МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ
РОССИЙСКОЙ ФЕДЕРАЦИИ

Индустриальный институт (филиал)
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(ИндИ (филиал) ФГБОУ ВО «ЮГУ»)

ПРАКТИЧЕСКОЕ ПОСОБИЕ

по учебной дисциплине

ИНОСТРАННЫЙ ЯЗЫК

для обучающихся 2 курса

специальность

21.02.01Разработка и эксплуатация нефтяных и газовых месторождений

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ОДОБРЕНА
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ПОЯСНИТЕЛЬНАЯ ЗАПИСКА

Практическое пособие предназначено для обучающихся 2 курса технических специальностей.

Цель настоящего пособия – формирование навыков работы с иноязычными текстами, навыков перевода, извлечения информации и её переработки на основе различных видов чтения, расширение активного и пассивного словарного запаса. Учебное пособие позволяет решать следующие *задачи* на занятии иностранного языка:

- ✓ совершенствование процесса качественного произношения слов;
- ✓ введение и закрепление лексики;
- ✓ работа над грамматикой;
- ✓ совершенствование навыков устной речи.

Специальная лексика вводится тематически, закрепляется в разнообразных упражнениях. Пособие состоит из 17 тем, которые включают в себя следующие задания:

- ✓ прочитать и перевести текст;
- ✓ дать ответы на вопросы к тексту;
- ✓ заполнить пропуски подходящей по смыслу лексикой;
- ✓ составить монологические и диалогические высказывания по предлагаемым для обсуждения темам с обязательным использованием лексики занятия.

В практическое пособие также включено приложение, содержащее информацию о знаменитых ученых.

Разработанные упражнения предназначены для организации адекватного понимания содержания текстов.

Задания, представленные в пособии, могут использоваться в качестве дополнительного материала как в ходе самостоятельной работы обучающихся над иностранным языком, так и на практических занятиях под руководством преподавателя.

СОДЕРЖАНИЕ

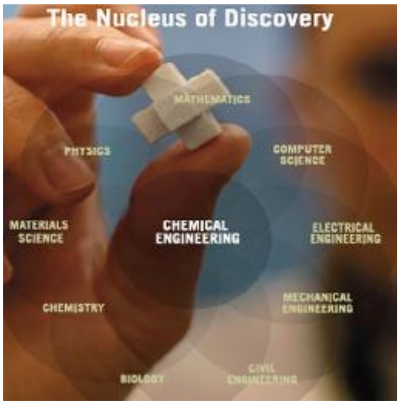
THEME 1. SCIENCE AND TECHNOLOGY

Topic vocabulary

a science, a scientist, scientific – наука, ученый, научный
to research, a researcher – исследовать, исследователь
to unify – объединять
to appear - поваляться
to attempt – пытаться
to prove – доказывать
to explain – объяснять
to contribute – вносить вклад
to refer - ссылаться
to measure – измерять
to satisfy – удовлетворять
to process data – обрабатывать данные
a complicated problem – сложная задача
closely interconnected – тесно взаимосвязанные
a tool – инструмент
a discovery, an invention – открытие, изобретение
a steam engine – паровой двигатель
nuclear, nuclear power – ядерный, ядерная энергия
digital, a digital computer – цифровой, цифровой компьютер
a quantity, a physical quantity – величина, физическая величина
liquid – жидкость, жидкий
annual - ежегодный
availabe - доступный
consequence - следствие
decade - десятилетие
influence – влияние; влиять
to occur - возникать
periphery - периферия
to simplify - облегчать
to tear (oneselt) away - оторвать(- ся)
virtual - виртуальный

Exercise 1. Read and translate the text.

SCIENCE



The word “science” coms from the Latin word “scientia”, which means “knowledge”. Science covers the board field of knowledge that deals with facts and the relationship among these facts.

Scientists study a wide variety of subjects. Some scientists search for clues to the origin of the universe and examine the structure of cells of living plants and animals. Other researchers investigate why we act the way we do, or try to solve complicated mathematical problems.

Scientists use systematic methods of study to make observations and collect facts. The develop theories that help them order and unify facts. Scientific theories consist of general principles or laws that attempt to explain how and why something happens or has happened. A theory is considered to become a part of scientific knowledge if it has been tested experimentally and proved to be true.

Scientific study can be divided into three major groups: the natural social and technical sciences. As scientific knowledge has grown and become more complicated, many new fields of science have appeared. At the same time, the boundaries between scientific fields have become less and less clear. Numerous areas of science overlap each other and it is often hard to tell where one science ends and another begins. All sciences are closely interconnected.

Science has great influence on our lives. It provides the basis of modern technology – the tools and machines that make our life and work easier. The discoveries and inventions of scientists also help to shape our view about ourselves and our place in the universe.

Two Kinds of Research: Basic and Applied

Research—the quest for information —was born when people first started asking questions and searching for answers. The inventors of the wheel were great researchers. Modern research, based on study and experimentation, got its true start in the 1500s with the work of Galileo.

In the natural sciences—such as biology, chemistry, and medicine — methods of research are very exact. Scientists have developed very accurate instruments such as electronic microscopes.

Basic research is aimed at discovering more about the laws of nature. As they push into the unknown, scholars doing basic research may have little idea of what lies ahead. They may be trying to find out why birds migrate or whether plants grow on Mars. Wishing only to add to the world's knowledge, they don't concern themselves with the practical applications of their findings.

Applied research is aimed at a practical goal. Researchers focus on discovering or inventing new and useful products or better ways of doing something. The first synthetic plastic, for example, was developed to find a substitute for ivory in the manufacture of billiard balls. This early plastic—called Celluloid—paved the way for development of today's enormous plastics industry.

Basic and applied researchers work hand in hand. Applied research is often built on ideas from basic research. In turn, basic researchers depend on applied research for the invention of instruments that make further investigations possible.

Exercise 2. Translate the following definitions of the words.

Science is the study of knowledge that can be made into system and which usually depends on seeing and testing facts and stating general natural terms.
Technology is a branch of knowledge dealing with scientific and industrial methods and their practical use in industry.
Research is a serious and detailed study of a subject that is aimed at learning new facts, scientific laws, testing ideas etc.

Exercise 3. Match each word with its correct definition.

to prove, to process, to unify, to explain, to appear

1. To combine parts of something to form a single whole.
2. To make clear or easy to understand, usually by speaking or writing.
3. To become able to be seen, to come into sight.
4. To show to be true by means of facts, documents, information etc.
5. To put information? Numbers etc. into a computer for examination.

Exercise 4. Write T or F to show whether each statement is *true* or *false*.

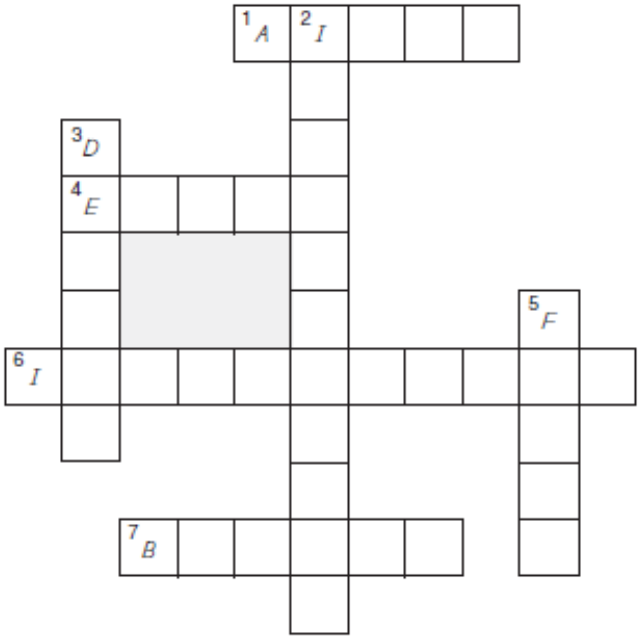
1. _____ Modern research got its start with the discovery of the wheel.
2. _____ Scientists involved in applied research are trying to solve specific problems.
3. _____ The words *knowledge* and *information* are synonyms.
4. _____ Basic researchers try to discover more about the laws of nature.

Exercise 5. Complete the crossword puzzle with words from the reading. Clue words are *synonyms* (words with a similar meaning) of the answer words.

SYNONYMS

ACROSS
1. targeted
4. precise
6. data
7. improved

DOWN
2. tools; devices
3. to rely
5. to concentrate



Exercise 6. Read and translate the text.

THE ROLE OF TECHNICAL PROGRESS

The scientific and technical revolution has changed our life very much. The computers, the mobile phones and other digital devices have entered our everyday life.

The atomic, space and energy age was followed by the age of computers. The tasks which had seemed eternal before have been solved one by one by computers. During the last decade many fundamental changes occurred because of electronic devices. It is even difficult to imagine the social and economic consequences of the microelectronic revolution.

The large use of computers has influenced our life in such a way that it was difficult to imagine 15 or 20 years ago. On the one hand, computers have simplified our life greatly. If you typed a text on the typewriter and made a mistake you had to type the whole page again. Making several copies of the same document used to be a difficult job too. But now it's quite different. Correcting mistakes is easy. Computer also helps us to buy goods, find information, book tickets, make presentations and annual reports, and make difficult calculations. Time is saved for leisure.

Leisure time is also influenced by computer and other periphery devices. You no longer go to the music shops - many things are available on the internet. You needn't write letters to your relatives or friends – you can send an e-mail. And your photo albums are on computer too.

Computer games are probably also a part of your free time. They became more and more realistic and complicated, and for many people it becomes impossible to tear themselves away. This means that electronic devices, such as computer and TV set are used mostly for entertainment and consume most of the time that could be spent on work, going for a walk and sleeping. Man becomes a slave of the devices which were designed to make him stronger.

Is there a way out? In fact, there is, but many people don't know it and are still slaves. The best decision is not to give these equipments place in your heart. They should do their work. And when you have a rest, prefer real communication to virtual one and living an active life to watching films about crime. Then electronics will be not our lord or enemy but our friend!

Exercise 7. Answer the following questions to the text.

1. The technical revolution has changed our life very much, hasn't it?
2. What were the predecessors of computer age?
3. Do computers make our life easier and simpler? In what way?
4. Computers influence our free time too, don't they?
5. Can you get music and video on the Interment? What other infoпnation can you get there?

6. What devices became compatible with computer during the last years?
7. Can you communicate with your friends on the Internet? Do you like such communication or you prefer real one?
8. In what way do computer games influence the people?
9. Do electronic devices take all our free time?
10. Is man a slave of the devices which were designed to make him stronger?
11. Does the author suggest a way out?
12. What is the way out in your opinion?

Exercise 7. Insert the missing words.

1. _____helps you to send letters quickly.
2. If there is an interesting program on TV, it's difficult for a person to_____.
3. During the last two _____scientific progress and digitization took place.
4. For some people a computer is an equivalent of a _____: a device for printing and editing documents.
5. Do you have many _____?- Yes, I have parents, grandparents, two sisters and three brothers.
6. I don't buy _____ any more, all my photos are on my computer.
7. Computer is a multifunctional device. So the _____is that it can be used both for work and for leisure.
8. _____age was followed by a microelectronic one.

Exercise 8. Continue the following statements.

1. The atomic, space and energy age was followed by ...
2. It's difficult to imagine the social and economic consequences ...
3. Computers have simplified ...
4. Computer helps us to buy goods, find information ...
5. Leisure time is also influenced ...
6. You no longer go to the music shops ...
7. You needn't write letters to your relatives ...
8. Computer and TV set are used mostly for entertainment ...
9. The best decision is not to give these equipments .. .
10. When you have a rest, prefer real communication .. .

Exercise 9. Write an essay on one of the following topics.

1. Man: a slave or a master of electronic devices.
2. The fundamental changes caused by technical revolution.
3. The use of computer for work.

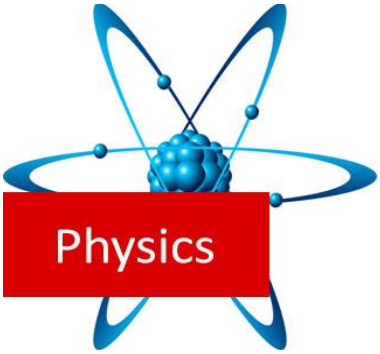
THEME 2. PHYSICS AS A SCIENCE

Topic vocabulary

matter – материя, вещество
motion – движение
to gain – получать
proof – доказательство
to deal with – рассматривать, иметь дело
theory of relativity – теория относительности
distance – расстояние
direction - направление
to distribute - распространяться
considerable - определенный
wireless waves – беспроводные волны
to resolve –
convenient – удобный
behavior – поведение
to seek out –
installation – оборудование, установка
forefathers –
to push – толкать
to pull – тянуть
to apply - применять

Exercise 1. Read and translate the text.

PHYSICS AS A SCIENCE



Physics is the science of matter, motion and energy. Newton was the first physicist in the modern sense. As he stated the three laws of motion in 1687, physics has advanced at a rapid pace along a broad road which may be divided into three stages.

