse once or twice to signal a menu selection or a command to the computer.

The **light pen** uses a light sensitive photoelectric cell to signal screen position to the computer. Another type of input hardware is optic-electronic **scanner** that is used





to input graphics as well as typeset characters. **Microphone** and **video camera** can be also used to input data into the computer. Electronic cameras are becoming very popular among the consumers for their relatively low price and convenience.

**Processing hardware**

The purpose of processing hardware is retrieve, interpret and direct the execution of software instructions provided to the computer. The most common components of processing hardware are the Central Processing Unit and main memory.

The Central Processing Unit (CPU) is the brain of the computer. It reads and interprets software instructions and coordinates the processing activities that must take place. The design of the CPU affects the processing power and the speed of the computer, as well as the amount of main memory it can use effectively. With a well-designed CPU in your computer, you can perform highly sophisticated tasks in a very short time.

**Memory** is the system of component of the computer in which information is stored. There are two types of computer memory: RAM and ROM.

**RAM** (random access memory) is the volatile computer memory, used for creating loading, and running programs and for manipulating and temporarily storing data;

**ROM** (read only memory) is nonvolatile, nonmodifiable computer memory, used to hold programmed instructions to the system.

The more memory you have in your computer, the more operations you can perform.

**Storage hardware**

The purpose of storage hardware is to store computer instructions and data in a form that is relatively perma-

nent and retrieve when needed for processing. Storage hardware serves the same basic functions as do office filing systems except that it stores data as electromagnetic signals. The most common ways of storing data are Hard disk, floppy disk and CD-ROM.

**Hard disk** is a rigid disk coated with magnetic material, for storing programs and relatively large amounts of data.

**Floppy disk (diskette)** — thin, usually flexible plastic disk coated with magnetic material, for storing computer data and programs. There are two formats for floppy disks: 5.25" and 3.5". 5.25" is not used in modern computer systems because of it relatively large size, flexibility and small capacity. 3.5" disks are formatted 1.4 megabytes and are widely used.

**CD-ROM** (compact disc read only memory) is a compact disc on which a large amount of digitized read-only data can be stored. CD-ROMs are very popular now because of the growing speed which CD-ROM drives can provide nowadays.

**Output hardware**

The purpose of output hardware is to provide the user with the means to view information produced by the computer system. Information is output in either **hardcopy** or **softcopy** form. Hardcopy output can be held in your hand, such as paper with text (word or numbers) or graphics printed on it. Softcopy output is displayed on a monitor.

**Monitor** is a component with a display screen for viewing computer data, television programs, etc.

**Printer** is a computer output device that produces a paper copy of data or graphics.

**Modem** is an example of **communication hardware** — an electronic device that makes possible the transmis-





sion of data to or from computer via telephone or other communication lines.

Hardware comes in many configurations, depending on what the computer system is designed to do. Hardware can fill several floors of a large office building or can fit on your lap.

*Vocabulary:*

**amount** — количество
**capacity** — вместительность
**circuitry** — эл. цепи
**CPU, microprocessor** — микропроцессор
**hard disk** — жесткий диск, «винчестер»
**input hardware** — устройства ввода данных
**keyboard** — клавиатура
**lap** — колени
**modem** — модем
**mouse** — устройство для перемещения объектов на экране, «мышь»
**output hardware** — выходные устройства отображения информации
**printer** — принтер
**processing hardware** — устройства обработки данных
**RAM** — ОЗУ (оперативное запоминающее устройство)
**ROM** — ПЗУ (постоянное запоминающее устройство)
**CD-ROM** — накопитель на компакт-дисках (CD)
**scanner** — сканер
**sensitive** — чувствительный
**sophisticated** — сложный
**storage hardware** — устройства хранения данных
**temporarily** — временно
**temporary** — временный
**the purpose** — цель
**tier** — ярус

**to affect** — влиять
**to connect** — соединять
**to convert** — преобразовывать
**to direct** — упралять
**to execute** — выполнять
**to interpret** — переводить
**to provide** — обеспечивать
**to reach** — достигать
**to retrieve** — извлекать
**to roll** — катать, перекатывать
**volatile** — летучий, нестойкий, временный

*General understanding:*

1. What is the Webster's dictionary definition of the hardware?
2. What groups of hardware could be defined?
3. What is input hardware? What are the examples of input hardware?
4. What is mouse designed for? What is a light pen?
5. What is processing hardware? What are the basic types of memory used in a PC?
6. Can a PC-user change the ROM? Who records the information in ROM?
7. What is storage hardware? What is CD-ROM used for? Can a user record his or her data on a CD? What kind of storage hardware can contain more information: CD-ROM, RAM or ROM?
8. What is modem used for? Can PC-user communicate with other people without a modem?

**Exercise 8.6. Which of the listed below statements are true/false. Specify your answer using the text.**

1) Computer is an electronic device therefore hardware is a system of electronic devices.





2) The purpose of the input hardware is to collect data and convert it into a form suitable for computer processing.
3) Scanner is used to input graphics only.
4) The purpose of processing hardware is to retrieve, interpret and direct the execution of software instructions provided to the computer.
5) CPU reads and interprets software and prints the results on paper.
6) User is unable to change the contents of ROM.
7) 5.25" floppy disks are used more often because they are flexible and have more capacity than 3.5" disks.
5) Printer is a processing hardware because its purpose is to show the information produced by the system.
6) Modem is an electronic device that makes possible the transmission of data from one computer to another via telephone or other communication lines.
7) The purpose of storage hardware is to store computer instructions and data in a form that is relatively permanent and retrieve them when needed for processing.

***Exercise 8.7.*** **Give definitions to the following using the vocabulary**

1) CPU
2) ROM
3) Floppy-disk
4) CD-ROM
5) Printer
6) Modem
7) Motherboard
8) Hard disk
9) Keyboard
10) Sound-card

*Exercise 8.8.* **Which of the following is Hardware:**

1) program
2) mouse
3) CPU
4) printer
5) modem
6) command
7) port
8) cursor or the pointer
9) keyboard
10) character

*Exercise 8.9.* **Match the following:**

1) процессор
2) клавиатура
3) мышь
4) дискета
5) «винчестер»
6) модем
7) экран
8) ПЗУ
9) ОЗУ

a) nonvolatile, nonmodifiable computer memory, used to hold programmed instructions to the system.

b) the part of a television or computer on which a picture is formed or information is displayed.

c) rigid disk coated with magnetic material, for storing computer programs and relatively large amounts of data.

d) an electronic device that makes possible he transmission of data to or from computer via telephone or other communication lines.

e) a set of keys, usually arranged in tiers, for operating a typewriter, typesetting machine, computer terminal, or the like.





f) volatile computer memory, used for creating, loading, and running programs and for manipulating and temporarily storing data; main memory.

g) central processing unit: the key component of a computer system, containing the circuitry necessary to interpret and execute program instructions.

h) a palm-sized device equipped with one or more buttons, used to point at and select items on a computer display screen and for controlling the cursor by means of analogous movement on a nearby surface.

i) a thin, usually flexible plastic disk coated with magnetic material, for storing computer data and program.

***Questions for group discussion:***

1) Without what parts computer is unable to work?
2) What is the most expensive part of the hardware?
3) What other hardware devices do you know? What are they for? Do you know how to use them?

## *Text C: «TYPES OF SOFTWARE»*

A computer to complete a job requires more than just the actual equipment or hardware we see and touch. It requires **Software** — programs for directing the operation of a computer or electronic data.

Software is the final computer system component. These computer programs instruct the hardware how to conduct processing. The computer is merely a general-purpose machine which requires specific software to perform a given task. Computers can input, calculate, compare, and output data as information. Software determines the order in which these operations are performed.

Programs usually fall in one of two categories: **system software and applications software.**

**System software** controls standard internal computer activities. An operating system, for example, is a collection of system programs that aid in the operation of a computer regardless of the application software being used. When a computer is first turned on, one of the systems programs is booted or loaded into the computers memory. This software contains information about memory capacity, the model of the processor, the disk drives to be used, and more. Once the system software is loaded, the applications software can be brought in.

System programs are designed for the specific pieces of hardware. These programs are called ***drivers*** and coordinate peripheral hardware and computer activities. User needs to install a specific driver in order to activate a peripheral device. For example, if you intend to buy a printer or a scanner you need to worry in advance about the driver program which, though, commonly goes along with your device. By installing the driver you «teach» your mainboard to «understand» the newly attached part.

Applications software satisfies your specific need. The developers of application software rely mostly on marketing research strategies trying to do their best to attract more users (buyers) to their software. As the productivity of the hardware has increased greatly in recent years, the programmers nowadays tend to include as much as possible in one program to make software interface look more attractive to the user. These class of programs is the most numerous and perspective from the marketing point of view.

Data communication within and between computers systems is handled by system software. **Communications software** transfers data from one computer system to another. These programs usually provide users with data security and error checking along with physically transferring data between the two computer's memories. During the past five years the developing electronic network communication has stimulated more and more companies to produce various communication software, such as Web-Browsers for Internet.





*Vocabulary:*

**aid** — помощь
**to attach** — присоединять
**control** — управление
**developer** — разработчик
**equipment** [ɪ′kwɪpmənt] — оборудование
**general-purpose** — общего назначения
**internal** — внутренний
**mainboard** — материнская плата
**memory capacity** — вместимость памяти
**peripheral** — периферийный
**regard** — отношение
**regardless** — несмотря на, безотносительно,
**security** — безопасность
**specific** — конкретный, определенный
**to boot** — загружать
**to check** — проверять
**to complete** — совершать, завершать
**to conduct** — проводить
**to develop** — развивать, проявлять
**to direct** [daɪ′rɛkt] — управлять, руководить
**to handle** — управлять, обращаться с
**to install** — устанавливать, встраивать, инсталлировать
**to provide with** — обеспечивать чем-либо
**to require** [rɪ′kwaɪə′] — требовать
**to secure** [sɪ′kjuə′] — обеспечивать безопасность
**to transfer** — переводить, переносить

**Web-browser** — «браузер» (программа, позволяющая пользователю искать и считывать информацию с глобальной электронной сети Internet)

*General understanding*

1. What is software?
2. In what two basic groups software (programs) could be divided?
3. What is system software for?
4. What is an operating system — a system software or application software?
5. What is a «driver»?
6. What is application software?
7. What is application software used for?
8. What is the tendency in application software market in the recent years?
9. What is the application of the communication software?

***Exercise 8.10.*** **Which of the following is Software:**

1. Program
2. Mouse
3. CPU
4. Word processor
5. Modem
6. Web-browser
7. Operating system
8. Scanner
9. Printer
10. Display

***Exercise 8.11.*** **Which of the listed below statements are true/false. Specify your answer using the text:**

1) Computer programs only instruct hardware how to handle data storage.





2) System software controls internal computer activities.

3) System software is very dependable on the type of application software being used.

4) The information about memory capacity, the model of the processor and disk drives are unavailable for system software.

5) The driver is a special device usually used by car drivers for Floppy-disk driving.

6) It is very reasonable to ask for a driver when you buy a new piece of hardware.

7) Software developers tend to make their products very small and with poor interface to save computer resources.

8) Communication software is in great demand now because of the new advances in communication technologies.

9) Application software is merely a general-purpose instrument.

10) Web-browsers is the class of software for electronic communication through the network.

***Exercise 8.12.*** **Find English equivalents in the text:**

1) Программное обеспечение определяет порядок выполнения операций.

2) Прикладные программы выполняют поставленную вами конкретную задачу (удовлетворяют вашу потребность).

3) Этот класс программ — самый многочисленный и перспективный с точки зрения маркетинга.

4) Системные программы предназначены для конкретных устройств компьютерной системы.

5) Устанавливая драйвер, вы «учите» систему «понимать» вновь присоединенное устройство.

6) Когда компьютер впервые включается, одна из системных программ должна быть загружена в его память.

7) Развитие систем электронной коммуникации за последние пять лет стимулировало производство соответствующих программных продуктов возрастающим числом компаний-разработчиков.

***Exercise 8.13.*** **Give definitions to the following using the vocabulary:**

1) Software
2) Driver
3) Application software
4) Operating system
5) Communication software
6) Computer
7) Peripheral device
8) Operating system

***Questions for group discussion:***

1) What do you think is more expensive — hardware or software?

2) Has anyone in your group ever purchased software? Why do you think piracy (audio, video, computer software) still exists?

## FAMOUS PEOPLE OF SCIENCE AND ENGINEERING

**Babbage, Charles** (1792–1871), British mathematician and inventor, who designed and built mechanical computing machines on principles that anticipated the modern electronic computer. Babbage was born in Teignmouth, Devon, and educated at the University of Cambridge. He became a Fellow of the Royal Society in





1816 and was active in the founding of the Analytical, the Royal Astronomical, and the Statistical Societies.

In the 1820s Babbage began developing his Difference Engine, a mechanical device that could perform simple mathematical calculations. Although Babbage started to build his machine, he was unable to complete it because of a lack of funding. In the 1830s Babbage began developing his Analytical Engine, which was designed to carry out more complicated calculations, but this device was never built, too. Babbage's book, «Economy of Machines and Manufactures» (1832), initiated the field of study known today as operational research.

# UNIT 9
## MODERN COMPUTER TECHNOLOGIES

I. **Text A: «Operating systems»**
   **Text B: «Windows 95»**
   **Text C: «Internet and WWW»**
II. **Famous people of science and engineering: Bill Gates.**

### Text A: «OPERATING SYSTEMS»

When computers were first introduced in the 1940's and 50's, every program written had to provide instructions that told the computer how to use devices such as the printer, how to store information on a disk, as well as how to perform several other tasks not necessarily related to the program. The additional program instructions for working with hardware devices were very complex, and time-consuming. Programmers soon realized it would be smarter to develop one program that could control the computer's hardware, which others programs could have used when they needed it. With that, the first operating system was born.

Today, operating systems control and manage the use of hardware devices such as the printer or mouse. They also provide disk management by letting you store information in files. The operating system also lets you run programs such as the basic word processor. Lastly, the operating system provides several of its own commands that help you to use the computer.





**DOS** is the most commonly used PC operating system. DOS is an abbreviation for **disk operating system**. DOS was developed by a company named Microsoft. MS-DOS is an abbreviation for «Microsoft DOS». When IBM first released the IBM PC in 1981, IBM licensed DOS from Microsoft for use on the PC and called it PC-DOS. From the users perspective, PC-DOS and MS-DOS are the same, each providing the same capabilities and commands.

The version of DOS release in 1981 was 1.0. Over the past decade, DOS has undergone several changes. Each time the DOS developers release a new version, they increase the version number.

**Windows NT** (new technology) is an operating system developed by Microsoft. NT is an enhanced version of the popular Microsoft Windows 3.0, 3.1 programmes. NT requires a 386 processor or greater and 8 Mb of RAM. For the best NT performance, you have to use a 486 processor with about 16 Mb or higher. Unlike the Windows, which runs on top of DOS, Windows NT is an operating system itself. However, NT is DOS compatible. The advantage of using NT over Windows is that NT makes better use of the PC's memory management capabilities.

**OS/2** is a PC operating system created by IBM. Like NT, OS/2 is DOS compatible and provides a graphical user interface that lets you run programs with a click of a mouse. Also like NT, OS/2 performs best when you are using a powerful system. Many IBM-based PCs are shipped with OS/2 preinstalled.

**UNIX** is a multi-user operating system that allows multiple users to access the system. Traditionally, UNIX was run on a larger mini computers to which users accessed the systems using terminals and not PC's. UNIX allowed each user to simultaneously run the programs they desired. Unlike NT and OS/2, UNIX is not DOS com-

patible. Most users would not purchase UNIX for their own use.

**Windows 95 & 98 (Windows 2000)** are the most popular user-oriented operating systems with a friendly interface and multitasking capabilities. The usage of Windows 95 and its enhanced version Windows 98 is so simple that even little kids learn how to use it very quickly. Windows 95 and 98 are DOS compatible, so all programs written for DOS may work under the new operating system.

Windows 95 requires 486 processor with 16 megabytes of RAM or Pentium 75–90 with 40 megabytes of free hard disk space.

***Vocabulary:***

**complex** — сложный
**to consume** — потреблять
**consumer** [kən'sju:mə'] — потребитель
**to realize** — понять, осознать
**smart** — умный
**decade** — декада, десятилетие
**version** ['və:ʃən] — версия
**to enhance** [ɪn'hɑ:ns] — увеличивать, расширять
**top** — верх, вершина
**on top of DOS** — «сверху», на основе ДОС
**are shipped** — поставляются
**compatible** — совместимый
**with a click of a mouse** — одним щелчком кнопки мыши
**access** ['æksɛs] — доступ
**to allow** — позволять
**multiple users** — многочисленные пользователи
**simultaneously** [sɪməl'teɪnɪəslɪ] — одновременно
**to desire** — желать
**to ship** — поставлять, доставлять





***General understanding:***

1) What problems faced programmers in the 1940's and 1950's?