The first consists in gaining quantitative knowledge about some particular phenomena. The next stage involves theoretical study, including, mathematical proof of theories. The last stage is experimental proof of the most important theories. Until quite recently physicists were in favour of mechanical explanation. The physicist today deals with mathematics to a large extent. Einstein`s theory of relativity by when the universe is explained mathematically is a powerful tool of physics.

Electricity and magnetism, and electromagnetic radiation of all kinds, from wireless waves to X-rays, were based on Maxwell`s theory. It resolves the world into electric charges and electric and magnetic waves.

Physics originally developed, and is still taught today, along several different lines: mechanics, heat, light, electricity and magnetism, and sound. When it was shown that light had the characteristics of a wave motion, heat may be converted into mechanical work, and electricity and magnetism can be generated by mechanical means, physics got a proof of the unity of nature.

The Nature of Physical Knowledge

In physics, certain properties of matter are measured and the results examined to see if there is any mathematical relationship between them. It is important to understand the true meaning of the equations we find in a physics book.

They do not tell us what things are in themselves, but are simple a convenient way of expressing the laws governing their behavior. This is the main purpose of science, to seek out the laws of the universe and, if possible, to express them in precise mathematical form. Technologists use this information for such purposes as designing electric dynamos and motors, radio, television and radar installations, artificial satellites and spacecraft, nuclear power generators and so on, all of which have helped to make our material way of life so different from that of our forefathers.

All measurements in physics, even of such things as electric current, are related to the three chosen fundamental quantities of length, mass and time. Until about the year 1800, workers in various countries used different systems of units. Thus, while an Englishman used inches, a

continental scientist would measure lengths in centimetres. Fortunately, this unsatisfactory situation has now been changed by the efforts of various international committees of scientists who have met for discussion regularly over many years. In 1960, the General Conference of Weight and Measures recommended that everyone should use a metric system of measurement called the International System of Units (abbreviated SI in all languages). The SI units are derived from the earlier MKS system, so called because its first three basic units are the metre (m), the kilogramme (kg) and the second (s). These will be explained shortly.

At the present time, however, we still have to consult books and scientific and technical papers which use the older centimetre-gramme-second system (CGS units). Some mention of these units will therefore be made later on so that the reader may be enabled to understand scientific literature in which they have been used.

Exercise 2. Give the definitions of the underlined words.

1. The science of physics is the science of matter and energy.
2. The laws of physics are to a large extent like the laws of other natural sciences.
3. The characteristics of this phenomenon are quite different from the characteristics of a wave motion.
4. Einstein`s theory of relativity is the theory explaining the universe mathematically.

Exercise 3. Define the part of the speech of the underlined words.

1. The study of this phenomenon is very important.
2. The scientists study the structure of matter.
3. The generator charges the batteries. The charges of an electric and of a proton are equal in strength.
4. The group of young physicists works at some theoretical problems. Maxwell`s works on electricity and magnetism are widely known.
5. By what means can electricity be generated?

Exercise 4. Match Russian and English words.

1) general;	a) на расстоянии;
2) term;	b) действовать;
3) force;	c) точка приложения;
4) body;	d) термин;
5) by another part;	e) в особых случаях;
6) from a distance;	f) площадь;
7) area;	g) противоположный;
8) straight line;	h) тело;
9) magnitude;	i) представлять, изображать;
10) of indefinite length;	j) прямая линия;
11) opposite;	k) величина;
12) point of application;	l) другой частью;
13) to act;	m) вычитать;
14) in special cases;	n) неопределенной длины;
15) equivalent;	o) разность;
16) to represent;	p) общий, общеупотребительный;
17) difference;	q) равнозначный, эквивалентный;
18) to subtract.	r) сила

Exercise 5. Translate the sentences into English.

1. В науке существует много различных теорий.

2. Они являются мощным инструментом для объяснения явлений природы.
3. В физике имеется несколько направлений.
4. Ими являются следующие.
5. В природе существуют электрические и магнитные волны.
6. Они являются причиной электромагнитных явлений.

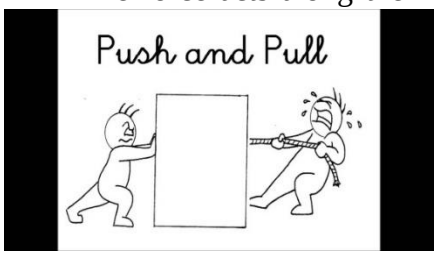
Exercise 6. Read and translate the text.

FORCES

The word force is a general term for any push or pull. A force is always exerted on a body by another body or on a part of a body by another part.

A force may act through a contact, or it may act from a distance like gravitational or magnetic attraction. It may act on a point of a body or be distributed over a considerable area. But whether exerted through a contact or from a distance a force is always exerted on something and by something.

The force acts along the line. The line of action of any force is a line of indefinite length parallel to the direction of the force and containing its point of application. To specify a force, it is necessary to know its direction, magnitude and sense. Hence, forces are vector quantities. They must be added, subtracted, multiplied and divided vectorially. The ordinary arithmetic rules of addition, subtraction, multiplication and division used for scalar quantities cannot be applied, except in special cases. Forces can be represented by straight lines.



The length of the line represents the magnitude of the force. The direction of the line is that of force. The head of the arrow of the line shows whether the force acts up of down, to the right or to the left, etc.

If a force acts on a body that is free to move, the body moves in the direction of the force. When two forces are applied in opposite directions, the body moves in the direction of the greater force. The force tending to move the body in this case is the difference between the two forces.

When the forces act in the same direction, the equivalent force known as the resultant is the sum of the two forces.

Exercise 7. Answer the following questions.

1. What is the word force?
2. What is a force always exerted by?
3. How may a force act?
4. What is the line of action of any force?
5. What quantities are forces?
6. Can ordinary arithmetic rules be applied to vector quantities?
7. How can forces be represented?
8. Where does a body move under the action of two forces?

Exercise 8. Read and translate the text.

GRAVITATION, WEIGHT AND DENSITY

What is the weight of a body? It is simply the amount of the gravitational attraction of the earth for the object. This means that a body has weight only because it is near a very large object like the earth. If a one-pound stone is moved father (дальше) from the earth surface, its weight decreases because the earth does not pull so hard.

In other words (другими словами), the weight of a body depends on how near the earth it is, but its mass is the same everywhere in the universe.

For example, two bricks (кирпичи) together have twice the mass of a single (один) brick, but if we take these bricks to the height of 1,600 miles, their weight will be about that of a single brick at sea level.

But a given volume of one material has a different weight than the same volume of some other material, because they have different density, for instance, we say that iron is "heavier" than wood.

The density of a substance is the weight of any portion (часть) of it divided by the volume. Stated as a formula D = m/V where D stands for density, m - for mass and V - for volume. Of course, this equation may be solved for m and for V: m = D x V (m equals D multiplied by V); V = m/D.

Exercise 9. Translate the following word combinations into English.

1. атомный, объемный - вес;
2. заряженное, твердое - тело;
3. плотность - плазмы, энергии;
4. земная, контактная - поверхность;
5. центр, плотность - земли;
6. равный, молекулярный, большой - объем;
7. энергетический, квантовый, технический - уровень.

Exercise 10. Match the words from the column A with word from the column B

1. about	a) высота	1. поверхность	1) weight
2. mean	b) фунт	2. движение	2) volume
3. equal	c) равный	3. вес	3) earth
4. height	d) установленный	4. объем	4) density
5. stated	e) приблизительно	5. уровень	5) surface
6. pound	f) означать	6. земля	6) movement
7. heavy	*g)* 7. тяжелый	7. плотность	*7)* level

Exercise 11. Math the beginnings and the endings of the sentences.

1. A body has weight...	a) greater than that of wood.
2. The mass of a body is...	b) the same everywhere.
3. The density of iron is...	c) when it is near the surface.
4. The density of a substance is...	d) the weight of any portion of it divided by the volume.

Exercise 12. Read and translate the text.

MEASUREMENTS

Physics is known as an exact science and this means that it is possible to make measurements of the things we talk about, because we must not only know how to describe things but be able to measure them.

There are many types of measurements. Some are very simple, others require the use of highly complex instruments.

The simpliest kind of measuring operation is finding the length of an object. The fundamental length unit in the Metric system is the standard meter.

The following table gives the most commonly used Metric units of

length: 1 kilometer (km) = (equals) 1,000 meters; 1 METER (m) = PRIMARY UNIT; 1 centimeter (cm) = 0.01 meter; 1 millimeter (mm) = 0.001 meter.

Length units in the English system: 1 in (inch) = 2.54cm; 1 ft (foot) = 30.5cm; 1 mile = 1609m.

For area measurement we have square centimeters (cm), square meters (m), etc.

Volume requires a cubical unit for its measurement. Thus there are cubic centimeters (cm), cubic feet (ft), etc.

The fundamental Metric standard of mass is the kilogramme. When we weigh an object we compare the mass of the object with that of the standard using the earth's attraction.

Exercise 13. Translate the following word combinations into English.

1. большая, маленькая, равная - площадь
2. притяжение - частиц, молекул, земли
3. простое, трудное, то же самое - уравнение
4. единица - длины, площади, веса
5. измерение - высоты, глубины
6. простой, сложный - прибор
7. сравните - приборы, оборудование, установки
8. измерьте - территорию, длину, глубину

Exercise 14. Answer the following questions.

1. Why do we call physics as an exact science?
2. What kind of measuring operations do you know (length, volume, mass)
3. What are the exact commonly used Metric units of length?
4. Do you know the length units of English system? What are they?
(1 inch = 2.54 cm; 1 foot = 30.5 cm; 1 mile = 1609 m)

Exercise 15. Read and translate the text.

UNITS MADE AFTER FAMOUS SCIENTISTS

Words like watt or volt have become part of our language so completely that we sometimes forget that these are the names of famous scientists. Let us recall a few such units.

An **ampere** is the unit of electric current in common use. It is that current which when passed through a solution of silver nitrate in water will deposit water (0,0001118 gram per second). The unit is made after Andre-Marie Ampere (1775-1836), the famous French physicist and mathematician.

A **bell** is a unit for comparing two values of power. It is 10 times the size of the more frequently used decibel, which is used as a measure of response in all types of electrical communication circuits. The unit is named after Alexander Graham Bell (1877-1922), the American inventor of telephone.

A **coulomb** is a unit of electric charge equal to the quantity of electricity transferred in one second by a current of one ampere. It is named after Charles Augustin de Coulomb (1736-1806), the prominent French physicist.

A **curie** (Cu) is the unit of the measurement of radioactivity. It is named after Pierre and Marrie Curie, French physicists.

A **farad** is a unit of electrical capacitance. It is named after Michael Faraday (1791-1867), the famous English physicist.

A **gal** is a unit of acceleration used in describing the effects of gravity. It is an acceleration of one centimetre per second each second. This unit is named after Galileo Galiley (1564-1642), the prominent Italian scientist.

A **kelvin** is a degree on the thermometric scale that takes absolute zero as it starting point (0o K). It was named after Willian Thomson (1824- 1907), who later became Lord Kelvin, a British professor, the inventor of mirror galvanometer.

A **newton** is the unit of force in the metre-kilogram second measurement system. It is named after Sir Isaac Newton (1642-1727), the English cientist, a professor of Cambridge University.

A **roentgen** is a unit of radiation. It is named after Wilhelm Condrad Roentgen (1845-1923), the famous German physicist.

A **volt** is the difference of potential between two points, if one joule of work is required to transport one coulomb of charge from one point to the other. It is named after Alessandro Volta (1745-1827), the Italian physicist.

A **watt** is a unit of power. It is named after James Watt (1730-1819), the English inventor of a steam-engine.

Exercise 16. Make up sentences using the model and using clichés.

Model: Ampere is the famous French physicist. He is from France.
Clichés: As far as I know... As to ...

1. Bell is ... (America - American)
2. M.Faraday is ... (England - English)
3. G.Galilei is ... (Italy - Italian)
4. Lord Kelvin is ... (British - Britain)
5. W. Roentgen is ... (German - Germany)

Exercise 17. Make up sentences trying to learn about the inventions.

Could you tell me		invented telephone?
Tell me, please	**WH O**	opened the x-rays?
I'd like to know		invented the steam-engine?
		discovered radioactivity?
		invented the mirror galvanometer?

Exercise 18. Give definitions of units and say after whom they were named.

1) an ampere; 2) a roentgen; 3) a curie; 4) a farad; 5) a gal; 6) a bel; 7) a newton; 8) a watt.

A unit of power, a unit of electrical capacitance, a unit for comparing two values of power, a unit for measuring radioactivity, a unit of electrical current, a unit of acceleration, a unit of force in the metre-kiligram-second measurement system, a unit of radiation.

Exercise 19. Finish the sentences.

1) We measure magnetic field intensity by ....
2) Two values of power are measured in ...
3) Radioactivity is measured in ...
4) Electrical capacitance is measured in ...
5) The difference of potential between two points is measured in ...

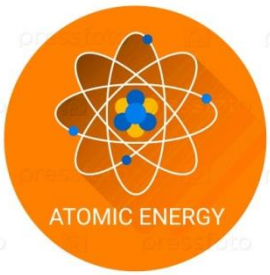
Exercise 20. Read and translate the text.

ATOMIC ENERGY

Some substances, such as radium and uranium, are .radio-active. This means that the nuclei of the atoms of these substances are continually splitting up. When the nucleus of an atom of radio-

active substance disintegrates, very small particles, known as alpha and beta particles, are thrown off with verygreat energy. At the same time, invisible rays, known as gamma rays, are produced. These rays are capable of passing through several inches of solid metal. The energy produced by the splitting of the nucleus of an atom is called nuclear or atomic energy.

The electrically charged particles which are thrown off by radio-active substance can be accelerated to a very high speed. If one of these accelerated particles hits the nucleus of another atom, it will cause it to disintegrate. Atomic energy will thus be released. It is possible, though very expensive, to transfer atoms of one element to atoms of another by this means. But more energy is used in accelerating the particle than is released by the disintegrating of a nucleus. So this is not a method of obtaining atomic power for practical purposes.



Some atoms contain uncharged particles called neutrons. If the nucleus of an atom of Uranium 235, a rare from of uranium, is struck by a moving neutron, the nucleus will split, releasing both energy and another neutron. If the two neutrons collide with the more nuclei the same thing will happen. More energy and more neutrons will be produced, and the process will continue. Though the amount of energy released by a single nucleus is very small, when such a .chain reaction is started, a great deal of energy can quickly be produced.

Exercise 21. Answer the following questions.

1. What substances are known as .radio-active?
2. When are alpha and beta particles thrown off?
3. When are gamma rays produced?
4. What is called .atomic energy?
5. How can electrically charged particles be accelerated?
6. When will atomic energy be released?
7. What is a neutron?
8. What is a chain-reaction?

Exercise 22. Match following words.

Synonyms

1. substance;	a) to vary;
2. energy;	b) nuclear;
3. to use;	c) power;
4. several;	d) to begin;
5. atomic;	e) velocity;
6. to hit;	f) some;
7. to transform;	g) beam;
8. to change;	h) very much;
9. to start;	i) aim;
10. speed;	j) to speed up;
11. purpose;	k) matter;
12. ray;	l) to utilize;
13. a great deal;	m) to strike;
14. to accelerate	n) to convert

Antonyms

1. possible;	a) to discharge;
2. high;	b) to finish;
3. visible;	c) low;
4. to release;	d) invisible;
5. to charge;	e) impossible;
6. to start;	f) to liberate;
7. solid;	g) to disintegrate;
8. to integrate;	h) liquid;
9. to accelerate;	i) to destroy;
10. to produce;	j) to decelerate;
11. to build	k) to arrest

THEME 3. MATHEMATICS AS A SCIENCE

Topic vocabulary

observation – наблюдение
to treat – обрабатывать
feature – черта, характеристика
aerobatics –
precise –
in connection with – в связи с
to enable – давать возможность
prediction –
to confirm –
to loop -
to increase – увеличивать, повышать, расти
to penetrate -

Exercise 1. Read and translate the text.

THE ROLE OF MATHEMATICS AND MATHEMATICAL ANALYSIS

In mathematics and, in particular, in mathematical analysis practical work and observation of nature are, as in other sciences, the main source of scientific discoveries. In their turn, mathematical methods play a very important role in natural sciences and engineering.

Mathematical methods lie in the foundation of physics, mechanics, engineering and other natural sciences. For all of them mathematics is a powerful theoretical and practical tool without which no scientific calculation and no engineering and technology are possible.

Mathematical analysis that treats of variables and functional relationships between them is particularly important since the laws of physics, mechanics, chemistry, etc. are expressed as such relationships.

An important feature of the application of mathematics to other sciences is that in enables us to make scientific predictions, that is to draw, on the basis of logic and with this aid of mathematical methods, correct conclusions whose agreement with reality is then confirmed by experience, experiment and practice. Here is one remarkable example illustrating what has been said.

As is known, the modern science of aviation was created by the famous Russian scientist Professor N. E. Jukovsky (1847—1921). He derived by means of mathematical methods certain formulas and laws which enabled him to predict impossibility of aerobatics, and, in particular, of looping the loop. Soon the loop was performed by the Russian pilot, captain P.N.Nesterov. The possibility of looping the loop was discovered mathematically before it was realized physically.

In recent years the role of mathematics has still increased especially in connection with the appearance of modern high-speed electronic computers. Realization of space flights, launching rockets to other planets and establishing radio and television communication with them require extremely complicated and precise mathematical calculations which cannot be performed without computers. Mathematical methods are penetrating deeply even into such traditionally «non-mathematical » sciences as economics, biology, medicine, etc. It can be said that no modern scientific and technical project can be realized without mathematics and its methods.

NUMBERS AND CALCULATIONS

Ordinal	Cardinal
1 - **one –** один	**the first** – первый
2 - **two –** два	**the second** – второй
3 - **three –** три	**the third** – третий
4 - **four –** четыре	**the fourth** – четвертый
5 - **five –** пять	**the fifth** – пятый
6 - **six –** шесть	**the sixth** – шестой

7 - **seven –** семь 8 - **eight –** восемь 9 - **nine -** девять 10 - **ten –** десять 11 - **eleven -** одиннадцать 12 - **twelve -** двенадцать 13 - **thirteen -** тринадцать 14 - **fourteen -** четырнадцать 15 - **fifteen -** пятнадцать 16 - **sixteen -** шестнадцать 17 - **seventeen -** семнадцать 18 - **eighteen -** восемнадцать 19 - **nineteen -** девятнадцать 20 - **twenty -** двадцать 30 - **thirty -** тридцать 40 - **forty -** сорок 50 - **fifty -** пятьдесят 60 - **sixty -** шестьдесят 70 - **seventy -** семьдесят 80 - **eighty -** восемьдесят 90 - **ninety -** девяносто **100 - hundred -** сто **1,000 - thousand –** одна тысяча **1,000 000 - million -** один миллион	**the seventh** – седьмой **the eighth** – восьмой **the ninth** – девятый **the tenth** – десятый **the eleventh** – одиннадцатый **the twelfth** – двенадцатый **the thirteenth** – тринадцатый **the fourteenth** – четырнадцатый **the fifteenth** – пятнадцатый **the sixteenth** – шестнадцатый **the seventeenth** – семнадцатый **the eighteenth** – восемнадцатый **the nineteenth** – девятнадцатый **the twentieth** – двадцатый **the thirtieth** - тридцатый **the fortieth** – сороковой **the fiftieth** - пятидесятый **the sixtieth** – шестидесятый **the seventieth** – семидесятый **the eightieth** – восьмидесятый **the ninetieth** – девяностый **the hundredth** - сотый **the thousandth** - тысячный
Composite numerals	
22 – twenty-two 66 – sixty-six 1,001 – one thousand and one 5,550 – five thousand five hundred and fifty 1,500 – fifteen hundred	the twenty-second – двадцать второй the sixty-sixth – шестьдесят шестой the thousand and first – одна тысяча первый the five thousand five hundred and fiftieth

Exercise 2. Read and study these words.

to add – сложить, прибавить
addition – сложение
to subtract – вычесть
subtraction – вычитание
plus – плюс
minus – минус
to equal – равняться
to be equal to – быть равным

to multiply – умножить
multiplied by – умноженный на
multiplication – умножение
to divide – разделить
divided by – разделенный на
division – деление
once – один раз
twice – дважды, два раза
three times – три раза

fractions – дроби
decimal fractions – десятичные дроби
common fractions – простые дроби
numerator – числитель
denominator – знаменатель
point – точка
nought – нуль
zero – нуль
O - нуль

ADDITION AND SUBTRACTION

5 + 7 = 12 – five plus seven is equal to twelve
66 + 13 = 79 – sixty-six plus thirteen equals seventy-nine
a + b = c – a plus b is c
15 – 6 = 9 – fifteen minus six equals nine
81 - 33 = 48 – eighty-one minus thirty-three is equal to forty-eight

c – b = a – c minus b equals a

Exercise 3. Read and solve these problems.

99 + 77 = _____	8 – 3 = _____	315 + 145 = _____
61 – 50 = _____	47 – 18 = _____	859 – 600 = _____
114 + 316 = _____	1,203 + 419 = _____	4,444 + 7,777 = _____
b + a = _____	d – c = _____	a – c = _____

MULTIPLICATION AND DIVISION

1 * 1 = - once one is one
2 * 2 = - twice two is equal to four
3 * 3 = - three times three equals nine
4 * 4 = - four times four equals sixteen
12 * 10 = 120 – twelve multiplied by ten is equal to one hundred and twenty
35 : 7 = 5 – thirty-five equals five
1,000 : 25 = 40 – one thousand divided by twenty-five is equal to forty
a : b = c – a divided by b is c

Exercise 4. Read and solve these problems.

10 * 7 = _____	49 : 7 = _____	10,660 :10 = _____
100 * 100 = _____	175 : 25 = _____	749 : 7 = _____
234 * 6 = _____	12 * 12 = _____	1 * 1 = _____
a * b = _____	n * m = _____	l * k = _____

COMMON AND DECIMAL FRACTIONS

½ = one half (a half)
1/3 = one third (a third)
2/7 = two seven**ths**
3 ½ = three and a half
5 1/7 = five and one seventh
6 5/7 = six and five seven**ths**

0.7 – O point seven
nought point seven
zero point seven
0.002 – zero double zeroes two
1.1 – one point one
5.36 – five point three six
65.237 – sixty-five point two three seen

Exercise 5. Read these common and decimal fractions.

1/3 _____	5/8 _____	15.89 _____
20.23 _____	10.25 _____	0.003 _____
2/5 _____	7 ½ _____	79.315 _____
0.009 _____	205.35 _____	9 5/8 _____

THEME 4. CHEMISTRY AS A SCIENCE

Topic vocabulary

chemistry - химия
science - наука
to include - включать
property - свойство
composition - состав
codas structure - структура, состояние
to undergo – подвергаться
accompanying - сопутствующие [
energy changes – преобразование энергии
abundance - изобилие
overall volume of production – общий объем продукции
much credit for this is due to our scientists – в этом большая заслуга наших ученых **research** – исследование
to win world-wide recognition – получить всемирное признание
to serve – служить
theoretical basis – теоретическая основа
to enable – давать возможность
to set up - основывать
contribution – вклад
to reveal - открывать, показывать
condition - условие
processing – обработка
chain reaction – цепная реакция
discovery - открытие
to achieve - достигать
to play an important part – играть важную роль
branch - отрасль
close links – тесная
large-scale production – производство в больших масштабах
compound – соединение
to evolve - разрабатывать
simultaneously - одновременно
field – область, отрасль
It was ... considered (thought) – предполагали, считали
to consist of - состоять из
to derive – происходить от
to include – включать, содержать в себе
hydrocarbon – углеводород
substance - вещество
to contain – содержать
for instance - например
behaviour - поведение
current – электрический ток
relation – соотношение, зависимость
whereby – посредством которого
to cause – вызывать
conducting medium – проводящая среда
solution - раствор
molten – расплавленный
method of deposition metals – метод осаждения металлов
to draw (drew, drawn) – тянуть
to repel – отталкиваться
boundary - граница

Exercise 1. Read and translate the text.

CHEMISTRY: KEY TO PROGRESS AND ABUNDANCE

The science of chemistry includes a study of properties, composition, and structure of matter, the changes in structure and composition which matter undergoes, and the accompanying energy changes.

The Russian chemical industry now holds second place in the world in overall volume of production. Much credit for this is due to our scientists whose research has won worldwide recognition. The classical works by Mendeleyev, Butlerov, Zelinsky, Zaitzev, Lebedev, Favorsky and many others not only served as a theoretical basis for the development of the chemical industry, but enabled our scientists to set up a number of modern branches of the chemical industry as well.

The close links between science and industry enabled the chemical industry to make great progress.

The Soviet Union was the first country to organize large-scale production of synthetic rubber.

Zelinsky's works formed the basis for the synthesizing of a large number of new chemical compounds. These compounds are now counted in thousands, and they are extremely important in the country's economy. Our scientists evolved an original method of extracting phenol and acetone simultaneously from benzene and propylene. Phenol and acetone are needed for the manufacture of plastics, textile fibres, organic glass and other chemical products.

Scientists are making a major contribution to the production of aniline dyes, and many new dyes have been evolved with their help.

The research of our scientists has revealed the physical and physico-chemical conditions necessary for the industrial production and processing of polymeric materials.

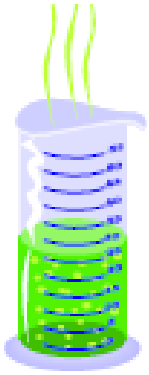
The theory of chain reactions is a major discovery of our time. The development of this theory is linked with the name of the Soviet scientist Semyonov, a Nobel Prize winner.