2) Why were the first programs «complex» and «time-consuming»?

3) What are the basic functions of operating system?

4) What does the abbreviation DOS mean?

5) What company developed the first version of DOS operating system? For what purpose was it done? Was the new operational system successful?

6) What is the difference between the PC-DOS and MS-DOS

7) What does the abbreviation NT stand for? Is NT DOS-compatible? What are the basic requirements for NT?

8) Who is the developer of OS/2?

9) What makes UNIX so different from the other operational systems?

10) What are the special features of Windows 95, Windows 98, Windows 2000?

***Exercise 9.1.*** **Match the following:**

1) Like NT, ... is DOS compatible and provides a graphical user interface that lets you run programmes with a click of a mouse.

2) ... is the most commonly used PC operating system

3) ... is a multi-user operating system that allows multiple users to access the system

4) ... is an operating system developed by Microsoft, an enhanced version of the popular Microsoft Windows programs.

5) The usage of... is so simple that even little kids learn how to use it very quickly.

a) UNIX

b) DOS
c) NT
d) OS/2
e) Windows 95

*Exercise 9.2.* **Which of the listed below statements are true/false. Specify your answer using the text.**

1) When computers were first introduced in 40's and 50's programmers had to write programs to instruct CD-ROMs, laser printers and scanners.

2) The operational system controls and manages the use of the hardware and the memory.

3) There are no commands available in operating systems, they are only in word processors.

4) Microsoft developed MS-DOS to compete with IBM's PC-DOS.

5) NT requires computers with 486 CPU and 16 M random access memory.

6) OS/2 is DOS compatible because it was developed by Microsoft.

7) Traditionally, UNIX was run by many users simultaneously.

8) Windows 95 and Windows 98 are DOS compatible and have very «friendly» and convenient interface.

*Exercise 9.3.* **Translate into English:**

1) Современная операционные системы контролируют использование системного оборудования, например, принтера и мыши.

2) С точки зрения пользователя, операционные системы PC-DOS и MS-DOS идентичны, с равными возможностями и набором системных команд.





3) OS/2 является DOS -совместимой операционной системой, позволяющей запускать программы при помощи графического интерфейса пользователя.

4) Дополнительные программы для работы с устройствами системного оборудования были очень сложны и поглощали много времени.

5) Операционная система также позволяет запускать программы, такие как простейший текстовый редактор.

6) DOS — наиболее распространенная операционная система для персонального компьютера.

***Questions for group discussion:***

1) Why do you think Bill Gates, President of Microsoft Company is one of the richest people on the Earth?

2) Judging from your experience tell if UNIX is used nowadays? What about OS/2?

3) Ask the students in your group who have experience working with Windows 95 and Windows 98 about the advantages and disadvantages of these operational systems.

## *Text B: «WINDOWS 95»*

**Windows 95** is a new operational system with an easy interface based on the expanding windows principle which uses icons to graphically represent files and their types.

Windows 95 makes the way you and your computer interact easy. Most everyday tasks are now easier to accomplish than ever before. For example, the second mouse button has become a powerful weapon. The old Windows 3.0 Program Manager and File Manager have been replaced. The desktop tools that replace them are very like those found on a Macintosh. For example, there

is a Recycle Bin that makes it easier to recover accidentally deleted files.

Your computer probably will crash less running Windows 95 than it did with Windows 3.1 and 3.0 or even DOS. Most memory related problems have been removed. Built-in networking features make it easy to reliably share files with co-workers across the room or across the world. And MS-DOS as we know it is so well hidden that you'll rarely give it a thought. Yes, you can still run DOS programs and older Windows applications but most users will probably want to spend most of their time using Windows 95 applications instead.

Microsoft says that it is moving forward to the time when we'll all think more about our data and less about the specific name-brand programs used to create them.

Window 95 plug-and-play capability makes it easy to upgrade your computer hardware. And portable computer users will like what Microsoft has done to make their lives calmer.

A new Windows shortcuts capability makes it easy to reach frequently used files and other necessities. A new Find feature helps you to locate and examine the contents of files in a flash.

Most of this is accomplished without sacrificing performance. In fact, many things (like printing) usually happen faster now, due to 32-bit support and other Windows 95 advancements.

*Vocabulary:*

**to interact** — взаимодействовать
**to accomplish** — выполнять, достигать
**weapon** ['wɛpən] — оружие
**to replace** — замещать





**Recycle Bin** — корзина
**to crash** — ломаться, давать сбои
**to remove** — удалять
**co-workers** — коллеги, сослуживцы
**rarely** ['rɛəlɪ] — редко
**to plug** — подключать
**frequently** — часто
**support** — поддержка
**necessity** — необходимость
**flash** — вспышка, зд. **in a flash** — моментально
**to give smth. a thought** — подумать о чем- либо
**brand-name** — торговая марка
**calm** [kɑ:m] — спокойный
**shortcut** — кратчайший путь
**to sacrifice** ['sækrɪfaɪs] — жертвовать
**advancement** [əd'vɑ:nsmənt] — прогресс, продвижение

*General understanding:*

1) What is Windows 95?
2) What new principles are used in Windows 95?
3) What is a Recycle Bin feature?
4) What problems has Windows 95 solved?
5) Is it possible to run old DOS programs under Windows 95?
6) What is a «plug-n-play» capability?
7) What is a «shortcut» capability?
8) What is a «Find» feature?
9) Why many things work faster now with Windows 95?

**Exercise 9.4. Which of the listed above statements are true/false. Specify your answer using the text.**

1) An «icon» is graphical image that represents file and its type.

2) Second button is not used in Windows 95 because most people use 1-button mouse.

3) There are no similarities between Macintosh and Windows 95 desktop tools.

4) Windows 95 has some tools which help to communicate with other people through computer network.

5) It's no longer possible to use MS-DOS commands and run MS-DOS files.

6) Microsoft corporation is oriented to produce as many programs as needed to meet people needs and make them buy specific brand- name products.

7) New plug-n-play capability is for those who like to play computer games 24 hours a day and seven days a week.

8) A new shortcut feature is used to cut long programs very short to save disk space.

9) New Find feature helps you to locate the contents of files.

10) It must be mentioned that all new Windows features are possible only because of the low level of performance and quality.

*Exercise 9.5.* **Find the equivalents in the text:**

1) Ваш компьютер вероятно будет давать меньше сбоев с Виндоуз 95, чем с более ранними версиями и даже ДОС.

2) Корпорация Майкрософт заявляет, что она делает все для того, чтобы приблизить время, когда мы все будем думать больше о наших данных, чем о конкретных «фирменных» программах, которые используются для создания этих данных.

3) Новая функция поиска позволяет обнаружить местоположение и исследовать содержимое файла в мгновение ока.





4) Большинство этих функций достигнуто в ущерб производительности.

5) ДОС, каким мы его знаем, так хорошо запрятан, что вы редко думаете о его использовании.

6) В Виндоуз 95 существует инструмент Корзина, который позволяет легко восстанавливать случайно удаленные файлы.

7) Инструменты Рабочего Стола очень схожи с инструментами Макинтоша.

8) Вторая кнопка мыши стала мощным оружием.

*Exercise 9.6.* **What is:**

1) window
2) icon
3) recycle bin
4) plug-and-play capability
5) shortcut feature

*Exercise 9.7.* **Practice:**

1) Start Windows 95. Empty the Recycle Bin. See the free diskspace on drives A and C. See the catalogue of disk C.

2) Resize, maximize and minimize the window. Close the window. Move it, holding the left button.

3) Create a folder COMPUTER. Copy any 2 files into it. Rename the folder. Delete two files into the Recycle Bin then recover them. Delete the whole folder.

4) Create a textual file in WordPad program. Save it as TEXT. Rename it as MYFILE. Create a shortcut for it. Put the shortcut on the DeskTOP.

5) Create a picture in Paintbrush program. Save it as MYPICTURE. Create folder PICTURES. Copy file MYPICTURE to the PICTURES folder.

6) QUIT Windows 95.

***Questions for group discussion:***

1) What are the poor features of Windows 95?

2) Computer society thinks, that Intel company, the most powerful CPU producer, has an agreement with Microsoft corporation that the latter will develop more and more sophisticated, large and demanding software to force users to buy new processors and upgrade their computers. Do you think this might be true? How does this suggestion correlate with the new Windows 2000 and Microsoft Office 2000? Do you think that Bill Gates' monopoly on Windows operating systems is very dangerous for the competition and price-making process?

3) Ask anyone in the group who has a computer if Windows 98 is better than Windows 2000? Why and why not?

## *Text C: «INTRODUCTION TO THE WWW AND THE INTERNET»*

Millions of people around the world use the Internet to search for and retrieve information on all sorts of topics in a wide variety of areas including the arts, business, government, humanities, news, politics and recreation. People communicate through electronic mail (e-mail), discussion groups, chat channels and other means of informational exchange. They share information and make commercial and business transactions. All this activity is possible because tens of thousands of networks are connected to the Internet and exchange information in the same basic ways.

The **World Wide Web** (WWW) is a part of the Internet. But it's not a collection of networks. Rather, it is information that is connected or linked together like a web. You access this information through one interface or tool called a ***Web browser***. The number of resources and services that are part of the World Wide Web is growing extremely fast. In 1996 there were more than 20 million users of the WWW, and more than half the information that is transferred across the Internet is accessed through the WWW. By using a computer terminal (hardware) connected to a network that is a part of the Internet, and by using a program (software) to browse or retrieve information that is a part of the World Wide Web, the people connected to the Internet and World Wide Web through the local ***providers*** have access to a variety of information. Each browser provides a graphical interface. You move from place to place, from site to site on the Web by using a mouse to click on a portion of text, icon or region of a map. These items are called hyperlinks or links. Each link you select represents a document, an image, a video clip or an audio file somewhere on the Internet. The user doesn't need to know where it is, the browser follows the link.

All sorts of things are available on the WWW. One can use Internet for recreational purposes. Many TV and radio stations broadcast live on the WWW. Essentially, if something can be put into digital format and stored in a computer, then it's available on the WWW. You can even visit museums, gardens, cities throughout the world, learn foreign languages and meet new friends. And, of course, you can play computer games through WWW, competing with partners from other countries and continents.

Just a little bit of exploring the World Wide Web will show you what a lot of use and fun it is.

*Vocabulary:*

**World Wide Web** — «Всемирная Паутина»
**to retrieve** — извлекать
**variety** — разнообразие, спектр
**recreation** — развлечение
**network** — сеть
**to share** — делить
**humanities** — гуманитарные науки
**business transactions** — коммерческие операции
**access** — доступ
**to browse** [brauz] — рассматривать, разглядывать
**browser** [brauzə] — браузер (программа поиска информации)
**to provide** — обеспечивать (чем-либо)
**provider** — провайдер (компания, предоставляющая доступ к WWW через местные телефонные сети)
**broadcast live** — передавать в прямом эфире
**site** — страница, сайт
**to link** — соединять
**hyperlink** [ˈhaɪpəˈlɪŋk] — гиперссылка
**to compete** [kəmˈpi:t] — соревноваться

*General understanding:*

1) What is Internet used for?
2) Why so many activities such as e-mail and business transactions are possible through the Internet?
3) What is World Wide Web?
4) What is Web browser?
5) What does a user need to have an access to the WWW?
6) What are hyperlinks?
7) What resources are available on the WWW?
8) What are the basic recreational applications of WWW?





***Exercise 9.8.*** **Which of the listed below statements are true/false. Specify your answer using the text.**

1) There are still not so many users of the Internet.
2) There is information on all sorts of topics on the Internet, including education and weather forecasts.
3) People can communicate through e-mail and chat programs only.
4) Internet is tens of thousands of networks which exchange the information in the same basic way.
5) You can access information available on the World Wide Web through the Web browser.
6) You need a computer (hardware) and a special program (software) to be a WWW user.
7) You move from site to site by clicking on a portion of text only.
8) Every time the user wants to move somewhere on the web he/she needs to step by step enter links and addresses.
9) Films and pictures are not available on the Internet.
10) Radio and TV-broadcasting is a future of Internet. They're not available yet.

***Exercise 9.9.*** **Define the following using the vocabulary:**

1) Internet
2) World Wide Web
3) Web browser
4) Internet provider
5) Hyperlinks

***Exercise 9.10.*** **Find the equivalents:**

1) Объем ресурсов и услуг, которые являются частью WWW, растет чрезвычайно быстро.
2) Каждая ссылка, выбранная вами представляет документ, графическое изображение, видеоклип или аудио файл где-то в Интернет.

3) Интернет может быть также использован для целей развлечения.

4) Вы получаете доступ к ресурсам Интернет через интерфейс или инструмент, который называется веб-браузер.

5) Вся эта деятельность возможна благодаря десяткам тысяч компьютерных сетей, подключенных к Интернет и обменивающихся информацией в одном режиме.

6) Пользователи общаются через электронную почту, дискуссионные группы, чэт-каналы (многоканальный разговор в реальном времени) и другие средства информационного обмена.

*Exercise 9.11.* **Match the following:**

1) You access the information through one interface or tool called a...

2) People connected to the WWW through the local... have access to a variety of information.

3) The user doesn't need to know where the site is, the... follows the...

4) In 1996 there were more than 20 million users of the...

5) Each... provides a graphical interface.

6) Local... charge money for their services to access... resources.

***Words to match with:***

1) web browser, providers, link, WWW,

***Questions for group discussion:***

1) Some people think that Internet is very harmful, especially for young people, because it carries a lot of information about sex, drugs, violence and terrorism. Do you think that some kind of censorship is necessary on the WWW?





2) World famous authors and publishers say that the Internet violates their copyright because Web-programmers put all kinds of books, pictures, music, films and programs free on the Internet and this reduces their sales and profits.

3) Has anyone in your group experience working on the Internet? Ask them 1) about the difficulties they had; 2) useful information retrieved; 3) fun they got? Why so few people have experience working on the Internet?

## FAMOUS PEOPLE OF SCIENCE AND ENGINEERING

### Bill Gates

**William Henry Gates** was born in Seattle, Washington, in 1955.

He is an American business executive, chairman and chief executive officer of the Microsoft Corporation. Gates was the founder of Microsoft in 1975 together with Paul Allen, his partner in computer language development. While attending Harvard in 1975, Gates together with Allen developed a version of the BASIC computer programming language for the first personal computer.

In the early 1980s, Gates led Microsoft's evolution from the developer of computer programming languages to a large computer software company. This transition began with the introduction of MS-DOS, the operating system for the new IBM Personal Computer in 1981. Gates also led Microsoft towards the introduction of application software such as the Microsoft Word processor.

Much of Gates' success is based on his ability to translate technical visions into market strategy. Although Gates has accumulated great wealth from his holdings of Microsoft stock, he has been known as a tough competitor who seems to value winning in a competitive environment over money. Gates still continues to work personally in product development at Microsoft.

# READER

## Тексты для дополнительного чтения

# 1. ALLOYS

Bronze and brass, the first alloys in the history of metallurgy, were probably obtained by man accidentally when melting mixed metal ores. Much later alloys of iron were obtained.

Steel was made in small quantities in early times until the mid–19th century when it was manufactured on a large scale in the iron and steel industry.

The commercial production of pure aluminium in about 1890 began a new range of alloys and among them duralumin, an alloy of about 94 per cent aluminium, with small quantities of copper, manganese, magnesium, and silicon. Most of aluminium alloys are both light and strong.

Nickel is often mixed with other metals for special purposes: permalloy is a nickel-iron alloy that is magnetically soft. The polarity of its magnetic field can be easily changed and it is used for transformer cores. Monel metals contain about two parts nickel to one part copper, plus other elements. They are stronger than nickel and extremely corrosion-resistant. These properties make them useful in chemical production.

Electrum is a natural or artificial alloy of gold and silver containing 15–45 per cent of silver. It was used in the ancient world for coinage.

Bismuth is frequently used as a part of alloys with low melting-points. Today alloys can be designed for particular applications with certain properties.



# 2. MANUFACTURING OF PLASTICS

The manufacture of plastic and plastic products involves procuring the raw materials, synthesizing the basic polymer, compounding the polymer into a material useful for fabrication, and moulding or shaping the plastic into its final form.

### Raw Materials

Originally, most plastics were made from resins derived from vegetable matter, such as cellulose (from cotton), oils (from seeds), starch derivatives, or coal. Casein (from milk) was among the nonvegetable materials used. Although the production of nylon was originally based on coal, air, and water, and nylon 11 is still based on oil from castor beans, most plastics today are derived from petrochemicals. These oil-based raw materials are relatively widely available and inexpensive. However, because the world supply of oil is limited, other sources of raw materials, such as coal gasification, are being explored.