The successes achieved by chemistry and engineering have played an important part in our country's achievements in space.

Fields of Chemistry

The field of chemistry is now a very large one. There are more than 30 different branches of chemistry. Some of the better known fields are inorganic chemistry, organic chemistry, physical chemistry, analytical chemistry, biological chemistry, pharmaceutical chemistry, nuclear chemistry, industrial chemistry, colloidal chemistry, and electrochemistry.

Inorganic chemistry. It is originally considered that the field of inorganic chemistry consists of the study of materials not derived from living organisms. However it now includes all substances other than the hydrocarbons and their derivatives.



Organic chemistry. At one time it was thought that all substances found in plants and animals could be made only by using part of a living plant or animal. The study of these substances, most of which contain carbon was therefore called organic chemistry. It is now known that this idea is quite wrong, for in 1828 F. Wohler made an "organic" substance using a simple laboratory process.

Organic chemistry now merely means the chemistry of carbon compounds.

Physical chemistry is concerned with those parts of chemistry which are closely linked with physics as, for in stance, the behaviour of substances when a current of electricity is passed through them.

Electrochemistry is concerned with the relation between electrical energy and chemical change. Electrolysis is the process whereby electrical energy causes a chemical change in the conducting medium, which usually is a solution or a molten substance. The process is generally used as a method of deposition metals from a solution.

Magnetochemistry is the study of behaviour of a chemical substance in the presence of a magnetic field. A paramagnetic substance, i.e. one having unpaired electrons is drawn into a magnetic field. Diamagnetic substances, i.e. those having no unpaired electrons, are repelled by a magnetic field.

Biochemistry. Just as the physical chemist works on the boundaries between physics and chemistry, so the biochemist works on the boundaries between biology and chemistry. Much of the work of the biochemist is concerned with foodstuffs and, medicines. The medicines known as antibiotics, of which penicillin is an early example, were prepared by biochemists.

Exercise 2. Give English equivalents for these words.

отрасль	условие	состав	производство
развитие	выделение	свойство	одновременно
исследование	открытие	наука	достигать

Exercise 3. Answer the questions.

1) Which branch of chemistry deals with the study of materials not derived from living organisms?

2) Which branch of chemistry studies the behaviour of a chemical substance in the presence of a magnetic field?
3) What is the study of substances containing carbon called?
4) What other branches of chemistry do you know?
5) By whom were antibiotics prepared?

Exercise 4. Fill in the gaps with suitable words from the box.

production repelled unpaired solution foodstuffs compounds
enabled branches electrolysis chain

1) Diamagnetic substances are ... by a magnetic field.
2) Much of the work of the biochemist is concerned with . . . and medicines.
3) ... is the process whereby electrical energy causes a chemical change in the conducting medium.
4) Electrolysis is generally used as a method of deposition of metals from ....
5) The theory of ... reactions is a major discovery of our time.
6) The close links between the science and industry ... the chemical industry to make great progress.
7) Zelinsky's works formed the basis for the synthesizing of a large number of new chemical ... .
8) Scientists are making a major contribution to ... of aniline dyes.
9) There are more than 30 different . . . of chemistry.
10) Diamagnetic substances have no ... electrons.

Exercise 5. Make up sentences out of these words.

1) And, phenol, an original method, acetone, our scientists, simultaneously, benzene, and, evolved, from, extracting, propylene, of.
2) Substance, field, the study, in the presence, behaviour, chemical, magnetochemistry, of, of, is, a, of, a, magnetic.
3) World-wide, this, to, scientists, recognition, much, due, research, credit, our, is, whose, won, has.
4) Other, needed, manufacture, textile fibers, plastics, acetone, and, are, organic glass, for, the, products, of, and, chemical, phenol.
Physics, chemistry, parts, linked, which, concerned, are, closely, with, with, physical, chemistry, is, those, of

Exercise 6. Translate into English.

1) Наши ученые разработали новый метод обработки металлов.
2) Биохимики внесли большой вклад в производство антибиотиков.
3) Электрохимия связана с изучением отношений между электрической энергией и химическими изменениями.
4) Русские ученые основали большое количество современных отраслей химической промышленности.
5) Они не знают состава этого соединения.
6) Советский союз был первым государством, которое организовало крупномасштабное производство синтетического каучука.
7) Этот ученый определил физические и физико-химические условия необходимые для промышленного производства и обработки полимерных материалов.

THEME 5. MATERIALS. METALS

Topic vocabulary

property — свойство
metallurgy — металлургия
separation — разделение, отстояние
dense — плотный
arrangement — расположение
to slide — скользить
malleable — ковкий, податливый, способный деформироваться
bend (bent, bent) — гнуть
to fracture — ломать
ductile — эластичный, ковкий
to draw — волочить, тянуть
wire — проволока
lead — свинец
iron — железо, чугун
grain — зерно
to depend on — зависеть
mould — форма *(для отливки)*
treatment — обработка
quenching — закалка
tempering — отпуск после закалки
annealing — отжиг, отпуск
rolling — прокатка
to hammer — ковать (напр. молотом)
metal fatigue — усталость металла
creep — ползучесть
stress — давление,
failure — повреждение, разрушение
vessel — сосуд, котел, судно
lathe — токарный станок
milling machine — фрезерный станок
shaper — строгальный станок
grinder — шлифовальный станок
to melt — плавить, плавиться расплавить
to cast — отливать, отлить
coarse — грубый, крупный
stiff — жесткий
to corrode — разъедать, ржаветь
rusty — ржавый
stainless, rust-proof — нержавеющий
to resist — сопротивляться
considerably — значительно, гораздо
forging — ковка
welding — сварка
cutting tools — режущие инструменты
surgical instruments — хирургические инструменты
spring — пружина
inclusion — включение
to affect — влиять
manganese — марганец
silicon — кремний
nitrogen — азот
tungsten — вольфрам
carbon— углерод

Exercise 1. Read and translate the text.

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.

Exercise 2. Answer the following questions.

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 / alloying / crystalline structure / creeping?
5. What do the properties of metals depend on?
6. What changes the size of grains in metals?
7. What are the main processes of metal forming?

Exercise 3. Find the following words and word combinations in the text.

1. свойства металлов
2. правильное расположение
3. сильно отличаются по своим свойствам
4. кристаллическая структура
5. размер / форма / структура / свойства зерен
6. закалка
7. способы обработки металлов
8. прокатка
9. ковка
10. горячая обработка
11. усталость металла
12. лавка и отливка в формы

Exercise 4. Complete the following sentences:

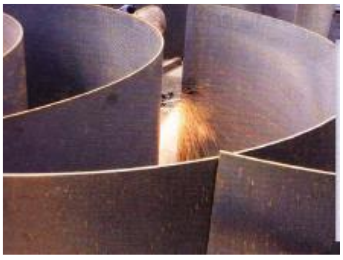
1. Metals are...
2. Metallurgy is...
3. Most metals are...
4. The properties of the metals depend...
5. Alloying is...
6. All metals can be formed by...
7. Creep is...
8. Metals can be worked using...

Exercise 5. 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.

Exercise 6. Read and translate the text.

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.

Exercise 7. Answer the following questions.

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)?

Exercise 8. 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

THEME 6. MATERIALS. SYNTHETIC MATERIALS

Topic vocabulary

fibre — волокно, нить
identical — одинаковый, идентичный
molecule — молекула
branch — разветвленный
to synthesize — синтезировать
chemicals — химические вещества
to soften — смягчать
cellulose — клетчатка, целлюлоза
wax — воск
thermosetting plastics — термореактивные пластмассы
to harden — делать твердым
to subject — подвергать
resin — смола
similar — сходный, подобный
sufficient — достаточный
to prevent — предотвращать
stretched — растянутый
transparent — прозрачный
rubber — резина, каучук
to decompose — разлагаться
soft-drink — безалкогольный напиток
coil — спираль
polyurethane — полиуретан
fibreglass — стекловолокно
reinforced — упрочненный
expansion — расширение
matrix — матрица
ceramic — керамический
specific strength — удельная прочность
specific stiffness — удельная жесткость
anisotropic — анизотропный

Exercise 1. Read and translate the text.

PLASTICS

Plastics are non-metallic, synthetic, carbon-based materials. They can be moulded, shaped, or extruded into flexible sheets, films, or fibres. Plastics are synthetic polymers.

Plastics are light-weight compared to metals and are good electrical insulators. The best insulators now are epoxy resins and teflon. Teflon was first made in 1938 and was produced commercially in 1950. Plastics can be classified into several broad types.

1. Thermoplastics soften on heating, then harden again when cooled. Thermoplastic molecules are also coiled and because of this they are flexible and easily stretched.

Typical example of thermoplastics is polystyrene. 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.

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 or polyurethane 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.

Exercise 2. Answer the following questions.

1. What is the definition of plastics?
2. What do polymers consist of?
3. What are the main types of polymers? Give examples of plastics belonging to these types.
4. What plastics are the best electrical insulators?
5. What are the most important properties of plastics?
6. Give the examples of various uses of plastics because of their characteristic properties.

Exercise 3. Find English equivalents in the text.

1. синтетические полимеры
2. молекулы с длинными цепями
3. характерные свойства полимера
4. хороший электрический изолятор
5. размягчаться при нагревании
6. затвердевать при охлаждении
7. гибкий и легко растяжимый
8. течь под нагрузкой
9. более высокая плотность
10. достаточная взаимосвязь между молекулами

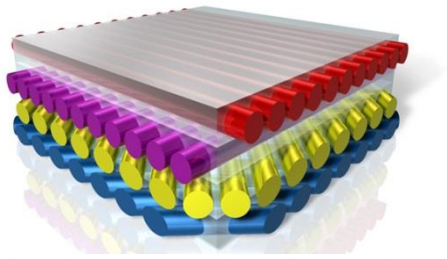
Exercise 4. Match the beginning and the ending of sentences.

1. Polymers consist of	a) be linear, branched, or cross-linked, depending on the plastic.
2. The giant molecules of which polymers consist may	b) the polystyrenes especially suitable for radio-frequency insulation and for parts used at low temperatures in refrigerators and in airplanes.
3. Most plastics are	c) urea-formaldehyde or polyurethane and epoxy resins, most polyesters, and phenolic polymers such as phenol-formaldehyde resin.
4. These properties make	d) long-chain molecules made of large numbers of identical small molecules (monomers).
5. Examples of thermosetting plastics include	e) synthesized from organic chemicals or from natural gas or coal.

Exercise 5. Read and translate the text.

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.

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.

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.

Exercise 6. Answer the following questions.

1. What is called «composite materials»?
2. What do composite material usually consist of?
3. What is used as filler or fibers in composites?
4. How are the composite materials with ceramic and metal matrices called?
5. What are the advantages and disadvantages of composites?

Exercise 7. Find equivalents in the text.

1. композитные материалы
2. уникальные механические качества
3. полимерные матричные композиты
4. составлять 60% объема
5. привлекательные качества
6. структура, подвергающаяся воздействию разнонаправленных сил

Exercise 8. What are these objects made of? Match the words in the box with the pictures, then read the text.

steel *gold* *wood* *plastic* *glass* *ceramic*

When a machine or a tool is made, the most suitable material must be chosen by considering its properties, which can be classified as mechanical, thermal , electrical and chemical. The main types of materials used in mechanical engineering are metals, polymer materials, ceramics and composite materials.

The most commonly used materials are metals, which can be divided into ferrous and non-ferrous. They can be used in their pure form or mixed with other elements. In this second case we have an alloy and it is used to improve some properties of the metals. The most commonly used ferrous metals are iron and alloys which use iron. Because iron is soft and pasty it is not suitable to be used as a strucfural material, so a small amount of carbon is added to it to make steel alloy.

Non-ferrous metals contain little or no iron. The most common non-ferrous metals used in mechanics are copper, zinc, tin and aluminium. Some common non-ferrous alloys are brass (formed by mixing copper and zinc), bronze (formed by mixing copper and tin) and other aluminium alloys

which are used in the aircraft industry. Other examples of materials used in mechanical engineering are plastic and rubber.

PVC or polyvinyl chloride is a type of plastic and is used to insulate wires and cables: Rubber is a polymer and its best property is elasticity, as it retums to its original size and shape after deformation.

Ceramic materials are good insulators: hard, resistant and strong, but brittle. Composite materials are made up of two or more materials combined to improve their mechanical properties.

Concrete is reinforced with steel and is used in building engineering.

Exercise 9. Answer the questions.

1 What is the basic classification of metals?
2 What are the characteristics of iron?
3 Why are alloys created?
4 Which materials are good insulators?
5 Is steel an alloy? What meals does it contain?

Exercise 10. Read the text again and match the words with their definitions.