### Synthesizing the Polymer

The first stage in manufacturing plastic is polymerization. As noted, the two basic polymerization methods are condensation and addition reactions. These methods may be carried out in various ways. In bulk polymerization, the pure monomer alone is polymerized, generally either in the gaseous or liquid phase, although a few solid-state polymerizations are also used. In solution polym-

erization, an emulsion is formed and then coagulated. In interfacial polymerization, the monomers are dissolved in two immiscible liquids, and the polymerization occurs at the interface of the two liquids.

### Additives

Chemical additives are often used in plastics to produce some desired characteristic. For instance, antioxidants protect a polymer from chemical degradation by oxygen or ozone; similarly, ultraviolet stabilizers protect against weathering. Plasticizers make a polymer more flexible, lubricants reduce problems with friction, and pigments add colour. Among other additives are flame retardants and antistatics.

Many plastics are manufactured as composites. This involves a system where reinforcing material (usually fibres made of glass or carbon) is added to a plastic resin matrix. Composites have strength and stability comparable to that of metals but generally with less weight. Plastic foams, which are composites of plastic and gas, offer bulk with low weight.

### Shaping and Finishing

The techniques used for shaping and finishing plastics depend on three factors: time, temperature, and flow (also known as deformation). Many of the processes are cyclic in nature, although some fall into the categories of continuous or semicontinuous operation.

One of the most widely used operations is that of extrusion. An extruder is a device that pumps a plastic through a desired die or shape. Extrusion products, such as pipes, have a regularly shaped cross section. The extruder itself also serves as the means to carry out other operations, such as blow moulding and injection moulding.





ing. In extrusion blow moulding, the extruder fills the mould with a tube, which is then cut off and clamped to form a hollow shape called a parison. The hot, molten parison is then blown like a balloon and forced against the walls of the mould to form the desired shape. In injection moulding, one or more extruders are used with reciprocating screws that move forwards to inject the melt and then retract to take on new molten material to continue the process. In injection blow moulding, which is used in making bottles for carbonated drinks, the parison is first injection moulded and then reheated and blown.

In compression moulding, pressure forces the plastic into a given shape. Another process, transfer moulding, is a hybrid of injection and compression moulding: the molten plastic is forced by a ram into a mould. Other finishing processes include calendering, in which plastic sheets are formed, and sheet forming, in which the plastic sheets are formed into a desired shape. Some plastics, particularly those with very high temperature resistance, require special fabrication procedures. For example, polytetrafluoroethene (Teflon) has such a high melt viscosity that it is first pressed into shape and then *sintered*—exposed to extremely high temperatures that bond it into a cohesive mass without melting it. Some polyamides are produced by a similar process.

### Uses

Plastics have an ever-widening range of uses in both the industrial and consumer sectors.

### Packaging

The packaging industry is a leading user of plastics. Much LDPE (low-density polyethene) is marketed in rolls of clear-plastic wrap. High-density polyethene

(HPDE) is used for some thicker plastic films, such as those used for plastic waste bags and containers. Other packaging plastics include polypropene, polystyrene, polyvinyl chloride (PVC), and polyvinylidene chloride. Polyvinylidene chloride is used primarily for its barrier properties, which can keep gases such as oxygen from passing into or out of a package. Similarly, polypropene is an effective barrier against water vapour. Polypropene is also often used in housewares and as a fibre for carpeting and rope.

### Construction

The building industry is a major consumer of plastics, including many of the packaging plastics mentioned above. HDPE is used for pipes, as is PVC. PVC is also used in sheets for building materials and similar items. Many plastics are used to insulate cables and wires, and polystyrene in the form of foam serves as insulation for walls, roofs, and other areas. Other plastic products are roofing, door and window frames, mouldings, and hardware.

### Other Uses

Many other industries, especially motor manufacturing, also depend on plastics. Tough engineering plastics are found in vehicle components like fuel lines, fuel pumps, and electronic devices. Plastics are also used for interior panelling, seats, and trim. Many car bodies are made of fibreglass-reinforced plastic.

Among the other uses of plastic are housings for business machines, electronic devices, small appliances, and tools. Consumer goods range from sports equipment to luggage and toys

## 3. PRINCIPLES AND PROCESS OF POLYMERISATION IN PLASTICS PRODUCTION

Condensation polymerisation and addition polymerisation are the two main processes in plastics production. The manufacture of plastics depends upon the building of chains and networks during polymerisation.

A condensation polymer is formed by a synthesis that involves the gradual reaction of reactive molecules with one another, with the elimination of small molecules such as water. The reaction gradually slows down as polymers are built up.

An addition polymer forms chains by the linking of small identical units without elimination of small molecules.

The most important concept in condensation polymers is that of «functionality», i.e., the number of reactive groups in each molecule participating in the chain build-up. Each molecule must have at least two reactive groups, of which hydroxyl (-OH), acidic endings (-COOH), and amine endings (-NH) are the simplest.

Hydroxyl is characteristic of alcohol endings, combining with an acid ending to give an ester, the polymer being known as a polyester. Examples are polyethylene terephthalate obtained by reaction of ethylene glycol containing hydroxyl groups at each end and terephthalic acid containing two acidic groups and polycarbonate resins.

Alcohols are a particular class of oxygen-containing chemical compounds with a structure analogous to ethyl alcohol (C-HOH). Amines are various compounds derived

from ammonia by replacement of hydrogen by one or more hydrocarbon radicals (molecular groups that act as a unit). Esters are compounds formed by the reaction between an acid and an alcohol or phenol with the elimination of water.

Bulk addition polymerization of pure monomers is mainly confined to styrene and methyl methacrylate. The process is highly exothermic, or heat producing. The dissipation of heat (necessary to maintain chain length) is achieved in the case of styrene by intensive stirring of the viscous, partially polymerized mixture, which is then passed down a tower through zones of increasing temperature. Alternatively, polymerization may be completed in containers that are small enough to avoid an excessive temperature rise as a result of the heat released during polymerization.

Methyl methacrylate is also partially polymerized before being poured into molds consisting of between sheets of plate glass, to produce clear acrylic sheet.

Ethylene is polymerized in tubular reactors about 30 metres long and less than 25 millimetres in diameter at pressures of 600–3,000 to give 10–20 percent conversion to low-density polyethylene. Residual gas is recycled.

Polymerization of monomers in solution allows easy emperature control, but the molecular weight of polyners formed is reduced because of chain transfer reactions

Solvent removal from such a solution may also be very difficult. The process can be applied advantageously to vinyl acetate and acrylic esters.

Suspension polymerization producing beads of plastic is extensively applied to styrene, methyl methacrylate, vinyl chloride, and vinyl acetate. The monomer,





in which the initiator or catalyst must be soluble, is maintained in droplet form suspended in water by agitation in the presence of a stabilizer such as gelatin, each droplet of monomer undergoing bulk polymerization.

In emulsion polymerization the monomer is dispersed in water by means of a surface-active agent (a substance slightly soluble in water that reduces the surface tension of a liquid), its bulk aggregating into tiny particles held in suspension. The monomer enters the hydrocarbon part of the surface-active micelles and is polymerized there by a water-soluble catalyst.

This process is particularly useful for the preparation of very high molecular weight polymers.

Exposure of certain substances to X-ray or ultraviolet radiation initiates chain reactions that can be used for manufacture of such thermoplastics as polyethylene and polyvinyl chloride.

# 3. Resins

Resins that cannot be softened by heating include the phenolics, furan resins, aminoplastics, alkyds, allyls, epoxy resins, polyurethanes, some polyesters, and silicones.

### Phenolics or phenol-aldehydes

The important commercial phenolic resin Bakelite is based on phenol and formaldehyde. The two processes in general use are the one-step process producing resol resins (the first stage in the formation of a phenolic resin) that are either liquid or brittle, soluble, fusible solids, from more than one molecule of formaldehyde per phenol molecule; and the two-step process, using an excess of phenol to produce novolacs, resins that have no reactive methylol groups and must be mixed with an aldehyde to undergo further reaction.

Resol resins thermoset on heating and are used for adhesives. Novolacs require a further source of formaldehyde in the form of hexamethylenetetramine to produce molding powders. Both resins are run out from the reaction vessel, after removal of water by distillation, and ground up, then compounded on heated rolls with fillers that vary from wood flour to mica; for strength and heat resistance fibrous asbestos is used as a filler (hexamethylenetetramine is also added at this stage in the case of the two-step resin). Final grinding produces the molding powders, which on further heat treatment will yield the typical thermoset resin.





Phenolic moldings are resistant to heat, chemicals, and moisture and are preferred for wet-dry applications as in washing machines. Their stability to heat and low heat conductivity suit them for use in appliance parts, and their electrical insulation qualities qualify them for electric fittings such as switches, plugs, and distributor caps; resistance to hydraulic fluids has led to their use in automotive parts. All these applications have been made more economical by the development of injection molding and extrusion methods. Complex phenols are used in manufacture of brake linings.

### Furan resins

Furfural is a five-membered ring compound (i.e., the basic molecule has a ring shape and contains five atoms) of four carbon atoms and one oxygen atom, carrying the aldehyde group, — CHO; it reacts like formaldehyde with phenols in the presence of an acid catalyst to give a rigid polymer with high chemical resistance, used for coatings in industry. It can be prepared in semiliquid form with a low viscosity and remarkable penetrating power when applied to porous forms such as foundry sand cores or graphite blocks, being in this respect superior to other liquid resins.

### Aminoplastics

Urea resins are made by the condensation in aqueous solution of formaldehyde and urea in the presence of ammonia as an alkaline catalyst, giving a colourless solution to which cellulose filler is added to yield a molding powder upon drying, which when heated in a mold gives

a water-white (transparent) molding unless previously coloured by pigment.

The filler confers considerable strength, so that thin sections such as in cups and tumblers can be molded. Very large quantities of urea-formaldehyde resin are used in kitchen and bathroom hardware details, and electric appliance housings and fittings.

Melamine behaves in the same way as urea, but the product is more moisture resistant, harder and stronger, leading to wide use for plates and food containers. Melamine moldings are glossy and harder than any other plastic and retain a dust-free surface. Solutions of the thermoplastic forms of urea-formaldehyde resins are widely used as bonding agents for plywood and wood-fibre products.

### Alkyds

Alkyds are polyesters, generally of phthalic acid (with two acid groups) and glycerol, a triol — i. e., an alcohol with three hydroxyl groups. The solid resins are molded at high speed under low pressure, cured quickly, and are used where insulating properties, strength, and dimensional stability over a wide range of voltage, frequency, temperature, and humidity are required, as in vacuum-tube bases and automotive ignition parts and with glass-fibre reinforcement for switch gear and housings for portable tools.

### Polyesters of unsaturated alcohols

The resins known as DAP and DAIP, are crossliked allyl esters of phthalic and isophthalic acid, respectively. They are notable for maintaining rigidity and excellent electrical properties at temperatures up to 230 C, prop-





erties also manifested by allylic resin-impregnated glass cloth, used in aircraft and missile parts. Other advantages are good storage life and absence of gas evolution during polymerization. The resin allyl diglycol carbonate, optically clear and colourless, is used for making cast objects; fully cured castings are more heat and abrasion resistant than other cast resins.

### Epoxy resins

Epoxy resins have outstanding mechanical and electrical properties, dimensional stability, resistance to heat and chemicals, and adhesion to other materials. They are used for casting, encapsulation, protective coatings, and adhesives, and for reinforced moldings and laminates of the highest quality. Popular adhesives (epoxy glues) contain the resin components and the curing agent, usually an amine or an anhydride, in separate packages. The two are mixed just before use.

### Polyurethanes

Formed by the reaction between diisocyanates and polyols (multihydroxy compounds), polyurethanes are among the most versatile of plastics, ranging from rigid to elastic forms. Their major use is for foams, with properties varying from good flexibility to high rigidity. Thermoplastic polyurethanes that can be extruded as sheet and film of extreme toughness can also be made.

### Polyesters of unsaturated acids

Certain esters can be polymerized to resin and are used on a very large scale in glass-fibre-reinforced plastics.

Unsaturated acid (usually maleic acid in the form of its anhydride) is first polymerized to a relatively short polymer chain by condensation with a dihydric alcohol such as propylene glycol, the chain length being determined by the relative quantities of the two ingredients. The resulting condensation polymer is then diluted with a monomer such as styrene and an initiator for addition polymerization added. This mixture is quite stable at room temperature over a long period. Frequently, a silicone compound is added to promote adhesion to glass fibres, and wax to protect the surface from oxygen inhibition of polymerization. Glass-fibre materials are impregnated with the syrup and polymerization is brought about by raising the temperature. Alternatively, the polymerization can be carried out at room temperature by addition of a polymerization accelerator to the syrup immediately before impregnation. After an induction period, which can be controlled, polymerization takes place, with rapid increase in temperature, to give a glass-fibre-reinforced cross-linked polymer, which is effectively a thermoset type of plastic and very resistant to heat. The properties of the resin are frequently varied by replacing part of the unsaturated maleic anhydride by anhydrides of saturated acids.

## Silicones

Silicon, unlike carbon, does not form double bonds or long silicon chains. It does, however, form long chains with oxygen such as in siloxanes with hydrocarbon groups attached to the silicon; these result in a wide range of oils, greases, and rubbers.

Produced through a series of reactions involving replacement of certain atoms in the chain, silicon resins,





or silicones, can be used for high- and low-pressure lamination, with glass-fibre reinforcement and with mineral or short glass-fibre fillers, or for molding powders. The outstanding characteristic of these products is high dielectric strength (that is, they are good insulators at high voltages) with low dissipation over a wide temperature and humidity range. Silicones are not distorted by heat up to 400 C. They are also physiologically inert and therefore valuable for prostheses (artificial body parts).

# 4. INDUSTRIAL PLASTICS: RIGID AND FLEXIBLE FOAMS

Rigid polyurethane foams in sandwich forms have wide applications as building components. They are also the best insulants known today and so have wide application in refrigeration and in buildings, where they are applied in fitted slab form or are foamed into cavities at the building site. They can also be applied by spraying about six millimetres thickness with each pass of the spray gun. The ability to spray a foaming mixture through a single nozzle is a great advantage in application.

A very important use of rigid foam is for furniture parts to reproduce wood structures; these can be injection molded. Polyurethane foam can be screwed and nailed with a retention about equal to white pine lumber.

A major advance in the manufacture of sandwich structures is a new method of injection molding, in which a large machine is used to produce moldings up to 1.2 metres square. Moldings of great strength and any desired surface are obtained.

## Flexible foams

Flexible foams, usually polyurethane, are made in slab form up to 2.4 metres in width and as much as 1.5





metres high; these are then cut to required shapes or sizes or are molded. The molded foams may be hot molded.

This involves filling heated aluminum castings and gives a product having high resistance to compression, as for automobile seats; or they may be cold molded, a process used particularly for semi-flexible foams with high load-bearing properties. Used almost exclusively by the automobile industry for crash pads, armrests, and dashboard covers, the process involves machine mixing the ingredients and pouring them into aluminum molds lined with vinyl or acrylonitrile-butadiene-styrene skins, which become the cover material for the part.

Polystyrene foams are made in a wide range of densities, from expandable beads, either by extrusion through slot-shaped openings to 40 times the original volume to form boards directly or by foaming in steam chests to form large billets. Using small beads in stainless steel molds, cups can be molded with thin sections.

Thin sheet for packaging can also be made by the tube extrusion technique. Though packaging is a major use for forms made in closed molds, the largest use is for building panels; they can be plastered directly.

Acrylonitrile-butadiene-styrene can be expanded from pellets and is particularly suitable for wood-grain effects and for the production of heavy sections.

Expanded vinyls can be made from plastisols for flooring or textile linings by calendering with a blowing agent and laminating to a fabric base, and by injection molding for insulation and such articles as shoe soles. An improved material is now obtained from cross-linked polyvinyl chloride and competes with polyester in glass reinforced plastic.

## 5. BASIC PRINCIPLES OF WELDING

A weld can be defined as a coalescence of metals produced by heating to a suitable temperature with or without the application of pressure, and with or without the use of a filler material.

In fusion welding a heat source generates sufficient heat to create and maintain a molten pool of metal of the required size. The heat may be supplied by electricity or by a gas flame. Electric resistance welding can be considered fusion welding because some molten metal is formed.

Solid-phase processes produce welds without melting the base material and without the addition of a filler metal. Pressure is always employed, and generally some heat is provided. Frictional heat is developed in ultrasonic and friction joining, and furnace heating is usually employed in diffusion bonding.

The electric arc used in welding is a high-current, low-voltage discharge generally in the range 10–2,000 amperes at 10–50 volts. An arc column is complex but, broadly speaking, consists of a cathode that emits electrons, a gas plasma for current conduction, and an anode region that becomes comparatively hotter than the cathode due to electron bombardment. Therefore, the electrode, if consumable, is made positive and, if non-consumable, is made negative. A direct current (dc) arc is usually used, but alternating current (ac) arcs can be employed.

Total energy input in all welding processes exceeds that which is required to produce a joint, because not all the heat generated can be effectively utilized. Efficiencies





vary from 60 to 90 percent, depending on the process; some special processes deviate widely from this figure. Heat is lost by conduction through the base metal and by radiation to the surroundings.

Most metals, when heated, react with the atmosphere or other nearby metals. These reactions can be extremely detrimental to the properties of a welded joint. Most metals, for example, rapidly oxidise when molten. A layer of oxide can prevent proper bonding of the metal. Molten-metal droplets coated with oxide become entrapped in the weld and make the joint brittle. Some valuable materials added for specific properties react so quickly on exposure to the air that the metal deposited does not have the same composition as it had initially. These problems have led to the use of fluxes and inert atmospheres.

In fusion welding the flux has a protective role in facilitating a controlled reaction of the metal and then preventing oxidation by forming a blanket over the molten material. Fluxes can be active and help in the process or inactive and simply protect the surfaces during joining.

Inert atmospheres play a protective role similar to that of fluxes. In gas-shielded metal-arc and gas-shielded tungsten-arc welding an inert gas—usually argon—flows from an tube surrounding the torch in a continuous stream, displacing the air from around the arc. The gas does not chemically react with the metal but simply protects it from contact with the oxygen in the air.

The metallurgy of metal joining is important to the functional capabilities of the joint. The arc weld illustrates all the basic features of a joint. Three zones result from the passage of a welding arc: (1) the weld metal, or fusion zone, (2) the heat-affected zone, and (3) the unaffected zone. The weld metal is that portion of the joint

that has been melted during welding. The heat-affected zone is a region adjacent to the weld metal that has not been welded but has undergone a change in microstructure or mechanical properties due to the heat of welding. The unaffected material is that which was not heated sufficiently to alter its properties.

Weld-metal composition and the conditions under which it freezes (solidifies) significantly affect the ability of the joint to meet service requirements. In arc welding, the weld metal comprises filler material plus the base metal that has melted. After the arc passes, rapid cooling of the weld metal occurs. A one-pass weld has a cast structure with columnar grains extending from the edge of the molten pool to the centre of the weld. In a multipass weld, this cast structure may be modified, depending on the particular metal that is being welded.

The base metal adjacent to the weld, or the heat-affected zone, is subjected to a range of temperature cycles, and its change in structure is directly related to the peak temperature at any given point, the time of exposure, and the cooling rates. The types of base metal are too numerous to discuss here, but they can be grouped in three classes: (1) materials unaffected by welding heat, (2) materials hardened by structural change, (3) materials hardened by precipitation processes.

Welding produces stresses in materials. These forces are induced by contraction of the weld metal and by expansion and then contraction of the heat-affected zone. The unheated metal imposes a restraint on the above, and as contraction predominates, the weld metal cannot contract freely, and a stress is built up in the joint. This is generally known as residual stress, and for some critical applications must be removed by heat treatment of the whole fabrication. Residual stress is unavoidable in all





welded structures, and if it is not controlled bowing or distortion of the weldment will take place.

## Arc welding

Shielded metal-arc welding accounts for the largest total volume of welding today. In this process an electric arc is struck between the metallic electrode and the workpiece. Tiny globules of molten metal are transferred from the metal electrode to the weld joint. Arc welding can be done with either alternating or direct current. A holder or clamping device with an insulated handle is used to conduct the welding current to the electrode. A return circuit to the power source is made by means of a clamp to the workpiece.

Gas-shielded arc welding, in which the arc is shielded from the air by an inert gas such as argon or helium, has become increasingly important because it can deposit more material at a higher efficiency and can be readily automated. The tungsten electrode version finds its major applications in highly alloyed sheet materials. Either direct or alternating current is used, and filler metal is added either hot or cold into the arc. Consumable electrode gas-metal arc welding with a carbon dioxide shielding gas is widely used for steel welding. Metal transfer is rapid, and the gas protection ensures a tough weld.

Submerged arc welding is similar to the above except that the gas shield is replaced with a granulated mineral material as a flux.

## Weldability of metals

Carbon and low-alloy steels are the most widely used materials in welded construction. Carbon content largely

determines the weldability of carbon steels. Low-alloy steels are generally regarded as those having a total alloying content of less than 6 percent. There are many grades of steel available, and their relative weldability varies.

Aluminum and its alloys are also generally weldable. A very thin oxide film on aluminum tends to prevent good metal flow, however, and suitable fluxes are used for gas welding. Fusion welding is more effective with alternating current when using the gas-tungsten arc process to enable the oxide to be removed by the arc action.

Copper and its alloys are weldable, but the high thermal conductivity of copper makes welding difficult. Metals such as zirconium, niobium, molybdenum, tantalum, and tungsten are usually welded by the gas-tungsten arc process. Nickel is the most compatible material for joining, is weldable to itself, and is extensively used in dissimilar metal welding of steels, stainless steels and copper alloys.

# 6. GEAR

**Gear** is a toothed wheel or cylinder used to transmit rotary or reciprocating motion from one part of a machine to another. Two or more gears, transmitting motion from one shaft to another, constitute a gear train. At one time various mechanisms were collectively called gearing. Now, however, gearing is used only to describe systems of wheels or cylinders with meshing (постоянное зацепление) teeth. Gearing is chiefly used to transmit rotating motion, but can, with suitably designed gears and flat-toothed sectors, be employed to transform reciprocating motion into rotating motion, and vice versa.

## Simple Gears

The simplest gear is the spur (зубчатая) gear, a wheel with teeth cut across its edge parallel to the axis. Spur gears transmit rotating motion between two shafts or other parts with parallel axes. In simple spur gearing, the driven shaft revolves in the opposite direction to the driving shaft. If rotation in the same direction is desired, an idler gear (паразитная) is placed between the driving gear and the driven gear. The idler revolves in the opposite direction to the driving gear and therefore turns the driven gear in the same direction as the driving gear. In any form of gearing the speed of the driven shaft depends on the number of teeth in each gear. A gear with 10 teeth driving a gear with 20 teeth will revolve twice as fast as the gear it is driving, and a 20-tooth gear driving a

10-tooth gear will revolve at half the speed. By using a train of several gears, the ratio of driving to driven speed may be varied within wide limits.

Internal, or annular, gears are variations of the spur gear in which the teeth are cut on the inside of a ring or flanged wheel rather than on the outside. Internal gears usually drive or are driven by a pinion, a small gear with few teeth. A rack, a flat, toothed bar that moves in a straight line, operates like a gear wheel with an infinite radius and can be used to transform the rotation of a pinion to reciprocating motion, or vice versa.

Bevel gears (конические передачи) are employed to transmit rotation between shafts that do not have parallel axes. These gears have cone-shaped bodies and straight teeth. When the angle between the rotating shafts is 90°, the bevel gears used are called mitre gears.

## Helical Gears

These gears have teeth that are not parallel to the axis of the shaft but are spiralled around the shaft in the form of a helix. Such gears are suitable for heavy loads because the gear teeth come together at an acute angle rather than at 90° as in spur gearing. Simple helical gearing has the disadvantage of producing a thrust that tends to move the gears along their respective shafts. This thrust can be avoided by using double helical, or herringbone, gears, which have V-shaped teeth composed of half a right-handed helical tooth and half a left-handed helical tooth. Hypoid gears are helical bevel gears employed when the axes of the two shafts are perpendicular but do not intersect. One of the most common uses of hypoid gearing is to connect the drive shaft and the rear axle in motor cars. Helical gearing used to transmit rotation between





shafts that are not parallel is often incorrectly called spiral gearing.

Another variation of helical gearing is provided by the worm gear, also called the screw gear. A worm gear is a long, thin cylinder that has one or more continuous helical teeth that mesh with a helical gear. Worm gears differ from helical gears in that the teeth of the worm slide across the teeth of the driven gear instead of exerting a direct rolling pressure. Worm gears are used chiefly to transmit rotation, with a large reduction in speed, from one shaft to another at a 90° angle.

## 7. BEARINGS

Bearing is a mechanical device for decreasing friction in a machine in which a moving part bears—that is, slides or rolls on another part. Usually in a bearing the support must allow the moving part one type of motion, for example, rotation, while preventing it from moving in any other way, for example, sidewise. The commonest bearings are found at the rigid supports of rotating shafts where friction is the greatest.

Bearings were invented early in history; when the wheel was invented, it was mounted on an axle, and where wheel and axle touched was a bearing. Such early bearings had surfaces of wood or leather lubricated with animal fat.

Modern bearings have been arbitrarily designated as friction bearings and antifriction bearings. The first comprises sleeve or journal bearings; the second, ball and roller bearings. Neither type of bearing is completely frictionless, and both are highly efficient in reducing friction. A large, modern aircraft engine, for example, has more than 100 bearings, including both types; yet the total power consumed in overcoming bearing friction is less than one per cent of the total power output of the engine.

Friction bearings (скольжения) of the sleeve or journal type are simpler than antifriction bearings in construction but more complex in theory and operation. The shaft supported by the bearing is called the journal, and the outer portion, the sleeve. If journal and sleeve are both





made of steel, the bearing surfaces, even if well lubricated, may grab or pick up, that is, rip, small pieces of metal from each other. The sleeves of most bearings therefore are lined with brass, bronze, or Babbitt metal. Sleeve bearings are generally pressure-lubricated through a hole in the journal or from the housing that contains the bearing. The sleeve is often grooved to distribute the oil evenly over the bearing surface.

Typical clearance (difference between the diameters of journal and sleeve) is nominally 0.0025 cm for every 2.54 cm of journal diameter. When the journal is rotating, it may be about 0.0000001 cm from the sleeve at the side with the greatest load. The journal is thus supported on an extremely thin film of oil, and the two parts have no actual contact. As the rotational speed increases, other variables remaining constant, the oil film becomes thicker, so that the friction increases in less than direct proportion to the speed. Conversely, at lower speeds the oil film is thinner if other factors are unchanged. At extremely low speeds, however, the film may rupture and the two pieces come into contact. Therefore, friction is high when the machine is started in motion, and the bearing may fail if high stresses are put on it during starting. Ball bearings, on the other hand, have low starting friction.

Jewel bearings are used to mount very little shafts such as those found in fine watches. They are friction-type bearings in which the ends of the shafts are mounted in extremely hard substances. The bearing is lubricated with a microscopic drop of fine oil.

In a ball bearing, a number of balls rotate freely between an inner ring, which is rigidly fixed to a rotating shaft, and an outer ring, which is rigidly fixed to a support. Both balls and rings are made of hardened alloy

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steel, usually finished to extremely fine tolerances. The balls are generally held in position by a cage or separator that keeps them evenly spaced and prevents them from rubbing against each other. The bearing is lubricated with grease or oil.

A roller bearing is similar to a ball bearing, except that small steel cylinders, or rollers, are substituted for the balls. A needle bearing is a roller bearing in which the rollers are extremely long and thin. An ordinary roller bearing may have 20 rollers — each twice as long as it is wide — whereas a needle bearing may have 100 needles, each 10 times as long as it is wide. Needle bearings are particularly useful when space is limited.

## 8. CONSTRUCTION OF AN AUTOMOBILE

The primary components of a car are the power plant, the power transmission, the running gear, and the control system. These constitute the chassis, on which the body is mounted.

The power plant includes the engine and its fuel, the carburettor, ignition, lubrication, and cooling systems, and the starter motor.

### The Engine

The greatest number of cars use piston engines.The four-cycle piston engine requires four strokes of the piston per cycle. The first downstroke draws in the petrol mixture. The first upstroke compresses it. The second downstroke—the power stroke—following the combustion of the fuel, supplies the power, and the second upstroke evacuates the burned gases. Intake and exhaust valves in the cylinder control the intake of fuel and the release of burned gases. At the end of the power stroke the pressure of the burned gases in the cylinder is 2.8 to 3.5 kg/sq cm. These gases escape with the sudden opening of the exhaust valve. They rush to a silencer (muffler), an enlarged section of piping containing expanding ducts and perforated plates through which the gases expand and are released into the atmosphere.

Greater smoothness of operation of the four-cycle engine were provided by the development of the four-cylinder engine, which supplies power from one or another

of the cylinders on each stroke of the cycle. A further increase in power and smoothness is obtained in engines of 6, 8, 12, and 16 cylinders, which are arranged in either a straight line or two banks assembled in the form of a V.

## Carburation

Air is mixed with the vapour of the petrol in the carburettor. To prevent the air and the carburettor from becoming too cold for successful evaporation of the fuel, the air for the carburettor is usually taken from a point close to a heated part of the engine. Modern carburettors are fitted with a so-called float-feed chamber and a mixing or spraying chamber. The first is a small chamber in which a small supply of petrol is maintained at a constant level. The petrol is pumped from the main tank to this chamber, the float rising as the petrol flows in until the desired level is reached, when the inlet closes. The carburettor is equipped with such devices as accelerating pumps and economizer valves, which automatically control the mixture ratio for efficient operation under varying conditions. Level-road driving at constant speed requires a lower ratio of petrol to air than that needed for climbing hills, for acceleration, or for starting the engine in cold weather. When a mixture extremely rich in petrol is necessary, a valve known as the choke cuts down the air intake, permitting large quantities of unvaporized fuel to enter the cylinder.

## Ignition

The mixture of air and petrol vapour delivered to the cylinder from the carburettor is compressed by the first upstroke of the piston. This heats the gas, and the higher





temperature and pressure facilitate ignition and quick combustion. The next operation is that of igniting the charge by a spark plug. One electrode is insulated by porcelain or mica; the other is grounded through the metal of the plug, and both form part of the secondary circuit of an induction system.

The principal type of ignition now commonly used is the battery-and-coil system. The current from the battery flows through the coil and magnetizes the iron core. When this circuit is interrupted at the distributor points by the interrupter cam, a current is produced in the primary coil with the assistance of the condenser. This induces a high-voltage current in the secondary winding. This secondary high voltage is needed to cause the spark to jump the gap in the spark plug. The spark is directed to the proper cylinder by the distributor, which connects the secondary coil to the spark plugs in the several cylinders in their proper firing sequence. The interrupter cam and distributor are driven from the same shaft, the number of breaking points on the interrupter cam being the same as the number of cylinders.

The electrical equipment controls the starting of the engine, its ignition system, and the lighting of the car. It consists of the battery, a generator for charging it when the engine is running, a starter and the necessary wiring. Electricity also operates various automatic devices and accessories, including windscreen wipers, directional signals, heating and air conditioning, cigarette lighters, powered windows and audio equipment.

## Lubrication

In the force-feed system, a pump forces the oil to the main crankshaft bearings and then through drilled holes

in the crankpins. In the full-force system, oil is also forced to the connecting rod and then out to the walls of the cylinder at the piston pin.

## Cooling

At the moment of explosion, the temperature within the cylinder is much higher than the melting point of cast iron. Since the explosions take place as often as 2,000 times per minute in each cylinder, the cylinder would soon become so hot that the piston, through expansion, would «freeze» in the cylinder. The cylinders are therefore provided with jackets, through which water is rapidly circulated by a small pump driven by a gear on the crankshaft or camshaft. During cold weather, the water is generally mixed with a suitable antifreeze, such as alcohol, wood alcohol, or ethylene glycol.

To keep the water from boiling away, a radiator forms part of the engine-cooling system. Radiators vary in shape and style. They all have the same function, however, of allowing the water to pass through tubing with a large area, the outer surface of which can be cooled by the atmosphere. In air cooling of engine cylinders, various means are used to give the heat an outlet and carry it off by a forced draught of air.

## The Starter

The petrol engine must usually be set in motion before an explosion can take place and power can be developed; moreover, it cannot develop much power at low speeds. These difficulties have been overcome by the use of gears and clutches, which permit the engine to work





at a speed higher than that of the wheels, and to work when the vehicle is at rest. An electric starter receiving its current from the storage battery, turns the crankshaft, thus starting the petrol engine. The starter motor is of a special type that operates under a heavy overload, producing high power for very short periods. In modern cars, the starter motor is automatically actuated when the ignition switch is turned on.

## The Power Transmission

The engine power is delivered first to the flywheel and then to the clutch. From the clutch, which is the means of coupling the engine with the power-transmission units, the power flows through the transmission and is delivered into the rear-axle drive gears, or differential, by means of the drive shaft and universal joints. The differential delivers the power to each of the rear wheels through the rear-axle drive shafts.