1. alloy	a) a type of plastic used for insulation
2. steel	b) combination of different metals
3. PVC	c) an alloy formed by mixing iron and carbon
4. concrete	d) an alloy formed by mixing copper and zinc
5. brass	e) metals containing iron
6. ferrous materials	f) a composite material used to build houses
7. ceramic	g) a metal not suitable as structural material
8. iron	h) a good insulator but brittle

Exercise 11. Put the words in the correct order to make complete sentences.

1. taking their forms / fluid substances / into moulds / solidify
2. drawing / room temperature / is done at
3. not essential / heat / is / in the drawing process
4. in the past / using / forging / a hammer / was done
5. can be / brittle materials / extrusion / done / with
6. many / is used / everyday objects / sheet forming / to make

Exercise 12. Write a summary of the texts following the flow chart.

Write about the importance in engineering of having a specific knowledge of materials. → List the materials and the main groups used in mechanics. → Tell the difference between different metals. → Say what an alloy is and why it is used. → Write a list of non-ferrous metals and alloys.

THEME 7. MATERIALS SCIENCE AND TECHNOLOGY

Topic vocabulary

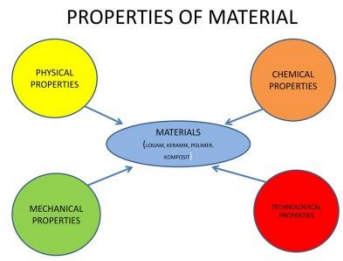
a bar— брусок, прут
compression — сжатие
creep — ползучесть
cross-sectional area — площадь поперечного сечения
cyclic stress — циклическое напряжение
elastic deformation — упругая деформация
elastic limit — предел упругости
to exceed — превышать
external forces — внешние силы
fatigue — усталость металла
fracture — перелом, излом
to loosen — ослаблять, расшатывать
car body — кузов автомобиля
a constituent — компонент
a crack — трещина
creep resistance — устойчивость к ползучести
density — плотность
ductility — ковкость, эластичность
failure — повреждение
gradual — постепенный
to sink — тонуть
a shear — срез
to stretch — растягивать
technique — методы
tension — напряженность
to propagate — распространяться
to extend — расширять, продолжаться
to meet the needs — отвечать требованиям
to occur — происходить
to respond — отвечать реагировать
torsion — кручение
twisting — закручивание, изгиб
a rupture — разрыв
remaining — оставшийся
stiffness — жесткость
strain — нагрузка, напряжение, деформация
strength — прочность
stress — давление, напряжение
tensile strength — прочность на разрыв
toughness — прочность, стойкость
yield strength — прочность текучести
Young modulus — модуль Юнга

Exercise 1. Read and translate the text.

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 localized 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 formation 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.

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/ m3 but most materials have a higher density and sink in water. Aluminium alloys, with typical densities around 2800 kg/ m3 are considerably less dense than steels, which have typical densities around 7800 kg/ m3. 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/m2, 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. 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.

Exercise 2. Answer the following questions.

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 strength?
6. What is ductility? Give the examples of ductile materials. Give the examples of brittle materials.
7. What is toughness?
8. What properties of steel are necessary for the manufacturing of: a) springs, b) car body parts, c) bolts and nuts, d) cutting tools?
9. Where is aluminium mostly used because of its light weight?

Exercise 3. Find the following words and word combinations in the text:

1. количество массы в единице объема
7. способность материала

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
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 4. Translate into English the following.

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. Большинство материалов имеют более высокую плотность, чем вода и тонут в воде.
5. Плотность материала очень важна, особенно в авиации.
6. Чем более металл жесткий, тем менее он деформируется под нагрузкой.
7. Свинец, медь, алюминий и золото — самые ковкие металлы.
8. Сопротивление ползучести является очень важным свойством материалов, которые используются в авиационных моторах.

THEME 8. MACHINE-TOOLS

Topic vocabulary

machine-tools — станки
electrically driven — с электроприводом
workpiece — деталь
accurate — точный
to allow — позволять, разрешать
interchangeable — взаимозаменяемый
facility — приспособление
relative —относительный
overheating – перегревание
by means of — посредством
lathe – токарный станок
range — ассортимент, диапазон
to lubricate — смазывать
spark erosion — электроискровая обработка
drilling machine – сверлильная машина
shaper – фрезерный станок
grinding machine – шлифовальный станок

Exercise 1. Read and translate the text.

A **machine tool** uses a power source to modify the shape of metal components of machines. It is a sort of machine used as a tool in the making of other machines. Machine tools were powered in the Middle Ages by humans and animals, and later by the energy captured by waterwheels. After the Industrial Revolution, most machine tools were powered by steam engine and nowadays by electricity.

Machine tools can be operated manually, or under automatic control. In the 1960s, computers gave more flexibility to the process. Such machines became known as computerized numerical control (CNC) machines. They could precisely repeat sequences, and could produce much more complex pieces than even the most skilled tool operators. Let's examine the main **features** of some of the most commonly used machine tools.

Turning machine. The engine lathe is the most important of all the machine tools. It is used to produce external or internal cylindrical surfaces. The piece is held by the machine and is rotated while a cutting tool removes excess metal from the external diameter. Internal turning consists of enlarging and finishing a hole.

Shaper. This is a metal-cutting machine used to produce or modify flat surfaces. The cutting tool moves cutting on the forward **stroke,** with the piece feeding automatically towards the tool during each return stroke. Shapers can be horizontal or vertical.

Drilling machine. It is used to produce circular holes in metal with a twist drill. It also uses a variety of other cutting tools to perform the basic hole-machining operations.

Milling machine. This cuts flat metal surfaces. The piece is fed against a rotating cutting tool. Cutters of many shapes and sizes are available for a wide variety of milling operations. Milling machines may be manually operated, mechanically automated, or digitally automated via computer control (CNC).

Grinding machine. This removes excessive material from parts that are brought into contact with a rotating abrasive wheel. Grinding is the most accurate of all the basic machining processes, but also the most time consuming.

Press. This is a machine tool that changes the shape of a workpiece. Historically, metal was shaped by hand using a hammer. Machine presses can be dangerous. Bi-manual controls (controls **Band saw** which require both hands to be on the buttons to operate) are a very good way to prevent accidents.

Band saw. It is a power tool which uses a blade consisting of a continuous band of metal with teeth along one edge. The band usually rides on two wheels rotating in the same plane. Band saws are used for woodworking, metalworking, or for cutting a variety of other materials, and are particularly useful for cutting irregular or curved shapes. A constant flow of liquid is poured over the blade to keep it cool and preventing it flom overheating.

Exercise 2. Read the texts about metalworking processes and complete the table.

Machine tool	Final result	Description
turning machine	external and internal flat surfaces	It removes excess metal from the external diameter. It enlarges and finishes a hole.
	specific shape	It cuts flat metal surfaces.
	holes	It uses a twist drill to make holes.
	flat surface	It cuts the piece.
	specific shape	It changes the shape of a workpiece.
	cut pieces	It cuts various parts using a continuous band of metal with teeth.
	finishing	It removes excessive material from parts.

Exercise 3. Read the texts again and decide if the following sentences are true (T) or false (F).

1. Turning machines remove excess metal from the external diameter and enlarge and finish a hole. _____
2. Shapers can only be vertical. _____
3. Drilling machines use a twist drill to make circular holes. _____
4. Milling machines can only be manually operated. _____
5. Grinding machines remove excessive material from parts. _____
6. Band saws use a band of metal with teeth to cut various parts. _____
7. Presses are not dangerous if operated by both hands. _____

Exercise 4. Read the text about CNC and put the sentences in the correct order.

Computer Numerical control (CNC) refers to the automation of machine tools in manufacturing processes. The machines are controlled by computer software which carries out a series of operations automatically. The first NC machines were built in the 1940s and 1950s. They are used to cut and shape products, such as automobile parts that need precise specifications. Parts must be carefully planned and prepared by CNC programmers. First they view the three-dimensional computer aided designed part. Then they calculate where to cut, the speed and shape and select the tools and materials. The CNC programmers translate the planned machine operations into a set of instructions. These instructions are translated into a computer aided manufacturing (CAM) program containing a set of commands for the machine. The commands are a series of numbers which explains where to cut and the position of material. The computer checks all the operations made by the machine tools.

a) The planned machine operations are translated into a set of instructions.
b) These instructions are translated into a CAM program.
c) The program contains a set of commands for the machine.
d) It is calculated where to cut and tools and materials are selected.
e) The computer checks all the operations made by the machine tools.
f) Programmers view the part in its three-dimensional computer aided design

THEME 9. COMPUTERS

Topic vocabulary

backup – резервное копирование
to process – обрабатывать
case – системный блок
rebooting - перезагрузка
to recharge - перезаряжать
countless – бесчисленный
reliability - надежность
illicit – противозаконный
removable - передвижной
to interfere – мешать, мешать, вредить
to retain – удерживать, сохранять
storage - хранилище
landline – проводной телефон
subscription - подписка
lap top – ноутбук
to link - связывать
mainframe – ПК обычных размеров
user-friendly – простой в эксплуатации
palmtop – карманный ПК
to perform – осуществлять
sophistication - сложность
keyboard – клавиатура
capacity — вместительность
circuitry — электрические цепи
CPU, microprocessor — микропроцессор
hard disk — жесткий диск, «винчестер»
input hardware — устройства ввода данных
keyboard — клавиатура
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 — управлять
to execute — выполнять
to interpret — переводить
to provide — обеспечивать
to reach — достигать
to retrieve — извлекать
to roll — катать, перекатывать
volatile — летучий, нестойкий, временный

Exercise 1. Read the text and complete the table.

COMPUTER COMPONENTS

A computer is an electronic device that **performs** high-speed mathematical or logical operations and executes instructions in a program . Its main functions are to accept and **process** data to produce results, store information and programs and show results.

The main characteristics of these powerful machines are:

• speed, as they can execute billions of operations per second
• high **reliability** in the elaboration and delivery of data
• **storage** of huge amounts of information

A computer consists of hardware and software. The word hardware refers to all the components you can physically see such as the CPU (Central Processing Unit), the internal memory system, the mass storage system, the peripherals (input and output devices) and the connecting system. Software, instead , comprises all the computer programs and related data that provide the instructions for a computer to work properly.

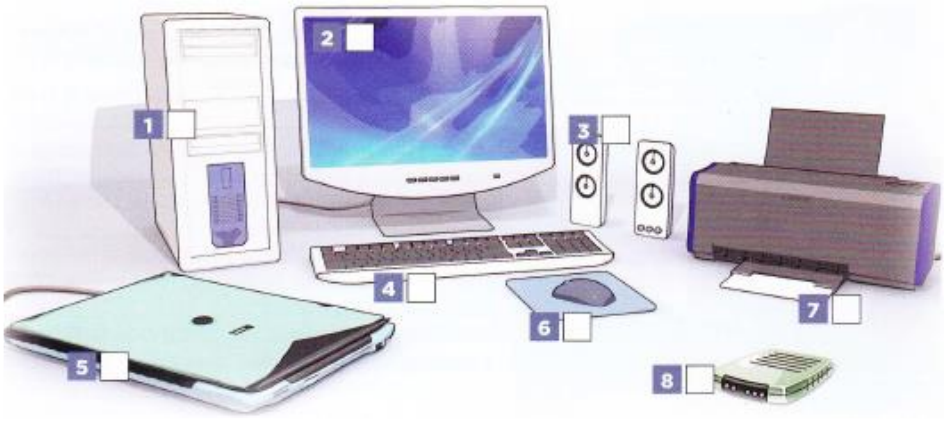
The CPU is the brains of your computer and consists of ALU (Arithmetic Logic Unit), which carries out the instructions of a program to perform arithmetical and logical operations, and CU (Control Unit), which controls the system and coordinates all the operations. In order to memorise input and output data, there is an internal memory that can be distinguished into volatile and non-volatile. Volatile memory is memory that loses its contents when the computer or hardware device is off. Computer RAM (Random Access Memory) is a good example of vo latile memory. It is the main memory of the computer where all data can be stored as long as the machine is on. On the contrary, a non-volatile memory contains information, data and programs that cannot be modified , or can be modified only very slowly and with difficulty. Computer ROM (Read Only Memory), for example, contains essential and permanent information and software which allow the computer to work properly. Memory **storage** devices are available in different options, sizes and capacities. These devices are extremely useful; they can be rewritten and offer incredible storage capacity, up to 256 GB. They can be magnetic (hard disks), optical (COs and OVOs) or solid (flash memory cards).

Mass storage devices are available in an incredible number of options with different storage capacity up to 256 GB for some portable drives. A very popular type of **removable** device is represented by USB flash drives, which are much smaller and **lighter** than other portable drives, but which can still provide a huge storage capacity.