## The Clutch

Some type of clutch is found in every car. The clutch may be operated by means of a foot pedal, or it may be automatic or semi-automatic. The friction clutch and the fluid coupling are the two basic varieties. The friction clutch, which depends on solid contact between engine and transmission, consists of: the rear face of the flywheel; the driving plate, mounted to rotate with the flywheel; and the driven plate, between the other two. When the clutch is engaged, the driving plate presses the driven plate against the rear face of the flywheel. Engine power is then delivered through the contacting surfaces to the transmission.

Fluid coupling may be used either with or without the friction clutch. When it is the sole means of engaging the engine to the transmission, power is delivered exclusively through an oil medium without any contact of solid parts. In this type, known as a fluid drive, an engine-driven, fan-bladed disc, known as the fluid flywheel, agitates the oil with sufficient force to rotate a second disc that is connected to the transmission. As the rotation of the second disc directly depends on the amount of engine power delivered, the prime result of fluid coupling is an automatic clutch action, which greatly simplifies the requirements for gear shifting.

### Manual and Automatic Transmissions

The transmission is a mechanism that changes speed and power ratios between the engine and the driving wheels. Three general types of transmission are in current use: conventional or sliding-gear, Hydra-Matic, and torque-converter systems.

The conventional transmission provides for three or four forward speeds and one reverse speed. It consists of two shafts, each with gears of varying diameters. One shaft drives the other at a preselected speed by meshing the appropriate set of gears. For reverse speed, an extra gear, known as the idler gear, is required to turn the driven shaft in the opposite direction from normal rotation. In high gear, the two shafts usually turn at the same speed. In low, second, and reverse gears, the driven shaft turns more slowly than the driving shaft. When a pair of gears permits the driven shaft to turn more rapidly than the driving shaft, the transmission is said to have overdrive. Overdrive is designed to increase the speed of a car.





The Hydra-Matic type of transmission combines the automatic clutch provided by fluid coupling with a semi-automatic transmission. A mechanical governor, controlled by the pressure exerted on the accelerator pedal, regulates gear selection through a system of hydraulically controlled shift valves. Hydra-Matic transmission provides for several forward gears.

The torque-converter type of transmission provides an unlimited number of gear ratios with no shifting of gears. The torque converter is a hydraulic mechanism using engine power to drive a pump, which impels streams of oil against the blades of a turbine. The turbine is connected to the drive shaft and causes it to rotate.

Both Hydra-Matic and torque-converter systems are controlled by a selector lever on the steering column, which provides also for reverse and sometimes for emergency-low gears.

### The Running Gear

The running gear of the car includes the wheel-suspension system, the stabilizers, and the wheels and tyres. The frame of the car may be considered the integrating member of the running gear. It is attached to the rear axle and to the front wheels by springs. These springs, along with the axles, the control and support arms, and the shock absorbers, constitute the wheel-suspension system. In modern cars the front wheels are independently suspended from the frame in a manner that permits either wheel to change its plane without appreciably affecting the other. This type of front-wheel suspension is known popularly as independent suspension. The stabilizers consist of spring-steel bars, connected

between the shock-absorber arms by levers, to decrease body roll and improve steerability.

### The Control System

Steering is controlled by a hand wheel, mounted on an inclined column and attached to a steering tube inside the column. The other end of the tube is connected to the steering gear, which is designed to provide maximum ease of operation. Power steering, adapted for passenger cars in the early 1950s, is generally a hydraulic mechanism used as a booster to reduce the effort of steering.

A car has two sets of brakes: the hand or emergency brake and the foot brake. The emergency brake generally operates on the rear wheels only. The foot brake in modern cars is always of the four-wheel type, operating on all wheels. Hydraulic brakes on cars and hydraulic vacuum, air, or power brakes on lorries apply the braking force to the wheels with much less force on the brake pedal than is required with ordinary mechanical brakes. The wheel brakes are generally of the internally expanding type, in which a convex strip of material is forced against a concave steel brake drum.

## 9. TWO-STROKE AND DIESEL ENGINES

Most diesels are also four-stroke engines. The first or suction stroke draws air, but no fuel, into the combustion chamber through an intake valve. On the second or compression stroke the air is compressed to a small fraction of its former volume and is heated to approximately 440°C by this compression. At the end of the compression stroke vaporised fuel is injected into the combustion chamber and burns instantly because of the high temperature of the air in the chamber. Some diesels have auxiliary electrical ignition systems to ignite the fuel when the engine starts and until it warms up. This combustion drives the piston back on the third or power stroke of the cycle. The fourth stroke is an exhaust stroke.

The efficiency of the diesel engine is greater than that of any petrol engine and in actual engines today is slightly over 40 per cent. Diesels are in general slow-speed engines with crankshaft speeds of 100 to 750 revolutions per minute (rpm) as compared to 2,500 to 5,000 rpm for typical petrol engines. Some types of diesel, however, have speeds up to 2,000 rpm. Because diesels use compression ratios of 14 or more, they are generally more heavily built than petrol engines, but this disadvantage is counterbalanced by their greater efficiency and the fact that they can be operated on less expensive fuel.

### Two-Stroke Engines

By suitable design it is possible to operate a diesel as a two-stroke or two-cycle engine with a power stroke every

other stroke of the piston instead of once every four strokes. The efficiency of such engines is less than that of four-stroke engines, and therefore the power of a two-stroke engine is always less then half that of a four-stroke engine of comparable size.

The general principle of the two-stroke engine is to shorten the periods in which fuel is introduced to the combustion chamber and in which the spent gases are exhausted to a small fraction of the duration of a stroke instead of allowing each of these operations to occupy a full stroke.

In the simplest type of two-stroke engine, the valves are the openings in the cylinder wall that are uncovered by the piston at the end of its outward travel. In the two-stroke cycle the fuel mixture or air is introduced through the intake port when the piston is fully withdrawn from the cylinder. The compression stroke follows and the charge is ignited when the piston reaches the end of this stroke. The piston then moves outward on the power stroke, uncovering the exhaust port and permitting the gases to escape from the combustion chamber.

## 10. DIRECT-CURRENT (DC) GENERATORS

If an armature revolves between two stationary field poles, the current in the armature moves in one direction during half of each revolution and in the other direction during the other half. To produce a steady flow of unidirectional, or direct, current from such a device, it is necessary to provide a means of reversing the current flow outside the generator once during each revolution. In older machines this reversal is accomplished by means of a commutator (коллектор) — a split metal ring mounted on the shaft of the armature. The two halves of the ring are insulated from each other and serve as the terminals of the armature coil. Fixed brushes of metal or carbon are held against the commutator as it revolves, connecting the coil electrically to external wires. As the armature turns, each brush is in contact alternately with the halves of the commutator, changing position at the moment when the current in the armature coil reverses its direction. Thus there is a flow of unidirectional current in the outside circuit to which the generator is connected. DC generators are usually operated at fairly low voltages to avoid the sparking between brushes and commutator that occurs at high voltage. The highest potential commonly developed by such generators is 1500 V. In some newer machines this reversal is accomplished using power electronic devices, for example, diode rectifiers.

Modern DC generators use drum armatures that usually consist of a large number of windings set in longitu-

dinal slits in the armature core and connected to appropriate segments of a multiple commutator. In an armature having only one loop of wire, the current produced will rise and fall depending on the part of the magnetic field through which the loop is moving. A commutator of many segments used with a drum armature always connects the external circuit to one loop of wire moving through the high-intensity area of the field, and as a result the current delivered by the armature windings is virtually constant. Fields of modern generators are usually equipped with four or more electromagnetic poles to increase the size and strength of the magnetic field. Sometimes smaller interpoles are added to compensate for distortions in the magnetic flux of the field caused by the magnetic effect of the armature.

DC generators are commonly classified according to the method used to provide field current for energizing the field magnets. A series-wound generator has its field in series with the armature, and a shunt-wound generator has the field connected in parallel with the armature. Compound-wound generators have part of their fields in series and part in parallel. Both shunt-wound and compound-wound generators have the advantage of delivering comparatively constant voltage under varying electrical loads. The series-wound generator is used principally to supply a constant current at variable voltage. A magneto is a small DC generator with a permanent-magnet field.

# 11. AC MOTORS

Two basic types of motors are designed to operate on polyphase alternating current: synchronous motors and induction motors. The synchronous motor is essentially a three-phase alternator operated in reverse. The field magnets are mounted on the rotor and are excited by direct current, and the armature winding is divided into three parts and fed with three-phase alternating current. The variation of the three waves of current in the armature causes a varying magnetic reaction with the poles of the field magnets, and makes the field rotate at a constant speed that is determined by the frequency of the current in the AC power line.

The constant speed of a synchronous motor is advantageous in certain devices. However, in applications where the mechanical load on the motor becomes very great, synchronous motors cannot be used, because if the motor slows down under load it will «fall out of step» with the frequency of the current and come to a stop. Synchronous motors can be made to operate from a single-phase power source by the inclusion of suitable circuit elements that cause a rotating magnetic field.

The simplest of all electric motors is the squirrel-cage type of induction motor used with a three-phase supply. The armature of the squirrel-cage motor consists of three fixed coils similar to the armature of the synchronous motor. The rotating member consists of

a core in which are imbedded a series of heavy conductors arranged in a circle around the shaft and parallel to it. With the core removed, the rotor conductors resemble in form the cylindrical cages once used to exercise pet squirrels. The three-phase current flowing in the stationary armature windings generates a rotating magnetic field, and this field induces a current in the conductors of the cage. The magnetic reaction between the rotating field and the current-carrying conductors of the rotor makes the rotor turn. If the rotor is revolving at exactly the same speed as the magnetic field, no currents will be induced in it, and hence the rotor should not turn at a synchronous speed. In operation the speeds of rotation of the rotor and the field differ by about 2 to 5 per cent. This speed difference is known as slip.

Motors with squirrel-cage rotors can be used on single-phase alternating current by means of various arrangements of inductance and capacitance that alter the characteristics of the single-phase voltage and make it resemble a two-phase voltage. Such motors are called split-phase motors or condenser motors (or capacitor motors), depending on the arrangement used. Single-phase squirrel-cage motors do not have a large starting torque, and for applications where such torque is required, repulsion-induction motors are used. A repulsion-induction motor may be of the split-phase or condenser type, but has a manual or automatic switch that allows current to flow between brushes on the commutator when the motor is starting, and short-circuits all commutator segments after the motor reaches a critical speed. Repulsion-induction motors are so named because their starting torque





depends on the repulsion between the rotor and the stator, and their torque while running depends on induction. Series-wound motors with commutators, which will operate on direct or alternating current, are called universal motors. They are usually made only in small sizes and are commonly used in household appliances.

# 12. ENGINEERING AS A PROFESSION

## Electrical and Electronics Engineering

Electrical and electronics engineering is the largest and most diverse field of engineering. It is concerned with the development and design, application, and manufacture of systems and devices that use electric power and signals. Among the most important subjects in the field are electric power and machinery, electronic circuits, control systems, computer design, superconductors, solid-state electronics, medical imaging systems, robotics, lasers, radar, consumer electronics, and fibre optics.

Despite its diversity, electrical engineering can be divided into four main branches: electric power and machinery, electronics, communications and control, and computers.

## Electric Power and Machinery

The field of electric power is concerned with the design and operation of systems for generating, transmitting, and distributing electric power Engineers in this field have brought about several important developments since the late 1970s. One of these is the ability to transmit power at extremely high voltages in both the direct current (DC) and alternating current (AC) modes, reducing power losses proportionately. Another is the real-





time control of power generation, transmission, and distribution, using computers to analyse the data fed back from the power system to a central station and thereby optimizing the efficiency of the system while it is in operation.

A significant advance in the engineering of electric machinery has been the introduction of electronic controls that enable AC motors to run at variable speeds by adjusting the frequency of the current fed into them. DC motors have also been made to run more efficiently this way.

## Electronics

Electronic engineering deals with the research, design, integration, and application of circuits and devices used in the transmission and processing of information. Information is now generated, transmitted, received, and stored electronically on a scale unprecedented in history, and there is every indication that the explosive rate of growth in this field will continue unabated.

Electronic engineers design circuits to perform specific tasks, such as amplifying electronic signals, adding binary numbers, and demodulating radio signals to recover the information they carry. Circuits are also used to generate waveforms useful for synchronization and timing, as in television, and for correcting errors in digital information, as in telecommunications.

Prior to the 1960s, circuits consisted of separate electronic devices — resistors, capacitors, inductors, and vacuum tubes — assembled on a chassis and connected by wires to form a bulky package. The electronics revolution of the 1970s and 1980s set the trend towards integrating electronic devices on a single tiny chip of silicon

or some other semiconductive material. The complex task of manufacturing these chips uses the most advanced technology, including computers, electron-beam lithography, micro-manipulators, ion-beam implantation, and ultraclean environments. Much of the research in electronics is directed towards creating even smaller chips, faster switching of components, and three-dimensional integrated circuits.

### Communications and Control

Engineers work on control systems ranging from the everyday, passenger-actuated, such as those that run a lift, to the exotic, such as systems for keeping spacecraft on course. Control systems are used extensively in aircraft and ships, in military fire-control systems, in power transmission and distribution, in automated manufacturing, and in robotics.

### Computers

Computer engineering is now the most rapidly growing field. The electronics of computers involve engineers in design and manufacture of memory systems, of central processing units, and of peripheral devices. The field of computer science is closely related to computer engineering; however, the task of making computers more «intelligent» (artificial intelligence), through creation of sophisticated programs or development of higher level machine languages or other means, is generally regarded as the aim of computer science.

One current trend in computer engineering is microminiaturization. Engineers try to place greater and greater numbers of circuit elements onto smaller and





smaller chips. Another trend is towards increasing the speed of computer operations through the use of parallel processors and superconducting materials.

### Mechanical Engineering

Engineers in this field design, test, build, and operate machinery of all types; they also work on a variety of manufactured goods and certain kinds of structures. The field is divided into (1) machinery, mechanisms, materials, hydraulics, and pneumatics; and (2) heat as applied to engines, work and energy, heating, ventilating, and air conditioning. The mechanical engineer, therefore, must be trained in mechanics, hydraulics, and thermodynamics and must know such subjects as metallurgy and machine design. Some mechanical engineers specialise in particular types of machines such as pumps or steam turbines. A mechanical engineer designs not only the machines that make products but the products themselves, and must design for both economy and efficiency. A typical example of modern mechanical engineering is the design of a car or an agricultural machine.

### Safety Engineering

This field of engineering has as its object the prevention of accidents. In recent years safety engineering has become a speciality adopted by individuals trained in other branches of engineering. Safety engineers develop methods and procedures to safeguard workers in hazardous occupations. They also assist in designing machinery, factories, ships and roads, suggesting alterations and improvements to reduce the possibility of accident.

In the design of machinery, for example, the safety engineer try to cover all moving parts or keep them from accidental contact with the operator, to put cutoff switches within reach of the operator and to eliminate dangerous sharp parts. In designing roads the safety engineer seeks to avoid such hazards as sharp turns and blind intersections that lead to traffic accidents.

# 13. Automation in Industry. Fixed and programmable automation

## Automated production lines

An automated production line consists of a series of workstations connected by a transfer system to move parts between the stations. This is an example of fixed automation, since these lines are set up for long production runs, making large number of product units and running for several years between changeovers. Each station is designed to perform a specific processing operation, so that the part or product is constructed stepwise as it progresses along the line. A raw work part enters at one end of the line, proceeds through each workstation and appears at the other end as a completed product. In the normal operation of the line, there is a work part being processed at each station, so that many parts are being processed simultaneously and a finished part is produced with each cycle of the line. The various operations, part transfers, and other activities taking place on an automated transfer line must all be sequenced and coordinated properly for the line to operate efficiently.

Modern automated lines are controlled by programmable logic controllers, which are special computers that can perform timing and sequencing functions required to operate such equipment. Automated production lines are utilized in many industries, mostly automobile, where they are used for processes such as machining and pressworking.

Machining is a manufacturing process in which metal is removed by a cutting or shaping tool, so that the remaining work part is the desired shape. Machinery and motor components are usually made by this process. In many cases, multiple operations are required to completely shape the part. If the part is mass-produced, an automated transfer line is often the most economical method of production. Many separate operations are divided among the workstations.

Pressworking operations involve the cutting and forming of parts from sheet metal. Examples of such parts include automobile body panels, outer shells of laundry machines and metal furniture More than one processing step is often required to complete a complicated part. Several presses are connected together in sequence by handling mechanisms that transfer the partially completed parts from one press to the next, thus creating an automated pressworking line.

## Numerical control

Numerical control is a form of programmable automation in which a machine is controlled by numbers (and other symbols) that have been coded on punched paper tape or an alternative storage medium. The initial application of numerical control was in the machine tool industry, to control the position of a cutting tool relative to the work part being machined. The NC part program represents the set of machining instructions for the particular part. The coded numbers in the program specify x-y-z coordinates in a Cartesian axis system, defining the various positions of the cutting tool in relation to the work part. By sequencing these positions in the program, the machine tool is directed to accomplish the machining of the part. A position feedback control system is used in most NC machines to verify that the coded instructions have been correctly performed. Today a small computer is used as the controller in an NC machine tool. Since this form of numerical control is implemented by computer, it is called computer numerical control, or CNC. Another variation in the implementation of numerical control involves sending part programs over telecommunications lines from a central computer to individual machine tools in the factory. This form of numerical control is called direct numerical control, or DNC.

Many applications of numerical control have been developed since its initial use to control machine tools. Other machines using numerical control include component-insertion machines used in electronics assembly, drafting machines that prepare engineering drawings, coordinate measuring machines that perform accurate inspections of parts. In these applications coded numerical data are employed to control the position of a tool or workhead relative to some object. Such machines are used to position electronic components (e.g., semiconductor chip modules) onto a printed circuit board (PCB). It is basically an x-y positioning table that moves the printed circuit board relative to the part-insertion head, which then places the individual component into position on the board. A typical printed circuit board has dozens of individual components that must be placed on its surface; in many cases, the lead wires of the components must be inserted into small holes in the board, requiring great precision by the insertion machine. The program that controls the machine indicates which components are to be placed on the board and their locations. This information is contained in the product-design database and is typically communicated directly from the computer to the insertion machine.

### Automated assembly

Assembly operations have traditionally been performed manually, either at single assembly workstations or on assembly lines with multiple stations. Owing to the high labour content and high cost of manual labour, greater attention has been given in recent years to the use of automation for assembly work. Assembly operations can be automated using production line principles if the quantities are large, the product is small, and the design is simple (e.g., mechanical pencils, pens, and cigarette lighters). For products that do not satisfy these conditions, manual assembly is generally required.

Automated assembly machines have been developed that operate in a manner similar to machining transfer lines, with the difference being that assembly operations, instead of machining, are performed at the workstations. A typical assembly machine consists of several stations, each equipped with a supply of components and a mechanism for delivering the components into position for assembly. A workhead at each station performs the actual attachment of the component. Typical workheads include automatic screwdrivers, welding heads and other joining devices. A new component is added to the partially completed product at each workstation, thus building up the product gradually as it proceeds through the line. Assembly machines of this type are considered to be examples of fixed automation, because they are generally configured for a particular product made in high volume. Programmable assembly machines are represented by the component-insertion machines employed in the electronics industry.

## 14. HISTORY OF ROBOTICS

The concept of robots dates back to ancient times, when some myths told of mechanical beings brought to life. Such **automata** also appeared in the clockwork figures of medieval churches, and in the 18th century some clockmakers gained fame for the clever mechanical figures that they constructed. Today the term **automaton** is usually applied to these handcrafted, mechanical (rather than electromechanical) devices that imitate the motions of living creatures. Some of the «robots» used in advertising and entertainment are actually automata, even with the addition of remote radio control.

The term **robot** itself is derived from the Czech word **robota**, meaning «compulsory labour». It was first used by the Czech novelist and playwright Karel Chapek, to describe a mechanical device that looks like a human but, lacking human sensibility, can perform only automatic, mechanical operations. Robots as they are known today do not only imitate human or other living forms. True robots did not become possible, however, until the invention of the computer in the 1940s and the miniaturization of computer parts. One of the first true robots was an experimental model designed by researchers at the Stanford Research Institute in the late 1960s. It was capable of arranging blocks into stacks through the use of a television camera as a visual sensor, processing this information in a small computer.

Computers today are equipped with microprocessors that can handle the data being fed to them by various

sensors of the surrounding environment. Making use of the principle of feedback, robots can change their operations to some degree in response to changes in that environment. The commercial use of robots is spreading, with the increasing automation of factories, and they have become essential to many laboratory procedures. Japan is the most advanced nation exploring robot technology. Nowadays robots continue to expand their applications. The home-made robots (горничная) available today may be one sign of the future.

## 15. MEASUREMENTS

**Metric System** is a decimal system of physical units, named after its unit of length, the metre. the metric system is adopted as the common system of weights and measures by the majority of countries, and by all countries as the system used in scientific work.

### Weights and Measures

Length, capacity, and weight can be measured using standard units. The principal early standards of length were the palm or hand breadth, the foot, and the cubit, which is the length from the elbow to the tip of the middle finger. Such standards were not accurate and definite. Unchanging standards of measurement have been adopted only in modern time.

In the English-speaking world, the everyday units of linear measurement were traditionally the inch, foot, yard and mile. In Great Britain, until recently, these units of length were defined in terms of the imperial standard yard, which was the distance between two lines on a bronze bar made in 1845.

In Britain units of weight (ounces, pounds, and tons) are now also derived from the metric standard — kilogram. This is a solid cylinder of platinum-iridium alloy maintained at constant temperature at Sevres, near Paris. Copies, as exact as possible, of this standard are maintained by national standards laboratories in many countries.

**International System of Units** is a system of measurement units based on the MKS (metre-kilogram-sec-

ond) system. This international system is commonly referred to as SI.

At the Eleventh General Conference on Weights and Measures, held in Paris in 1960 standards were defined for six base units and two supplementary units:

### Length

The metre had its origin in the metric system. By international agreement, the standard metre had been defined as the distance between two fine lines on a bar of platinum-iridium alloy. The 1960 conference redefined the metre as 1,650,763.73 wavelengths of the reddish-orange light emitted by the isotope krypton–86. The metre was again redefined in 1983 as the length of the path travelled by light in a vacuum during a time interval of 1/299,792,458 of a second.

### Mass

When the metric system was created, the kilogram was defined as the mass of 1 cubic decimetre of pure water at the temperature of its maximum density or at 4.0 °C.

### Time

For centuries, time has been universally measured in terms of the rotation of the earth. The second, the basic unit of time, was defined as 1/86,400 of a mean solar day or one complete rotation of the earth on its axis in relation to the sun. Scientists discovered, however, that the rotation of the earth was not constant enough to serve as the basis of the time standard. As a result, the second was redefined in 1967 in terms of the resonant frequency of the caesium atom, that is, the frequency at which this atom absorbs energy: 9,192,631,770 Hz (hertz, or cycles per second).





### Temperature

The temperature scale is based on a fixed temperature, that of the triple point of water at which it's solid, liquid and gaseous. The freezing point of water was designated as 273.15 K, equalling exactly 0° on the Celsius temperature scale. The Celsius scale, which is identical to the centigrade scale, is named after the 18th-century Swedish astronomer Anders Celsius, who first proposed the use of a scale in which the interval between the freezing and boiling points of water is divided into 100 degrees. By international agreement, the term Celsius has officially replaced centigrade.

One feature of SI is that some units are too large for ordinary use and others too small. To compensate, the prefixes developed for the metric system have been borrowed and expanded. These prefixes are used with all three types of units: base, supplementary, and derived. Examples are *millimetre* (mm), *kilometre/hour* (km/h), *megawatt* (MW), and *picofarad* (pF). Because double prefixes are not used, and because the base unit name *kilogram* already contains a prefix, prefixes are used not with *kilogram* but with *gram*. The prefixes *hecto, deka, deci,* and *centi* are used only rarely, and then usually with *metre* to express areas and volumes. In accordance with established usage, the centimetre is retained for body measurements and clothing.

In cases where their usage is already well established, certain other units are allowed for a limited time, subject to future review. These include the nautical mile, knot, angstrom, standard atmosphere, hectare, and bar.

# 16. COMPUTERS

**Computer** is an electronic device that can receive a program (a set of instructions) and then carry out this program by calculating numerical information.

The modern world of high technology is possible mainly due to the development of the computer. Computers have opened up a new era in manufacturing by means of automation, and they have enhanced modern communication systems.

## Personal computers

Personal computers are also called microcomputers or home computer. The most compact are called laptops. They are portable and work on built-in batteries.

Personal computers are designed for use at homes, schools, and offices. At home they can be used for home management (balancing the family finances, for example) and for playing computer games, watching films or listening to music. Schoolchildren can use computers for doing their homework and many schools now have computers for independent learning and computer-literacy studies. In the office personal computers may be used for word processing, bookkeeping, storage and handling of necessary information.

Personal computers were made possible by two technical innovations in the field of microelectronics: the integrated circuit, or IC, which was developed in 1959 and the microprocessor that first appeared in 1971. The





IC permitted the miniaturization of computer-memory circuits, and the microprocessor reduced the size of a computer's CPU to the size of a single silicon chip.

Because a CPU calculates, performs logical operations, contains operating instructions, and manages data flows, a complete microcomputer as a separate system was designed and developed in 1974.

In 1981, IBM Company offered its own microcomputer model, the IBM PC that became a necessary tool for almost every business. The PC's use of a 16-bit microprocessor initiated the development of faster and more powerful personal computers, and its use of an operating system that was available to all other computer makers led to a standardisation of the industry.

In the mid–1980s, a number of other developments were especially important for the growth of personal computers. One of these was the introduction of a powerful 32-bit CPU capable of running advanced operating systems at high speeds.

Another innovation was the use of conventional operating systems, such as UNIX, OS/2 and Windows. The Apple Macintosh computers were the first to allow the user to select icons — graphic symbols of computer functions — from a display screen instead of typing commands. New voice-controlled systems are now available, and users are able to use the words and syntax of spoken language to operate their personal computers.

## 17. History and Future of the Internet

The Internet technology was created by Vinton Cerf in early 1973 as part of a project headed by Robert Kahn and conducted by the Advanced Research Projects Agency, part of the United States Department of Defence. Later Cerf made many efforts to build and standardise the Internet. In 1984 the technology and the network were turned over to the private sector and to government scientific agencies for further development. The growth has continued exponentially. Service-provider companies that make «gateways» to the Internet available to home and business users enter the market in ever-increasing numbers. By early 1995, access was available in 180 countries and more than 30 million users used the Internet. The Internet and its technology continue to have a profound effect in promoting the exchange of information, making possible rapid transactions among businesses, and supporting global collaboration among individuals and organisations. More than 100 million computers are connected via the global Internet in 2000, and even more are attached to enterprise internets. The development of the World Wide Web leads to the rapid introduction of new business tools and activities that may lead to annual business transactions on the Internet worth hundreds of billions of dollars.



## 18. Agricultural Machinery

Agricultural machines are used to till soil and to plant, cultivate, and harvest crops. Since ancient times, when cultures first began cultivating plants, people have used tools to help them grow and harvest crops. They used pointed tools to dig and keep soil loosened, and sharp, knife-like objects to harvest ripened crops. Modifications of these early implements led to the development of small hand tools that are still used in gardening, such as the spade, hoe, rake and trowel, and larger implements, such as ploughs and larger rakes that are drawn by humans, animals, or simple machines.

Modern machinery is used extensively in Western Europe, Australia, the United States, the Russian Federation and Canada.

Modern large agricultural implements, adapted to large-scale farming methods, are usually powered by diesel- or petrol-fuelled internal-combustion engines. The most important implement of modern agriculture is the tractor. It provides locomotion for many other implements and can furnish power, via its power shaft, for the operation of machines drawn behind the tractor. The power shafts of tractors can also be set up to drive belts that operate equipment such as feed grinders, pumps, and electric-power generators. Small implements, such as portable irrigators, may be powered by individual motors.

### Implements for Growing Crops

Many types of implements have been developed for the activities involved in growing crops. These activities in-

clude breaking ground, planting, weeding, fertilizing, and combating pests.

Ground is broken by ploughs to prepare the seed-bed. A plough consists of a blade-like ploughshare that cuts under, then lifts, turns, and pulverizes the soil. Modern tractor ploughs are usually equipped with two or more ploughshares so that a wide area of ground can be broken at a single sweep. Harrows are used to smooth the ploughed land and sometimes to cover seeds and fertilizer with earth. The disc harrow, which has curved, sharp-edged steel discs, is used mainly to cut up crop residues before ploughing and to bury weeds during seed-bed preparation. Rollers with V-shaped wheels break up clods of soil to improve the aeration of the soil and its capacity for taking in water.

Some cereal crops are still planted by broadcasting seeds—that is, by scattering the seeds over a wide area. Machines for broadcasting usually consist of a long seed-box mounted on wheels and equipped with an agitator to distribute the seeds. Broadcast seeds are not always covered by a uniform or sufficient depth of soil, so seeding is more often done with drills, which produce continuous furrows of uniform depth. Specialized implements called planters are necessary for sowing crops that are planted in rows, such as maize. Maize planters and other similar machines have a special feed wheel that picks up small quantities of grain or separate kernels and places them in the ground.

Fertilizer can be distributed during the winter or shortly before seeding time. Commercial fertilizers are commonly distributed, along with seeds, by drills and planters. Manure is distributed most efficiently by a manure spreader, which is a wagon equipped with a bottom conveyor to carry the fertilizer back to a beater at-





tachment, which disintegrates it and then scatters it on the ground.

After crops have begun to grow, a cultivator is used to destroy weeds and loosen and aerate the soil. A flame weeder, which produces a hot-air blast, can be used to destroy weeds growing around crops, such as cotton, that have stems of tough bark. The weeds are vulnerable to the hot air, but the tough stems protect the crops from damage. Chemical herbicides applied in the form of a spray or as granules are used extensively for weed control.

Insecticides for pest control are applied to soil and crops in the form of granules, dust, or liquid sprays. A variety of mechanical spraying and dusting equipment is used to spread chemicals on crops and fields; the machinery may be self-powered, or drawn and powered by a tractor. In areas where large crops of vegetables and grain are grown, aircraft are sometimes used to dust or spray pesticides.

Chemical pesticides are used in nearly all farming operations undertaken in developed countries. However, increasing concern over the harmful effects that pesticides may have on the environment has led to the use of alternative forms of pest control. For example, farmers use crop rotation to prevent pests that feed on a certain crop. Also, certain pests are controlled by introducing an organism that damages or kills the pests, but leaves the crops unharmed. Finally, some crops are being genetically engineered to be more resistant to pests.

### Implements for Harvesting Crops

Most cereal crops are harvested by using a combine—a machine that removes the fruiting heads, beats off the grain kernels, and cleans the grain as the combine moves

through the fields. The cleaned grain is accumulated in an attached grain tank.

Wheat and other cereal crops are harvested by a combine which, as it moves along the rows, picks the ears from the stalks and husks them. The ears are then transferred either to a sheller, which removes the kernels from the ear, or to a vehicle trailing behind the machine.

Hay harvesting usually requires several steps. First, the hay is cut close to the ground with a mower. After drying in the sun, most hay is baled. In baling, the pick-up baler lifts the hay to a conveyor that carries it to a baling chamber, which compresses the hay into bales weighing up to 57 kg or more and ties each bale with heavy twine or wire. A machine called a field chopper cuts down green hay or field-cured hay for use as animal feed. After being cut down, the hay is stored in a silo and allowed to ferment; this type of animal feed is nutritious and resistant to spoilage.

Specialized machinery is also used to harvest large root crops such as potatoes and sugar beet and to harvest fruits and vegetables. Some mechanical fruit-pickers that are used to harvest tree fruits, such as plums, cherries, and apricots shake the fruit tree, causing the fruit to fall on to a raised catching frame that surrounds the tree. Nut crops can also be harvested in this manner.

Use of agricultural machinery substantially reduces the amount of human labour needed for growing crops. The average amount of labour required per hectare to produce and harvest corn, hay, and cereal crops has fallen to less than a quarter of what was required only a few decades ago.

# APPENDIX A
## BASIC NUMERACY SKILLS TEST

Write in words and solve:

1. a. $-3 + 4 =$ b. $-5 : 2 =$
   c. $0{,}05 \times 1{,}5 =$ d. $3/8 \times 5 =$
   e. $78 : 0{,}23 \times -5 = 10$; $x = ?$
   f. $X^2 \times X^4 =$
2. Convert 5/12 to a decimal.
3. Express 0,28 as a fraction.
4. What is 67.469 to 3 significant figures?
5. Find 16% of 8.
6. Find 18 as a percentage of 64.
7. The price of an item including the dealer's 20% mark-up is $36. What did it cost before the mark-up?
8. If it costs $6 to drive *k* miles, then what is the cost of driving 4 miles?
9. Items priced at *m* pence per dozen are repacked in boxes of 100. What will the cost of such a box be, in pounds?
10. There are *f* female workers and *m* male workers in a factory. Write down an algebraic expression to show that the total work-force must be less than 150.
11. Where does the graph of $s = 3t + 5$ cross the t-axis?

*Vocabulary:*

(x) — multiply, times
(:) — divide, divided by
(+) — add, sum up, plus,
(−) — subtract, minus,
(=) — equals, is equal, makes,
$2^2$ — two in the second power.