Component (acronym)	Full name / Description	Functions and properties
hardware		
software		
CPU		
ALU		
CU		
RAM		
ROM		

Exercise 2. Read the text and complete the definitions with the words in the box.

mouse speaker modem keyboard printer
disk drives monitor scanner



We call hardware the equipment involved in the functioning of a computer. It consists of several components that can either send data to the computer (input devices) or convert and transfer data out of the computer in the form of text, sound, image, or other media (output devices). The main input and output devices are: (1) _____ : this is the display, which helps you control computer operations. It accepts video signals from a computer and shows information on a screen. The first models used cathode ray tubes (CRTs), which was the dominant technology until they were replaced by liquid crystal displays (LCDs) in the 21 st Century.

(2) _____: this is like a **typewriter** with an arrangement of **keys** corresponding to written symbols. It is generally used to type text and numbers in a word processor. However

there are some special keys or combination of keys which, pressed simultaneously, can produce actions or computer commands.

(3) _____ : this is a dynamic pointing device used to move the cursor on the screen. It consists of a plastic case, a little ball that sends impulses to the computer when rolled on a flat surface, one or more buttons, and a cable that connects the device to the computer. Modern computers are provided with built-in pointing devices that let you control the cursor by simply moving your finger over a pad.

(4) _____ : this captures images from printed pages or photos and converts them into digital data. They usually come with software that lets you resize or modify a captured image.

(5) _____: this receives text and graphics from a computer and transfers the information to paper. It may vary in size, speed , **sophistication,** and cost. In general, more expensive models are used for higher-resolution colour printing.

(6) _____: this converts electrical signals into sounds and allows you to listen to music,

multimedia web sites and conversations with other people.

(7) _____: this is a device or program that enables a computer to transmit data over telephone lines, by converting digital signals into analog waves. It can be either internal or external to your computer.

(8) _____: these are devices that allow you to read and write data on disks. They can be either mounted inside the computer and store the computer operating system and all the documents and programs, or come in the form of removable devices .

Exercise 3. Read the descriptions of the different types of computers, match them with the correct picture, and answer the questions.

1. What does a desktop computer consist of?
2. Are desktop computers designed to be carried around?
3. Who are laptops useful for?
4. What is the difference between a netbook and a laptop?
5. How can you access or enter information on a palmtop?
6. What are mainframes used for?

When you go to a computer shop, you can find computers for any use, size or capability.

1. **Desktop:** this is a personal computer intended for regular use at a single location. It's designed to sit on your desk, and as such it consists of a monitor and a **tower** with extra drives inside.

2. **Laptop:** this is a portable computer, which integrates all the usual components of a desktop computer into a single unit. Smaller versions of laptops are known as notebooks. It is usefu l for people who do not have a fixed place to work at. They are lighter and handier than desktop computers, but they also tend to be more expensive. They require an expensive battery that needs to be **recharged** quite often.

3. **Netbook:** this is a portable computer, with limited capabilities as compared to standard laptops. It is smaller and lighter, but it also has less procssing power than a full-sized laptop. It is useful for people who don't have a fixed place to work at or for those who travel, but still need to surf the Net. They use a battery which needs to be recharged often.

3. **Palmtop:** this is a small portable computer designed to have large amounts of information **close to hand.** They are provided with light longlasting batteries and special operating systems. They don't require any keyboard but use special pens or touch screens to enter data and access information.

5. **Mainframe:** this is a very large and expensive computer capable of supporting thousands of users at the same time. For this reason, it is used in businesses and it's the centre of computer networks. These super computers, which are usually as big as a large refrigerator, are the most powerful and expensive ones and they're used for jobs which require enormous amounts of calculations, such as weather forecasting, engineering design and economic data processing.

Exercise 4. Read the text and complete the sentences with the missing information.

THE INTERNET

The Internet is a worldwide information system consisting of **countless** networks and computers, which allow millions of people to share information and data . Thanks to the Internet it is now possible for people all over the world to communicate with one another in a fast and cheap way.

The Internet was first invented in the 1960s in the USA by the Department of Defence as an internal project to **link** computers. The Department wanted an extremely safe way of sending messages in case of nuclear attack. It was a British physicist, Sir Timothy Berners-Lee, who used it to make information available to everyone and created the most important media of the 21 sI century. In 1980 while working at CERN in Geneva - the largest particle physics laboratory in the world - he first thought of using hypertext to share and update information among researchers. Then in 1989-90 he produced a plan to link hypertext to the Internet to create the World Wide Web. He designed and built the first site browser and editor, as well as the first web server called httpd (Hypertext Trasfer Protocol Deamon). Hypertext are the words or chains of words in a text we can click on to be linked to new sites whose content is related to the words.

But how does this global system work? It is a network of people and information linked together by telephone lines which are connected to computers. The applications are based on a client/server relationship, in which your computer is the client and a remote computer is the server. All you need to join this system is a computer, a normal telephone line, a modem and an account with an Internet Service Provider (ISP), a company that provides access to the Internet. A user buys a **subscription** to a service provider, which gives him/her an identifying username, a password and an email address. With a computer and a modem, the user can connect to the service provider's computer which gives access to many services, such as WWW (world wide web), emails and FTP (file t'ransfer protocol).

1. The Internet allows people to _____
2. In the 1960s, the Internet was used _____
3. Thanks to Sir Timothy Berners-Lee _____
4. He created the World Wide Web by linking _____
5. All you need to access the Internet is _____
6. The ISP is _____

Exercise 5. Read the text about the different types of Internet connections and match the words in the box with the correct definition.

DSL	w ireless	satellite	cable	dial-up

1. _____

It used to be the most common way to access the Internet. This type of connection requires you to use a **landline** telephone connection and a modem connected to your computer. **In** order to establish the connection, you must dial a telephone number provided by the ISP. Nowadays it represents the cheapest but slowest way to connect to the Internet. Another disadvantage of this type of connection is that you cannot make or receive phone calls while connected to the Internet.

2. _____

A digital subscriber line is another way to connect to the Internet through a telephone connection, but the quality and speed of the connection is significantly greater than a dial-up connection. Moreover, unlike a dialup connection, this connection is always on, which means you can still make and receive telephone calls with your landline telephone.

3. _____

In order to have this type of connection you must subscribe to an account with a local cable television provider and connect a cable modem to your computer. This connection is very fast and doesn't interfere with your telephone line.

4 _____.
This is one of the newest Internet connection types. This connection does not require your computer to be connected to telephone or cable wires, as it uses radio frequency bands. You simply need a modem and an account with an Internet provider. Nowadays, many coffee shops, restaurants, public libraries and schools offer this type of connection for free . However, it is typically more expensive and mainly available in metropolitan areas.

5 ._____
This type of connection allows a user to access the Internet via a satellite that orbits the earth. Because of the enormous distances signals must travel , this connection is slightly slower than terrestrial connections through cables. It represents an excellent option for people living in rural areas where other types of connections are not available.

Exercise 6. Read and study these words.

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 welldesigned 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, non-modifiable 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 permanent 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 transmission 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.

Exercise 7. Answer the following questions.

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. 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.

8) Printer is a processing hardware because its purpose is to show the information produced by the system.

9) Modem is an electronic device that makes possible the transmission of data from one computer to another via telephone or other communication lines.

10) 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 9. Give definitions to the following using the vocabulary.

1)CPU	3) Floppy-disk	5) Printer	7) Motherboard	9) Keyboard
2) ROM	4) CD-ROM	6) Modem	8) Hard disk	10) Sound-card

Exercise 10. Match the following.

1) процессор	a) nonvolatile, non-modifiable computer memory, used to hold programmed instructions to the system.
2) клавиатура	b) the part of a television or computer on which a picture is formed or information is displayed.
3) мышь	c) rigid disk coated with magnetic material, for storing computer programs and relatively large amounts of data.
4) дискета	d) an electronic device that makes possible he transmission of data to or from computer via telephone or other communication lines.
5) «винчестер»	e) a set of keys, usually arranged in tiers, for operating a typewriter, typesetting machine, computer terminal, or the like.
6) модем	*f)* volatile computer memory, used for creating, loading, and running programs and for manipulating and temporarily storing data; main memory.
7) экран	g) central processing unit: the key component of a computer system, containing the circuitry necessary to interpret and execute program instructions.
8) ПЗУ	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.
9) ОЗУ	i) a thin, usually flexible plastic disk coated with magnetic material, for storing computer data and program.

Exercise 11. How much do you know about computers? Work in pairs and answer the questions.

1. What is a computer?
2. What does a computer do?
3. What are the main components of a computer?
4. Have you got a computer at home? What type is it?
5. What do you generally use your computer for?

THEME 10. AUTOMATION AND ROBOTICS

Topic vocabulary

sequence — последовательность
assembly plant — сборочный завод
non-manufacturing — непроизводственный
device — устройство, прибор
resemble — походить
efficiency — эффективность
flyball governor — центробежный регулятор
household thermostat — бытовой термостат
punched — перфорированный
aid — помощь
dimension — измерение, размеры
equipment — оборудование
sequence — последовательность
initial — первоначальный, начальный
investment — инвестиция, вклад
to facilitate — способствовать
rate — скорость, темп
assembly machines — сборочные машины
quantity — количество
non-productive — непроизводительный
changeover — переход, переналадка
handling — обращение
transfer — передача, перенос
location — местонахождение
pick up — брать, подбирать
arrangement — расположение
to utilize — утилизировать, находить применение
gripper — захват
to grasp — схватывать
spot welding — точечная сварка
continuous — непрерывный
arc welding — электродуговая сварка
spray painting — окраска распылением
frame — рама
spray-painting gun — распылитель краски
grinding — шлифование
polishing — полирование
spindle — шпиндель
manual — ручной
labour — труд
hazardous — опасный
shift — смена

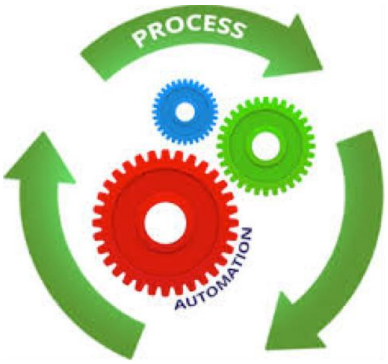
Exercise 1. Read and translate the text.

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 non-manufacturing 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 automatically 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 dialing and transmission are all done automatically. Railways are also controlled by automatic signaling 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.

Exercise 2. Answer the following questions.

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 3. 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
6. принцип обратной связи
7. механизм может разгоняться и тормозить
8. компьютер автоматически посылает команды

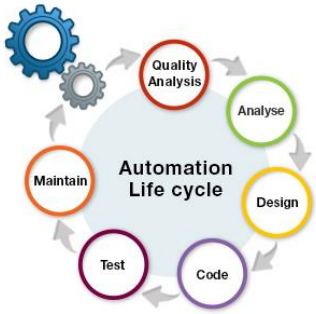
5. интегрированная система производства
9. высокоавтоматизированная система
10. непроизводственная система

Exercise 4. Read and translate the text.

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 umerical-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.

Exercise 5. Answer the following questions.

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 6. Find equivalents in English in the text.

1. сфера применения
2. фиксированная последовательность операций
5. станок с числовым программным управлением
6. потерянное производственное время

3. автоматические сборочные машины
4. определенные химические процессы
7. разнообразная продукция

Exercise 7. Explain in English the meaning of the following word combinations.

1. automation technology
2. fixed automation
3. assembly machines
4. non-productive time
5. programmable automation
6. computer terminal
7. numerical-control machine-tool

Exercise 8. Read and study these words.

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 **grip-per** 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 an 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 is too heavy and difficult to handle,
4. the operation allows the robot to be used on two or three shifts.

Exercise 9. Answer the following questions.

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 10. 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 производство разнообразной продукции.

Exercise 11. Read the text about automation and match the words with their definition.

Mechanisation refers to the process of providing human beings with machinery capable of assisting them with the muscular requirements of work. A further development of mechanisation is represented by automation, which implies the use of control systems and information technologies to reduce the need for both physical and mental work to produce goods.

Automation has had a great impact on industries over the last century, changing the world economy from industrial jobs to service jobs. In manufacturing, where the process began, automation has meant that the desired results can be obtained through a series of instructions made automatically by the system, which define the actions to be done. Automated manufacturing grants higher consistency and quality, while reducing lead times and handling. It also improves work flow and increases the morale of workers when a good implementation of the automation is made.