# APPENDIX B

This supplement shows the quantitative relationship between several important **British/American** (Brit./U.S.) units of measure and the relevant units of the **metric system** of measurement. The units dealt with here come under the headings of

1. Linear Measures
2. Square Measures
3. Cubic Measures
4. Weights
5. Power and Work
6. Speeds
7. Temperatures

The British units of measure are also used in the U.S.A. unless exceptions are expressly stated in brackets.

The conversion tables included in this supplement are drawn up for practical use and related to British units of measure.

Abbreviations of the terms are given in brackets () behind the expression when it appears in the text for the first time.

## 1. Linear Measures British

1 statute mile (mi.) = 1,760 yards
1 yard (yd) = 3 feet
1 foot (ft) = 12 inches
1 inch (in.) = 1,000 mils

*Metric:*

1 kilometre (km) =1,000 metres
1 metre (m) = 100 centimetres
1 centimetre (cm) = 10 millimetres (mm)





*Metric equivalents of British linear measures*

1 mile = 1.609347 km
1 yard = 0.9144m = 91.44 cm = 914.4mm
1 foot = 0.3048 m = 30.48 cm = 304.8mm
1 inch = 0.0254 m = 2.54 cm = 25.4 mm

*Note*: The decimal point placed after the unit and denoting tenths, hundreds etc. is in the Russian way of writing replaced by a comma.

*British equivalents of metric linear measures*

1 km = 0.621370 mi.
1 m = 3.281 ft = 39.4 in.
1 cm = 0.033 ft = 0.394 in.
1 mm = 0.0394 in.

***Conversion Table.*** **Conversion of inches expressed in decimal fractions into millimetres and vice versa**

| IN. | MM | IN. | MM | IN. | MM | IN. | MM |
|---|---|---|---|---|---|---|---|
| 0.01 | 0.25 | 4.0 | 101.60 | 0.01 | 0.0004 | 4.0 | 0.1575 |
| 0.05 | 1.27 | 5.0 | 127.00 | 0.05 | 0.0020 | 5.0 | 0.1968 |
| 0.1 | 2.54 | 6.0 | 152.40 | 0.1 | 0.0039 | 6.0 | 0.2362 |
| 0.5 | 12.70 | 7.0 | 177.80 | 0.5 | 0.0197 | 7.0 | 0.2756 |
| 1.0 | 25.40 | 8.0 | 203.20 | 1.0 | 0.0394 | 8.0 | 0.3150 |
| 2.0 | 50.80 | 9.0 | 228.60 | 2.0 | 0.0787 | 9.0 | 0.3543 |
| 3.0 | 76.20 | 10.0 | 254.00 | 3.0 | 0.1181 | 10.0 | 0.3937 |

Example: 4.687 in. = ?

SOLUTION

4.0 in. = 101.6000 mm
0.6 in. = 15.2400 mm
0.08 in. = 2.0320 mm
0.007 in. = 0.1778 mm
4.687in. = 1.19.0498mm

***Conversion Table.*** **Conversion of inches expressed in proper fractions into millimetres**

| IN. | MM | IN. | MM | IN. | MM | IN. | MM |
|---|---|---|---|---|---|---|---|
| 1 | 25.4 | 1/32 | 0.794 | 1/64 | 0.397 | 33/64 | 13.097 |
| 1/2 | 12.7 | 3/32 | 2.381 | 3/64 | 1.191 | 35/64 | 13.891 |
| 1/3 | 8.47 | 5/32 | 3.969 | 5/64 | 1.984 | 37/64 | 14.684 |
| 1/8 | 3.175 | 7/32 | 5.556 | 7/64 | 2.778 | 39/64 | 15,478 |
| 3/8 | 9.525 | 9/32 | 7.144 | 9/64 | 3.572 | 41/64 | 16.272 |
| 5/8 | 15.875 | 11/32 | 8.731 | 11/64 | 4.366 | 43/64 | 17.066 |
| 7/8 | 22.225 | 13/32 | 10.319 | 13/64 | 5.159 | 45/64 | 17.857 |
| 1/16 | 1.588 | 15/32 | 11.906 | 15/64 | 5.953 | 47/64 | 18.653 |
| 3/16 | 4.762 | 17/32 | 13.494 | 17/64 | 6.747 | 49/64 | 19.447 |
| 5/16 | 7.938 | 19/32 | 15.081 | 19/64 | 7.541 | 51/64 | 20,241 |
| 7/16 | 11.112 | 21/32 | 16.669 | 21/64 | 8.334 | 53/64 | 21.034 |
| 9/16 | 14.288 | 23/32 | 18.256 | 23/64 | 9.128 | 55/64 | 21.828 |
| 11/16 | 17.463 | 25/32 | 19.844 | 25/64 | 9.922 | 57/64 | 22.622 |
| 13/16 | 20.638 | 27/32 | 21.431 | 27/64 | 10.716 | 59/64 | 23.416 |
| 15/16 | 23.812 | 29/32 | 32.019 | 29/64 | 11.509 | 61/64 | 24.209 |
| | | 31/32 | 24.606 | 31/64 | 12.303 | 63/64 | 25.003 |

Example: 3 11/16 in. = ? mm

SOLUTION: 3 in. = 76.200 mm
11/16 in. = 17.463 mm
3 11/16 in. = 93.663 mm





***Conversion Table.*** **Conversion of feet into metres and vice versa**

| FT | M | FT | M | M | FT | M | FT |
|---|---|---|---|---|---|---|---|
| 0.01 | 0.003 | 4.0 | 1.219 | 0.01 | 0.033 | 4.0 | 13.123 |
| 0.05 | 0.015 | 5.0 | 1.524 | 0.05 | 0.164 | 5.0 | 16.404 |
| 0.1 | 0.030 | 6.0 | 1.829 | 0.1 | 0.328 | 6.0 | 19.685 |
| 0.5 | 0.152 | 7.0 | 2.134 | 0.5 | 1.640 | 7.0 | 22.966 |
| 1.0 | 0.305 | 8.0 | 2.438 | 1.0 | 3.281 | 8.0 | 26.247 |
| 2.0 | 0.610 | 9.0 | 2.743 | 2.0 | 6.561 | 9.0 | 29.528 |
| 3.0 | 0.914 | 10.0 | 3.048 | 3.0 | 9.842 | 10.0 | 32.808 |

## 2. Square measures

*British:*

1 square mile (sq. mile) = 640 acres
1 acre = 10 square chains
1 square chain = 16 square rods
1 square rod (sq.rd) = 30.25 square yards
1 square yard = 9 square feet
1 square feet = 144 square inches

*Metric:*

1 square kilometre ($km^2$) = 1,000,000 square metres ($m^2$)
1 square metre = 10,000 square centimetres ($cm^2$)
I square centimetre = 100 square millimetres ($mm^2$)

*Metric equivalents of British square measures*

1 sq. mile = 2.5899 km
1 acre = 4047.0 $m^2$
1sq. yard = 0.836 $m^2$
1 sq. foot = 0.0929 $m^2$ = 929 $cm^2$

1 sq. in. = 6.452 $cm^2$ = 645.2 $mm^2$

*British equivalents of metric square measures*

1 $km^2$ = 0.3861 sq. mile

1 $m^2$ = 10.764 sq. feet

1$cm^2$ = 0.155 sq. in.

1 $mm^2$ = 0.00155 sq. in.

***Conversion Table.*** **Conversion of sq. ft into $m^2$ and vice versa**

| sq. ft | $m^2$ | sq. ft | $m^2$ | $m^2$ | sq. ft | $m^2$ | sq. ft |
|---|---|---|---|---|---|---|---|
| 0.1 | 0.009 | 6.0 | 0.557 | 0.01 | 0.11 | 6.0 | 64.58 |
| 0.5 | 0.046 | 7.0 | 0.650 | 0.05 | 0.54 | 7.0 | 75.35 |
| 1.0 | 0.093 | 8.0 | 0.743 | 0.1 | 1.08 | 8.0 | 86.11 |
| 2.0 | 0.186 | 9.0 | 0.836 | 0.5 | 5.38 | 9.0 | 96.87 |
| 3.0 | 0.279 | 10.0 | 0.929 | 1.0 | 10.76 | 10.0 | 107.64 |
| 4.0 | 0.372 | 100.0 | 9.290 | 2.0 | 21.53 | 100.0 | 1,076.39 |
| 5.0 | 0.465 | 1,000.0 | 92.903 | 3.0 | 32.29 | 500.0 | 5,381.94 |
| | | | | 4.0 | 43.06 | 1,000.0 | 10,763.87 |
| | | | | 5.0 | 53,82 | | |

***Conversion Table.*** **Conversion of sq. in. into $cm^2$ and vice versa**

| sq. in. | $cm^2$ | sq. in. | $cm^2$ | $cm^2$ | sq. in. | $cm^2$ | sq. in. |
|---|---|---|---|---|---|---|---|
| 0.01 | 0.06 | 5.0 | 32.26 | 0.01 | 0.002 | 5.0 | 0.775 |
| 0.05 | 0.32 | 6.0 | 38.71 | 0.05 | 0.008 | 6.0 | 0.930 |
| 0.1 | 0.65 | 7.0 | 45.16 | 0.1 | 0.016 | 7.0 | 1.085 |
| 0.5 | 3.23 | 8.0 | 51.61 | 0.5 | 0.078 | 8.0 | 1.240 |
| 1.0 | 6.45 | 9.0 | 58.06 | 1.0 | 0.155 | 9.0 | 1.395 |
| 2.0 | 12.90 | 10.0 | 64.52 | 2.0 | 0.310 | 10.0 | 1.550 |
| 3.0 | 19.35 | 100.0 | 645.16 | 3.0 | 0.465 | 100.0 | 15.550 |
| 4.0 | 25.81 | 1,000.0 | 6,451.63 | 4.0 | 0.620 | 1,000.0 | 155.000 |





## 3. Cubic Measures

*British:*

1 cubic yard (cu. yd) = 27 cubic feet

1 ciibic foot (cu. ft) = 1,728 cubic inches (cu. in.)

1 gallon (gal.) = 4 quarts

1 quart (qt.) = 2 pints (pt.)

1 pint = 16 fluid ounces (U. S.) = 20 fluid ounces (Brit.)

*Metric:*

1 cubic metre ($m^3$) = 1,000,000 cubic centimetres ($cm^3$)

1 cubic centimetre = 1,000 cubic millimetres ($mm^3$)

1 hectolitre (hi) = 100 litres (1) = 100,000 cubic centimetres

1 litre = 1,000 cubic centimetres

| Metric equivalents of British cubic measures | British equivalents of metric cubic measures | | |
|---|---|---|---|
| 1 cu. yd | = 0.76453 $m^3$ | 1 $m^3$ | = 1.308 cu. yd |
| 1 cu ft | = 0.02832 $m^3$ | 1 $m^2$ | = 34.314 cu. ft |
| 1 cu. ft | = 28.317 1 | 1 l | = 0.0353 cu. ft |
| 1 cu. in. | = 16.38716 $cm^3$ | 1 1 | = 0.2200 gal. (Brit.) |
| 1 gal.(Brit.) | = 4.546 1 | 1 1 | = 0.2642 gal. (U. S.) |
| 1 gal. (U. S.) | = 3.785 1 | 1 1 | = 1.7598 pt. (Brit.), liquid |
| 1 qt. (Brit.), liquid | = 1.1365 1 | 1 1 | = 2.1134 pt. (U. S.), liquid |
| 1 qt. (U. S.), liquid | = 0.9463 1 | 1 $cm^3$ | = 61.0 cu. in. |
| 1 pt. (Brit.), liquid | = 0.5682 1 | 1 $mm^3$ | = 0.061 cu. in. |
| 1 pt, (U. S.), liquid | = 0.4731 1 | | |

**Conversion Table. Conversion of. cu. ft into $m^3$ and vice versa**

| cu. ft | $m^3$ | cu. ft | $m^3$ | $m^3$ | cu. ft | $m^3$ | cu.ft |
|---|---|---|---|---|---|---|---|
| 0.1 | 0.003 | 6.0 | 0.170 | 0.1 | 3.53 | 6.0 | 211.89 |
| 0.5 | 0.014 | 7.0 | 0.198 | 0.5 | 17.66 | 7.0 | 247.20 |
| 1.0 | 0.028 | 8.0 | 0.227 | 1.0 | 35.31 | 8.0 | 282.52 |
| 2.0 | 0.057 | 9.0 | 0.255 | 2.0 | 70.63 | 9.0 | 317.83 |
| 3.0 | 0.085 | 10.0 | 0.283 | 3.0 | 105.94 | 10.0 | 353.14 |
| 4.0 | 0,113 | 100.0 | 2.832 | 4.0 | 141.26 | 100.0 | 3,531.44 |
| 5.0 | 0.142 | 1,000.0 | 28.317 | 5.0 | 176.57 | 1,000.0 | 35,314.45 |

**Conversion Table. Conversion of cu. ft into L and vice versa**

| cu. ft | l | cu.ft | l | l | cu.ft | l | cu.ft |
|---|---|---|---|---|---|---|---|
| 0.01 | 0.28 | 5.0 | 141.58 | 0.1 | 0.004 | 7.0 | 0,247 |
| 0.05 | 1.42 | 6.0 | 169.90 | 0.5 | 0.018 | 8.0 | 0.283 |
| 0.1 | 2.83 | 7.0 | 198.21 | 1.0 | 0.035 | 9.0 | 0,318 |
| 0.5 | 14.16 | 8.0 | 226.53 | 2.0 | 0.071 | 10.0 | 0.353 |
| 1.0 | 28.32 | 9.0 | 254.85 | 3.0 | 0.106 | 100.0 | 3.532 |
| 2.0 | 56.63 | 10.0 | 283.16 | 4.0 | 0.141 | 1,000.0 | 35,315 |
| 3.0 | 84.95 | 100.0 | 2,831.62 | 5.0 | 0.177 | 10,000.0 | 353.154 |
| 4.0 | 113.26 | 1,000.0 | 28,316.22 | 6.0 | 0.212 | | |





**Conversion Table. Conversion of cu. in. into $cm^3$ and vice versa**

| cu. in | $cm^3$ | cu. in | $cm^3$ | $cm^3$ | cu. in | $cm^3$ | cu. in |
|---|---|---|---|---|---|---|---|
| 0.01 | 0.16 | 5.0 | 81.94 | 0.1 | 0.006 | 7.0 | 0.427 |
| 0.05 | 0.82 | 6.0 | 98.32 | 0.5 | 0.031 | 8.0 | 0.488 |
| 0.1 | 1.64 | 7.0 | 114.71 | 1.0 | 0.061 | 9.0 | 0.549 |
| 0.5 | 8.19 | 8.0 | 131.10 | 2.0 | 0.122 | 10.0 | 0.610 |
| 1.0 | 16.39 | 9.0 | 147.48 | 3.0 | 0.183 | 100.0 | 6.102 |
| 2.0 | 32.77 | 10.0 | 163.87 | 4.0 | 0.244 | 1,000.0 | 61.023 |
| 3.0 | 49.16 | 100.0 | 1,638.72 | 5.0 | 0.305 | 10,000.0 | 610.234 |
| 4.0 | 65.55 | 1,000.0 | 16,387.16 | 6.0 | 0.366 | | |

## 4. Weights (Avoirdupois)

*British:*

1 long ton (tn. l.) = 2,240 pounds = 20 hundredweight
1 short ton (tn. sh.) = 2,000 pounds
1 hundredweight (cwt.) = 112 pounds
1 pound (lb.) = 16 ounces (oz.)
1 ounce = 437.5 grains Troy

*Metric:*

1 metric ton (t) = 10 decitons (dt)
1 deciton = 100 kilograms (kg)
1 kilogram = 1000 grams (g)

| Metric equivalent of British weights | British equivalent of metric weights |
|---|---|
| 1 tn. long. = 1.016 t = = 1,016.064 kg | 1t = 0.9842 tn. 1. |
| 1 tn. short. = 0.9072 t = = 907.2 kg | 1 dt = 0.09842 tn. 1. |
| 1 cwt. (long) = 50.8023 kg | 1 kg= 2.2046 lb. = 35.274 oz. |
| 1 lb. = 0.4536 kg | 1 g = 0.03527 oz. = 15.432 grains |
| 1 oz. = 28.35 g | |
| 1 grain = 0.0648 g | |

***Conversion Table.*** **Conversion of lb. into kg and vice versa**

| lb. | kg | lb. | kg | kg | lb. | kg | lb. |
|---|---|---|---|---|---|---|---|
| 0.1 | 0.05 | 7.0 | 3.18 | 0.1 | 0.22 | 7.0 | 15.43 |
| 0.5 | 0.23 | 8.0 | 3.63 | 0.5 | 1.10 | 8.0 | 17.64 |
| 1.0 | 0.45 | 9.0 | 4.08 | 1.0 | 2.20 | 9.0 | 19.84 |
| 2.0 | 0.91 | 10.0 | 4.54 | 2.0 | 4.41 | 10.0 | 22.05 |
| 3.0 | 1.36 | 100.0 | 45.36 | 3.0 | 6.61 | 100.0 | 220.46 |
| 4.0 | 1.81 | 1,000.0 | 435.59 | 4.0 | 8.82 | 1,000.0 | 2,204.62 |
| 5.0 | 2.27 | 10,000.0 | 4,535.92 | 5.0 | 11.02 | 10,000.0 | 22,04.6.22 |
| 6.0 | 2.72 | | | 6.0 | 13.23 | | |

***Conversion Table.*** **Conversion of oz. into g and vice versa**

| oz. | g | oz. | g | g | oz. | g | oz. |
|---|---|---|---|---|---|---|---|
| 0.01 | 0.28 | 5.0 | 141.75 | 0.02 | 0,001 | 5.0 | 0.176 |
| 0.05 | 1.42 | 6.0 | 170.10 | 0.05 | 0,002 | 6.0 | 0.212 |
| 0.1 | 2.84 | 7.0 | 198.45 | 0.1 | 0.004 | 7.0 | 0.247 |
| 0.5 | 14.17 | 8.0 | 226.80 | 0.5 | 0.018 | 8.0 | 0.282 |
| 1.0 | 28.35 | 9.0 | 255.15 | 1.0 | 0.035 | 9.0 | 0.317 |
| 2.0 | 56.70 | 10.0 | 283.50 | 2.0 | 0.071 | 10.0 | 0.353 |
| 3.0 | 85.05 | 100.0 | 2,834.95 | 3.0 | 0.106 | 100.0 | 3.527 |
| 4.0 | 113.40 | | | 4.0 | 0.141 | | |





## 5. Power and work

*Brilish:*

1 horsepower (h. p.) = 33,000 foot-pounds per minute (ft-lb./min) = 550 foot-pounds per second (ft-lb./sec)

1 British Thermal Unit (B. Th. U.) = 778 foot-pounds (ft-lb.)

1 horsepower-hour (h. p.-hr.) = 1,980,000 foot-pounds = 2,545 B.Th.