However, the purpose of automation cannot be seen only in terms of a reduction of cost and time; there are several more aspects to be taken into consideration. For example, while it is true that automation offers a higher precision in the manufacturing process, it is also true that it requires skilled workers who can make repairs and manage the machinery. The following table sums up the main advantages and disadvantages of automation:

Advantages	**Disadvantages**
1. Speeding up the developmental process of society	1. Sharp increase in unemployment rate due to machines hard physical or monotonous work replacing human beings
2. Replacing human operators in tasks that involve in tasks that involve hard physical or monotonous work	2. Technical limitations as current technology is unable to automate all the desired tasks
3. Saving time and money as human operators can be employed in higher-level work	3. Security threats as an automated system may have a limited level of intelligence and can make errors
4. Replacing human operators in tasks done in dangerous environments (fire, space, volcanoes, nuclear facilities, underwater)	4. Unpredictable costs due to research and development, which may exceed the cost saved by the

automation itself

5. Higher reliability and precision in performing tasks

6. Economy improvement and higher productivity

5. High initial costs as the automation of a new product requires a large initial investment

1. manufacturing	a. the time between the design of a product and its production
2. information technologies	b. the amount of confidence that a group of people have
3. goods	c. a set of tasks performed to complete a procedure
4. service jobs	d. the process of packing and distributing goods
5. skilled	e. the industry in which machinery is used to produce goods
6. morale	f. the development and application of computer systems
7. unemployment	g. having the knowledge and the ability to do something well
8. lead times	h. things that are made to be sold
9. handling	i. i.jobs in transports, communications, hospitals, energy industry, etc.
10. work flow	j. the state of not having a job

Exercise 12. Read the text about automation technologies and answer the questions.

Numerical control over automated devices has resulted in a rapidly expanding range of applications and human activities. Computer-aided technologies (CAT) is a broad term that means the use of computer systems to aid in the design, analysis, and manufacture of products, by serving the basis for mathematical and organizational tools used to create complex systems. It includes computer-aided design (CAD software) and computer-aided manufacturing (CAM software).

The current limit of computer-aided technologies is that some abilities are well beyond the capabilities of modern mechanical and computer systems. Moreover, these technologies require high-skilled engineers and the synthesis of complex sensory data to work properly. As for costs involved, in some cases, automation is more expensive than mechanical approach.

Thanks to the incredible improvements in automation technology, a number of other technologies have developed from it, such as domotics and robotics.

Domotics is a field in building automation aimed at the application of automation technologies in households for the comfort and security of its residents. This means that lights, heating and conditioning systems, windows shutters, kitchen equipment and surveillance systems can be controlled by a remote control or even by a cell phone at a distance.

Robotics is a special branch of automation in which the automated machines have certain human features and are used to replace human workers in factory operations. Robots are computercontrolled mechanical devices that are programmed to move, manipUlate objects and interact with the environment. Nowadays more and more sophisticated robots are being built to serve various practical purposes, for example in houses, businesses, in the army and for medical appliances for disabled people.

1. What does computer-aided technologies mean?
2. Which software does CAx include?
3. What are the current limits of CAx?
4. Can you name two applications of automation technologies?
5. How does a domotic house differ from a traditional house?
6. What are robots used for?

THEME 11. TECHNICAL DRAWING

Topic vocabulary

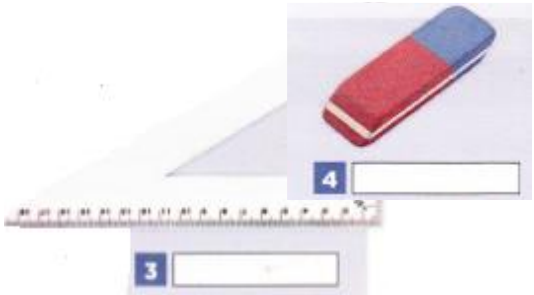
to carry out - осуществлять
to replace - заменять
drafter – чертежник, составитель
ruler - линейка
drafting - черчение
skill – мастерство, навык
to fit – подгонка
technical drawing - тех.рисунок, чертеж
hardness - трудность, твердость
to save - сохранять
triangle - треугольник
prototype - образец, пример
T-square –инструмент Т-образной формы
protractor – транспортир
width - ширина

Exercise 1. Read the text and label the pictures.

TECHNICAL DRAWING

Technical drawing, also known as drafting, is the act and discipline of composing plans. The main purpose of technical drawing is to describe or explain all the characteristics of a product, giving all the necessary information that will help a manufacturer to produce that component. The visual image should be accurate in terms of dimensions and proportions, and should provide an overall impression of what an object is or does. It is a precise task requiring a high level of skill and suitable engineering tools. A drafter is the person who makes a drawing and who requires a wide knowledge of geometry, trigonometry and spatial comprehension and in all cases must be precise and accurate and give great attention to detail.

People who communicate with technical drawings use a visual language and technical standards that define practical symbols, perspectives and units of measurement. What are the tools and instruments used by a drafter in manual drafting? A T-square, a protractor, a compass, rulers, and triangles. Paper is also important and can be divided into layout paper, which is thin and fragile, and cartridge paper, which is heavier and more suitable for final drawings. Pencils used in drawing are graded from H to F depending on the hardness. The final drawing is made using a technical pen, graded according to the point, which must maintain the same line width . They are used with a range of stencils to add symbols, letters and patterns to the drawing. Rubbers remove pencils or pen writing when mistakes are found. Correction fluid is used to mask text errors.



Exercise 2. Read the text again and choose the correct answer.

1. Technical drawing is needed to ...
A make a scale of the product.
B practice pens, rulers and stencils.
C let the manufacturer understand the requirements.

2. The drafter needs .. .
A some paper and a pencil.
B a wide range of technical instruments.
C the final product.

3. Paper is chosen considering .. .
A what sort of drawing the drafter is going to make.
B the pencils he/she is going to use.
C the drafter's preference.

4. Pencils are graded according to ...
A hardness.
B hardness and colour.
C hardness and point.

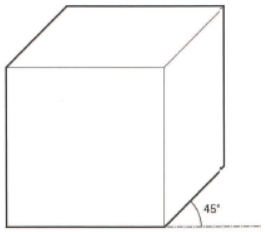
5. A technical pen .. .
A makes regular lines.
B maintains the same line width .
C draws lines of the same length .

6. When mi stakes are found .. .
A we can't correct them .
B they're removed with correction fluid .
C stencil can cover them.

Exercise 3. Read the text.

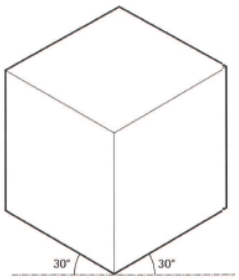
THREE-DIMENSIONAL DRAWINGS

An oblique projection shows an object with one of its faces at the front. Lines at 45 degrees from the horizontal show the 3D shape of the object.



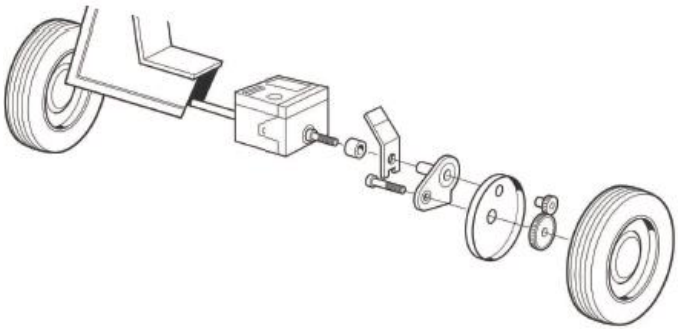
An oblique projection

An isometric projection shows an object with one of its corners at the front. Lines at 30 degrees from the horizontal show the 3D shape of the object.



An isometric projection

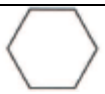
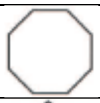
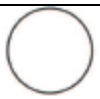
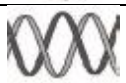
An exploded view shows an assembly with its components spaced out, to show how the components fit together.


An exploded view showing part of a lawnmower.

Exercise 4. Study the table.

The nouns and adjectives below can be used to describe the shapes of components and assemblies.

2D shapes			3D shapes		
Noun	**Adjectives**		**Noun**	**Adjectives**	

square	square		cube	cubic	
rectangle	rectangular		cylinder	cylindrical	
triangle	triangular		tube	tubular	
hexagon	hexagonal		sphere	spherical	
octagon	octagonal		hemisphere	hemispherical	
pentagon	pentagonal		dome	dome-shaped	
circle	circular		cone	conical/cone-shaped	
semicircle	semicircular		pyramid	pyramidal/pyramid-shaped	
spiral	spiral		helix	helical	
			wedge	wedge-shaped	

Exercise 5. Work in pair. Give a description of some objects you like.

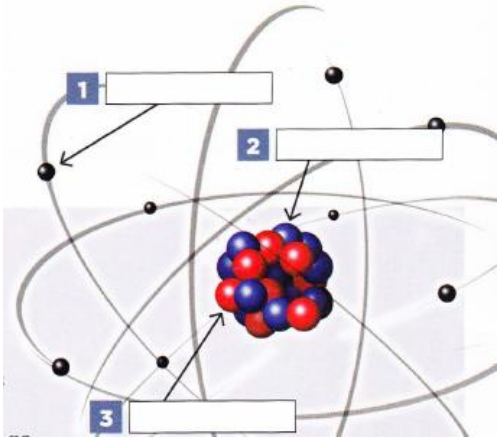
THEME 12. WHAT IS ELECTRICITY

Topic vocabulary

charge - заряд
to pass through – проходить по/через
coated – покрытый
property – свойство
semiconductor - полупроводник
current flows – ток проходит
shell – орбита, наружная оболочка
steady – постоянный, устойчивый
impurity – примесь
to switch off - выключать
insulator – изолятор
valence - валентность
halfway – пол оборота, пол пути
to orbit – вращаться по орбите

Exercise 1. Read the text and label the picture with the name of each part.

All substances, solids, liquids or gases, are composed of one or more of the chemical elements. Each element is composed of identical atoms.



Each atom is composed of a small central nucleus consisting of protons and neutrons around which orbit shells of electrons. These electrons are very much smaller than protons and neutrons.

The electrons in the outermost shell are called valence electrons and the electrical properties of the substance depend on the number of these electrons.

Neutrons have no electric charge, but protons have a positive charge while electrons have a negative charge. In some substances, usually metals, the valence electrons are free to move from one atom to another and this is what constitutes an electric current.

Exercise 2. Read the text again and complete the sentences with the missing information.

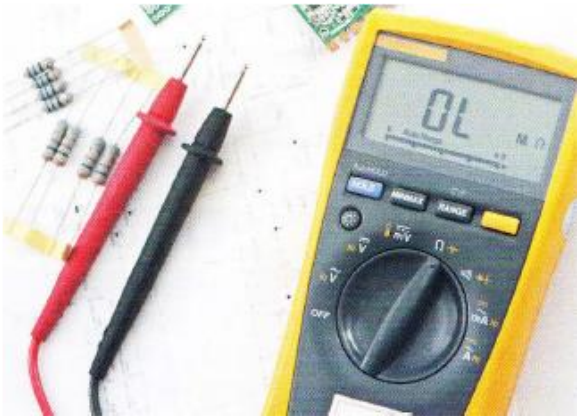
1. Elements make up _____
2. Identical atoms _____
3. Atoms consist of _____ and _____
4. Inside there are _____ and , while outside _____
5. Shells _____
6. Valence electrons _____
7. Neutrons do not have _____
8. Electricity is generated when _____

Exercise 3. Read the text again and decide if the following statements are true (T) or false (F), then correct the false ones.

1. A flow of electrons moving inside a conductor creates an electric current.
2. A generator is used to move the charges.
3. Electrons can easily pass through any material.
4. Any material is a good conductor.
5. Conductors are coated with insulators.
6. The presence of free electrons affects the conductivity of materials.
7. Impurities are introduced to increase conductivity.
8. Insulating materials resist the flow of electrons.

Exercise 4. Read the text and complete the table with the missing information.

There are two types of current: Direct current (DC) and Alternating current (AC).



Direct current is a continuous flow of electrons in one direction and it never changes its direction until the power is stopped or switched off.

Alternating current constantly changes its direction because of the way it is generated. The term 'frequency' is used to indicate how many times the current changes its direction in one second.

Alternating current has a great advantage over direct current because it can be transmitted over very long distances through small wires, by making energy high voltage and low current.

There are several quantities that are important when we are talking about electric current. Vols (V) - so named after the Italian physicist Alessandro Volta - measure the difference of electric potential between two points on a conducting wire. Amperes (A) measure the amount of current flowing through a conductor, that is to say the number of electrons passing a point in a conductor in one second.

Coulomb (C) measure the quantity of charge transferred in one second by a steady current of one ampere. Power is the rate at which work is performed and it is measured in watts (W). A Kilowatt (kW), which is equal to one thousand watts, is used to measure the amount of used or available energy. The amount of electrical energy consumed in one hour at the constant rate of one kilowatt is called kilowatt-hour.

Unit of measurement	**What does it measure?**
(1) _____	the number of electrons passing a given point in a conductor in one second
(2) _____	the quantity of electricity transferred by a steady current of one ampere
(3) _____	the amount of electric energy used
(4) _____	the difference of potential between two point'.on a conductor
(5) _____	rate at which work is done

Exercise 6. Complete the text with the missing information.

Electricity consists of a (1) _____ of free electrons along a conductor. To produce this current flow, a generator is placed at the end of the conductor in order to move the (2) _____.

Conductors. Electricity needs a material which allows a current to pass through easily, which offers little (3) _____ to the flow and is full of free electrons. This material is called a conductor and can be in the form of a bar, tube or sheet. The most commonly used (4) _____ are wires, available in many sizes and thicknesses. They are coated with insulating materials such as plastic.