*Metric:*

1 metric horsepower (PS) = 75 kilogram-metres/second = 75 kgm/s

1 kilowatt (kW) = 1000 watts (W) = 102 kgm/s

1 kilowatt-hour (kWh) = 3,600,000 watt-seconds (W/s)

*Relationship between various units:*

1 h. p. = 746 W = 0.746 kW = 1.014 PS

1 h. p. = 76.065 kgm/s lh.p.nr. = 0.746 kVh

1 B.I Th.U. = 0.000292 kWh = 0.252 kcal

1 ft.lb. = 0.1383 kgm

1 kgm = 7.231 ft-lb.

1 kcal = 3.968 B.Th.U.

1 kW =1.34 h.p. = 44,220 ft-lb./min = 3,415 B. Th.U. per hour

1 W = 0.00134 h. p. = 44.22 ft-lb./min = 3.42 B. Th. U. per hour

## 6. Speeds

100 feet per minute (ft/min) = 30.5 metres per minute (m/min) = 0.508 metres per second (m/sec)

1 mile per hour (m. p. h.) = 1.609 km/h

The speed of shafts (e. g. of a motor) is expressed in terms of revolutions per minute (r. p. m.).

### 7. Temperatures

Temperatures are expressed in degrees of temperature scales. There are scales based on the following different units:

Celsius or Centigrade (C., °C)
Fahrenheit (F., °F)
Reaumur (R., °R)
Kelvin (K., °K)
Relationship: 100 °C = 212 °F = 80 °R = 373 °K

# APPENDIX C

## Предлоги, обозначающие движение

***to***

движение по направлению к предмету (лицу), протекающему процессу: *Come to me.* — Подойдите ко мне.

***from***

движение от предмета (лица), удаление от протекающего процесса:

*Take this book from the table.*— Убери книгу со стола.

*I come from Russia.* — Я из России.

***into***

движение внутрь ограниченного пространства:

*Put the book into the bag.* — Положи книгу в портфель.

***out of***

движение из ограниченного пространства:

*Take the book out of the table.* — Достань книгу из стола.

***on(to) /onto***

движение на поверхность:

*Snow fell onto the ground.* — Снег падал на землю.

***through*** через, сквозь:

*He went in through the door.* — Он вошел через дверь.

## Предлоги, обозначающие место

***at***

местонахождение у предмета (лица), а также там, где протекает определенный процесс:

*I am sitting at the table.* — *Я* сижу у стола.

*I study at school.* — Я учусь в школе.

*The pupils are at the lesson.* —Ученики на уроке.

***in***

местонахождение внутри ограниченного пространства:

*He is in the office.* — Он в офисе.

*The books are in the bag.* — Книги в портфеле.

***on***

местонахождение на поверхности:

*The book is on the desk.* — Книга на столе.

***under***

местонахождение под другим предметом:

*The book is under the table.* — Книга под столом.

***across*** через:

*My school is across the street.* — Моя школа находится через дорогу.

***above***

Местонахождение над другим предметом:

*There is a lamp above the table.* — Над столом висит лампа.

***between*** между:

*Between us.* — Между нами.

***in front of***

местонахождение предмета (лица) впереди другого предмета (лица)





*There is a telephone in front of him.* — Перед ним стоит телефон.

***behind*** местонахождение предмета (лица) позади другого предмета (лица),

*There is a sport ground behind our school.* — За нашей школой спортплощадка.

***around***

местонахождение одного предмета вокруг другого предмета: *We are sitting around the table.* — Мы сидим вокруг стола.

***beyond*** по ту сторону:

*Beyond the limits of the city.* — За пределами города.

***over*** над, через, сверх:

*There is a bridge over the river.* — Над рекой мост.

***near***

вблизи, около, рядом с, возле, за:

*She is sitting near the table.* — Она сидит за столом.

***up*** вверх:

*Up the river.* — Вверх по реке.

***down*** вниз:

*Down the river.* — Вниз по реке.

## Предлоги времени

***in***

внутри временного отрезка: *In April, in 1999.* — В апреле, в 1999 году.

***in***

через некоторое время: *in an hour, in two days* — через час, через два дня

*at* в (точка во времени):
*at 5 o'clock, at midnight* — в 5 часов, в полночь

*on*
в (с названием дней недели, датами):
*on Monday, on the 10th of February*- в понедельник, 10 февраля

*by*
к определенному моменту: *by 8 o'clock tomorrow* — к 8 часам завтра

*from... till / from... to...* от... до:
*from 5 till 6 o'clock / from 5 to 6 o' clock* — с 5-ти до 6-ти

*for*
в течение (отрезок времени):
*for an hour* — в течение часа

*during*
вовремя (чего-либо):
*during the lesson*— во время урока

*after* после (чего-либо):
*after work* — после работы

*before*
перед (чем-либо): *before the lesson*- перед уроком

*within*
внутри, в рамках: *within a month* — в течение месяца

### Прочие предлоги

*by*
при, около, посредством:
*by the window, by plane* — около окна, самолетом





*with* вместе с:
*with a friend* — с другом

*for* для:
*I'll do it for you.* — Я сделаю это для тебя.

### Наиболее употребительные наречия.

**Наречия места и направления:**

**here** — здесь, тут
**there** — там
**somewhere** — где-то, где-нибудь
**anywhere** — везде, повсюду, где-нибудь
**nowhere** — нигде
**inside** — внутри
**outside** — снаружи
**down** — внизу
**back** — сзади, назад
**away** — вдали, вон, прочь
**downward** — вниз
**upward** — вверх

**Наречия времени:**

**now** — сейчас, теперь
**before** — до, перед, прежде
**ever** — когда-либо
**never** — никогда
**always** — всегда
**often** — часто
**usually** — обычно
**seldom** — редко
**still** — все-еще
**already** — уже
**just** — только-что, только
**yet** — еще, уже
**sometimes** — иногда

**today** — сегодня
**tomorrow** — завтра
**yesterday** — вчера
**recently** — недавно
**lately** — в последнее время
**commonly** — обычно

**Наречия образа действия:**

**slowly** — медленно
**quickly** — быстро
**easily** — легко
**calmly** — спокойно
**brightly** — ярко
**hardly** — с трудом, едва

**Наречия меры и степени:**

**much** — много, сильно
**little** — немного, мало
**enough** — достаточно
**too** — слишком
**almost** — уже, почти
**very** — очень

## Наиболее употребительные суффиксы и префиксы существительных

**-er/or** — teacher, writer, actor, doctor
**-ist** — scientist, artist
**-ment** — movement, development, government
**-ess** — fortress, hostess, actress
**-ian** — musician, technician, politician
**-ance** — distance, importance, appearance
**-(t)ion** — revolution, translation, operation
**-ity/-ty** — popularity; honesty, morality, ability
**-hood** — childhood, neighbourhood
**-y** — energy, assembly





**-ship** — friendship, leadership
**-age** — passage, marriage
**-ism** — heroism, socialism, capitalism
**-ant** — assistant, cousultant
**-ence** — conference, silence, difference
**-ure** — culture, picture, agriculture
**-ing** — building, reading, meeting
**-dom** — freedom, kingdom, wisdom
**-sion/ssion** — revision, session, discussion,
**-ness** — happiness, illness, darkness
**(-s)ure** — pleasure, treasure, measure

### II. Префиксы существительных

**re** — reconstruction,
**co** — cooperation, coexistence
**dis** — disadvantage, discomfort, distaste
**in** — inaccuracy, independance
**mis** — misunderstanding, misprinting, misinformation
**im** — impossibility, impatience
**un** — unemployment, unconcern, unreality
**il** — illegality, illiteracy.

## Наиболее употребительные суффиксы и префиксы глаголов

### I. Суффиксы

**en** — deepen, lighten, strengthen;
**fy** — classify, electrify, specify
**ize** — organize, characterize, mechanize
**ate** — indicate, activate, translate
**co** — cooperate, coexist, collaborate
**de** — decode, decompose, demobilize
**dis** — disbelieve, disapprove, disapear
**in** — input, inlay, incut, indraw

**im** — immigrate, impart, implant;
**inter** — interact, interchange, interdepend
**ir** — irradiate, irrigate, irritate
**over** — overcome, overheat, overhear, overlook
**re** — readjust, rebuild, reconstruct,rewrite
**mis** — misprint, misunderstand, miscount.

### Наиболее употребительные суффиксы и префиксы прилагательных

**-ful** — careful, beautiful, useful, powerful
**-ant** — distant, important, resistant
**-ous** — famous, dangerous, various
**-ed** — talented, developed, interested
**-ing** — interesting, disappointing
**-al** — natural, cultural, territorial
**-ent** — dependent, transparent, different
**-ish** — Spanish, British, boyish, Irish
**-ible** — possible, terrible, visible, convertible
**-able** — comfortable, miserable
**-ic** — atomic, historic, poetic, heroic
**-y** — rainy, busy, sunny, windy, dirty
**-less** — hopeless, lifeless, useless, homeless
**-ary** — ordinary, revolutionary, necessary
**-ive** — inventive, effective, impressive, detective
**-ian** — Russian, Canadian, Rumanian

### II. Префиксы

**un** — unhappy, unable, uncomfortable
**in** — independent, indirect, invisible
**dis** — disappointing, discouraging, disconnectng
**im** — impossible, imperfect, immoral, immaterial
**non** — non-ferrous, non-governmental
**ir** — irregular, irresponsible, irrational





**post** — post-war, post-operational
**inter** — interdependent, interchangeable, international
**il** — illegal, illiberal, illimitable.

### Таблица неправильных глаголов

| 1 форма | 2 форма | 3 форма | 4 форма | Перевод |
|---|---|---|---|---|
| to be | was/were | been | being | быть, находиться |
| to bear | bore | born | bearing | нести |
| to beat | beat | beaten | beating | бить |
| to begin | began | begun | beginning | начинать(ся) |
| to bend | bent | bent | bending | гнуть |
| to bind | bound | bound | binding | переплетать |
| to bite | bit | bitten/bit | biting | кусать |
| to blow | blew | blown | blowing | дуть |
| to break | broke | broken | breaking | ломать |
| to bring | brought | brought | bringing | приносить |
| to build | built | built | building | строить |
| to burst | burst | burst | bursting | гореть, жечь |
| to buy | bought | bought | buying | покупать |
| to catch | caught | caught | catching | ловить |
| to choose | chose | chosen | choosing | выбирать |
| to cut | cut | cut | cutting | резать, рубить |
| to dive | dived/dove | dived | diving | нырять |
| to do | did | done | doing | делать |
| to draw | drew | drawn | drawing | рисовать, тащить |
| to drink | drank | drunk | drinking | пить |
| to drive | drove | driven | driving | вести |
| to eat | ate | eaten | eating | есть, кушать |
| to fall | fell | fallen | falling | падать |
| to feel | felt | felt | feeling | чувствовать |
| to feed | fed | fed | feeding | кормить |
| to fight | fought | fought | fighting | бороться, драться |

| 1 форма | 2 форма | 3 форма | 4 форма | Перевод |
|---|---|---|---|---|
| to fly | flew | flown | flying | летать |
| to forbid | forbade | forbidden | forbidding | запрещать |
| to forget | forgot | forgotten | forgetting | забывать |
| to forgive | forgave | forgiven | forgiving | прощать |
| to freeze | froze | frozen | freezing | замораживать |
| to get | got | got | getting | получать, становиться |
| to give | gave | given | giving | давать |
| to go | went | gone | going | идти, ехать |
| to grow | grew | grown | growing | расти, выращивать |
| to hang | hung | hung | hanging | висеть, вешать |
| to have | had | had | having | иметь |
| to hear | heard | heard | hearing | слышать |
| to hit | hit | hit | hitting | ударять |
| to hold | held | held | holding | держать |
| to hurt | hurt | hurt | hurting | повредить |
| to know | knew | known | knowing | знать |
| to lay | laid | laid | laying | накрывать |
| to lead | lead | lead | leading | вести |
| to leap | leapt/leaped | leapt/leaped | leaping | прыгать, скакать |
| to leave | left | left | leaving | покидать, оставлять |
| to lend | lent | lent | lending | давать взаймы |
| to let | let | let | letting | позволять |
| to lie | lay | lain | lying | лежать |
| to light | lit | lit | lighting | зажигать |
| to lose | lost | lost | losing | терять |
| to make | made | made | making | делать |
| to meet | met | met | meeting | встречать (ся) |





| 1 форма | 2 форма | 3 форма | 4 форма | Перевод |
|---|---|---|---|---|
| to pay | paid | paid | paying | платить |
| to put | put | put | putting | класть, ставить |
| to read | read | read | reading | читать |
| to ride | rode | ridden | riding | ехать (верхом) |
| to ring | rang | rung | ringing | звонить, звенеть |
| to rise | rose | risen | rising | поднимать |
| to run | ran | run | running | бежать |
| to say | said | said | saying | говорить, сказать |
| to see | saw | seen | seeing | видеть |
| to sell | sold | sold | selling | продавать |
| to send | sent | sent | sending | посылать, отправлять |
| to shake | shook | shaken | shaking | трясти |
| to shine | shone | shone | shining | светить, сиять |
| to shoot | shot | shot | shooting | стрелять, снимать |
| to show | showed | shown | showing | показывать |
| to sing | sang | sung | singing | петь |
| to sink | sank | sunk | sinking | тонуть |
| to sit | sat | sat | sitting | сидеть |
| to sleep | slept | slept | sleeping | спать |
| to speak | spoke | spoken | speaking | говорить, разговаривать |
| to spend | spent | spent | spending | тратить, проводить время |
| to stand | stood | stood | standing | стоять |
| to steal | stole | stolen | stealing | воровать, украсть |
| to stick | stuck | stuck | sticking | приклеить |
| to strike | struck | struck | striking | бить, ударить |
| to swear | swore | sworn | swearing | клясться |

| 1 форма | 2 форма | 3 форма | 4 форма | Перевод |
|---|---|---|---|---|
| to sweep | swept | swept | sweeping | мести, подметать |
| to swim | swam | swum | swimming | плавать |
| to take | took | taken | taking | взять, брать |
| to teach | taught | taught | teaching | учить, обучать |
| to tear | tore | torn | tearing | рвать |
| to tell | told | told | telling | сказать, сообщать |
| to think | thought | thought | thinking | думать |
| to throw | threw | thrown | throwing | бросать, кидать |
| to wake | woke | woken | waking | будить, просыпаться |
| to wear | wore | wakened | wearing | носить |
| to weep | wept | wept | weeping | плакать |
| to win | won | won | winning | побеждать, выигрывать |
| to write | wrote | written | writing | писать |