Semiconductors. Semiconductors such as silicon and germanium are used in transistors and their conductivity is halfway in between a conductor and an (5) _____. Small quantities of other substances, called impurities, are introduced in the material to (6) _____ the conductivity.

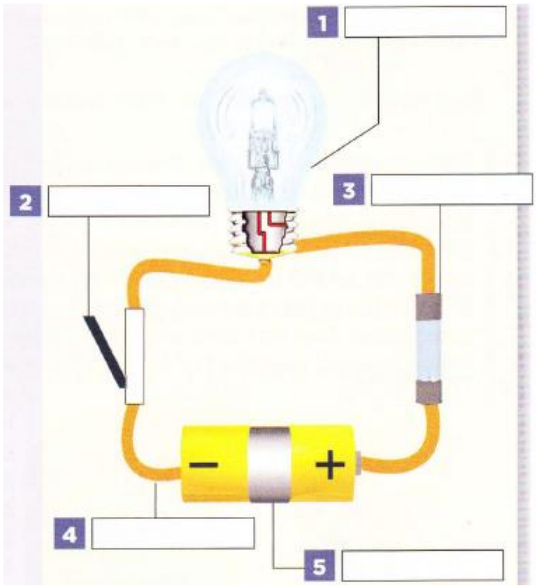
Insulators. A material which contains very (7) _____ electrons is called an insulator. Glass, rubber, dry wood and (8) _____ resist the flow of electric charge, and as such they are good insulating materials.

THEME 13. ELECTRIC CIRCUIT

Topic vocabulary

to arrange – располагать, упорядочивать
power source – источник напряжения
branch - отвод
to prevent - предотвращать
to burn out – потухать, сгорать
series circuit – параллельное соединение
parallel circuit – параллельное соединение
device - устройство, прибор
short circuit – оборванная, разомкнутая цепь
socket - розетка
fuse - предохранитель
light bulb – лампа накаливания
load - нагрузка
to turn into – превращаться в
to melt - плавить
undue – чрезмерный, несоответствующий
fault - повреждение

Exercise 1. Read the text and label the picture with the name of each part.



An electric circuit or network is a pathway through which the electric current can flow. A simple circuit consists of a power source, two conducting wires, each one attached to a terminal of the source and a device through which electricity can flow. This device is called a load and it's attached to the wires. If all the parts are properly connected, the current flows and the lamp lights up. This kind of circuit is called 'closed'.

On the contrary, if the wires are disconnected the circuit is called 'open' or 'broken'. The

circuit can be opened and closed by a device called a switch.

Loads can turn electrical energy into a more useful form. Some examples are:

• light bulbs, which change electrical energy into light energy;

• electric motors, which change electrical energy into mechanical energy;

• speakers, which change energy into sound.

The source provides the electrical energy used by the load. It can be a storage battery or a generator. The switch interrupts the current delivered to the load by the source and allows us to control the flow.

When an abnormally high amount of current passes through a network, you get a short circuit. This may occur when there is a drop in the resistance or a broken insulation. In order to prevent short circuits, it is best to use fuses, which melt when too much current flows through them, interrupting in this way the circuit.

Exercise 2. Match the words with their definitions.

1. load	a. a device which interrupts the circuit
2. switch	b. a circuit in which wires are disconnected
3. source	c. a device which provides power
4. fuse	d. a complete circuit with no breaks at all
5. closed circuit	e. a device which consumes electric power
6. broken circuit	f. a protective device

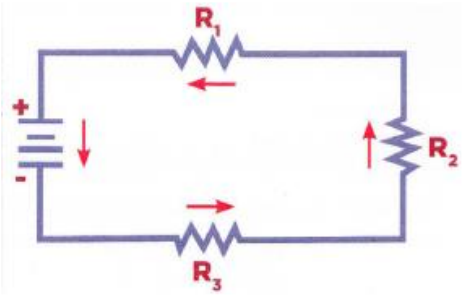
Exercise 3. Read the text again and answer the following questions.

1. What does a simple circuit consist of?

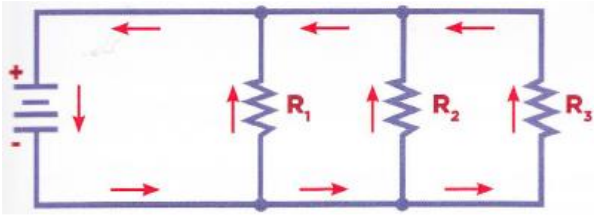
2. What is the fun ction of a switch?
3. When does a short circuit occu r?
4. What happens to the lamp in a closed circuit?
5. Can you name some examples of loads?
6. What is a generator?
7 What can we use to prevent short circuits?
8 How does a fuse work?

Exercise 4. Complete the texts with the words in the box. Then listen and check.

components	current	turn on	branch	amount	positive
appliances	continue	burns out	path		



The (1) *components* of a circuit can be wired in two different ways:
series or parallel. If components are arranged one after another to form a single (2) _____ between the terminals and the components, the circuit is known as a series circuit. In this type of circuit, the (3) _____ flows from the negative terminal to the (4) _____terminal, passing through all the other components of the circuit. This means that the (5) _____ of energy passing through all the components in the series is the same. The main disadvantage of a series circuit is that when a single component in the path (6) _____,the entire circuit stops operating (e.g. Christmas tree lights).
A parallel circuit consists of several paths connecting the different components. Each separate path is called a (7) _____of the circuit. Current from the source divides and flows through the different branches.



Unlike series circuits, if one of the components in the parallel circuit burns out, the other paths (8) _____ to operate. Parallel circuits are commonly used to connect (9) _____ at home, so that each socket can function independently.
For example, you don't have to (10) _____ the light in your room for the TV socket to work.

Exercise 5. Read the text and find synonyms for the words below.

A fuse can be added to an electric circuit to protect it from the effects of **undue** power. This safety device, which is made of a heat-sensitive alloy, is connected in series with the circuit it has to protect. If an excessive amount of current flows through the circuit, the alloy will liquefy and open the circuit. A circuit breaker is fundamental in a house to protect circuits against overloading, overheating and short circuits. The advantage of a circuit breaker is that it can be reset after the overloading by replacing the fuse. A professional electrician should always provide his customers with a map of the electric circuit in the house so that it will be easier to work on it in case of **faults.**

1. excessive: _____ 2. reacting to high temperatures: _____3. to melt: _____
4. loading up: _____ 5. adjusted: _____ 6. clients: _____

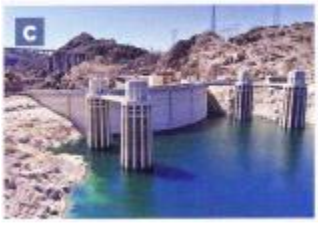
THEME 14. HOW ENERGY IS PRODUCED

Topic vocabulary

array - схема расположения, совокупность элементов
power plants - электростанции
to release - высвобождать
blade – лопасть
reliable – надежный, прочный
renewable - возобновляемый
dam – плотина
to require - требовать
to damage – повреждать, наносить вред
shoreline – береговая линия
splitting - разделение
fuel – топливо
to step down - снижаться
to step up - повышаться
maintenance – наладка
manure – органическое удобрение
tide – морской прилив, отлив
network – сеть
turbine - турбина
to occur – случаться, происходить, встречаться
waste - отходы

Exercise 1. Have you ever wondered where the electricity in your house comes from? Read the texts about the different types of power plants and match them with the pictures.

CONVENTIONAL POWER PLANTS



1. Nuclear power plants

About 10% of the world's electric power is produced by nuclear power plants. Nuclear power requires little fuel and causes much less air pollution than other power plants, but it can cause severe health and environmental problems when accidents occur, with a consequent release of radioactive material. This type of energy is produced by the splitting of atoms of uranium, which releases heat.

This process - called fission - produces large amounts of steam, which is used to turn the blades of turbines thus creating energy. The main problems with nuclear power are linked to the location of the power plants, as people are not willing to have these plants near their homes, and the disposal of waste material, which stays radioactive for centuries.

2. Thermoelectric power plants

They provide about 2/3 of the world's electricity. These plants burn fossil fuels, such as coal, oil or natural gas, which are all non-renewable resources. This means that in the future there will be a limited supply of these resources. The main advantage of thermoelectric power plants is that they are reliable and can meet the demand in peak periods. Electricity is generated by heating water in a boiler to create steam, which is then

pressurised and used to turn the blades of giant turbines that produce electricity. These

3. Hydroelectric power plants

The energy produced by water can be captured and turned into electricity. The use of a dam on a river allows hydroelectric power plants to store water in an artificial lake, or reservoir.

When released, the force of the water spins the blades of giant turbines, which are connected to a generator producing energy.

Hydropower is one of the most important renewable energy resources, because it is re liable, efficient and does not pollute the air. Although it has high initial costs, it is cheap to operate.

power plants cause environmental pollution because of the combustion of fossil fuels which release carbon dioxide. Unfortunately, it has a great impact on the environment, as humans, animals and plants may lose their natural habitats.

Exercise 2. Read the texts again and decide if the following sentences are true (T) or false (F), then correct the false ones.

1. Nuclear power plants do not produce air pollution at all.
2. Accidents in nuclear power plants can have terrible consequences for the environment.
3. Nuclear power plants produce biodegradable waste material.
4. Thermoelectric power is generated by the combustion of renewable resources.
5. Thermoelectric power plants are environmentally friendly.
6. Dams are built on rivers to store water.
7. The water released from the reservoir flows through the generator.
8. The only disadvantage of hydropower is its high initial cost.

Exercise 3. Read the texts about alternative power sources and complete the table with the missing information.

ALTERNATIVE POWER SOURCES

Environmental problems such as the **greenhouse effect** and air pollution have led scientists to find alternative power sources which are renewable and less polluting.

SOLAR ENERGY

Sunlight can be directly converted into electricity by solar cells made of silicon. When light strikes the cells, a part of it is absorbed by the semiconductor material. The energy of the absorbed light **knocks** electrons loose, allowing them to flow freely and produce electricity. The process of converting light (photons) into electricity (voltage) is known as the photo-voltaic process (PV). Solar cells are usually combined into panels and grouped into **arrays.** Even if the initial costs can be high, the PV system provides an independent, reliable electrical power source. It can produce energy for more than 15 years and its routine **maintenance** is simple and cheap.

WIND ENERGY

Wind energy is one of the cheapest renewable technologies available today. The wind turns the blades of giant turbines, producing in this way kinetic energy which is then converted into mechanical power and electricity by a generator. The main disadvantage of wind energy is that there are few suitable wind sites where it is possible to have a constant production of electricity.

TIDAL ENERGY

This alternative power source, which is placed in areas with high tidal movements and are designed to capture the kinetic energy of rising and falling tides. The turbines are driven by the power of the sea both when the tide comes in and when it goes out. The problem with tidal power is that only massive

increases in tides can produce energy and there are very few places where this occurs. Moreover, the aquatic ecosystem and the **shoreline** can be **damaged** by the changes in the tidal flow.

GEOTHERMALENERGY

In the past, people used **hot springs** for bathing, cooking and heating. Geothermal energy is based on the fact that the Earth is hotter below the surface. The hot water which is stored in the Earth can be brought to the surface and used to drive turbines to produce electricity or it can be **piped** through houses

as heat. This energy is cheap and has a low impact on the environment, but there are few sites where it can be extracted at low cost.

BIOMASS ENERGY

Biomass is a renewable energy source deriving from plant material and animal waste. When it is burnt, it releases its chemical energy as heat. Biomass fuels include forest residues (such as dead trees, branches and tree **stumps), straw, manure** and even municipal solid waste. Biomass energy is a natural process, it is carbon neutral and has low initial costs. It used to be the main source of heating at home in the past

typically used in coastal areas, turns the potential energy of **tides** into electricity. Tidal power generators use rising and fallingtides in much the same manner as hydroelectric power plants. Large underwater turbines are and it continues to be highly exploited in the developing world. The main disadvantage of biomass is that it has a smaller potential than other energy sources and requires excellent maintenance skills.

Type of energy	How it works	Advantages	Disadvantages
			high initial costs
Wind energy			
		It is *a natural process because it exploits the potential energy of tides.*	

Exercise 4. Match the words with their definitions.

1. array	a. a spot where hot water comes up naturally from the ground
2. kinetic	b. unwanted material left after using
3. tide	c. a group of things arranged in a particular way
4. hot spring	d. waste material from animals used as fertilizer
5. to pipe	e. the process of keeping something in good condition by regularly checking it
6. manure	f. produced by motion
7. waste	g. to send a liquid or a gas through a tube
8. aintenance	h. the regular change in the level of the sea caused by gravitational attraction of the

Exercise 5. Read the text about the electrical distribution system and complete it with the words in the box.

pole	demand	lower voltages	consumers	high-voltage
power plants	delivery appliances	**network**	transformer	

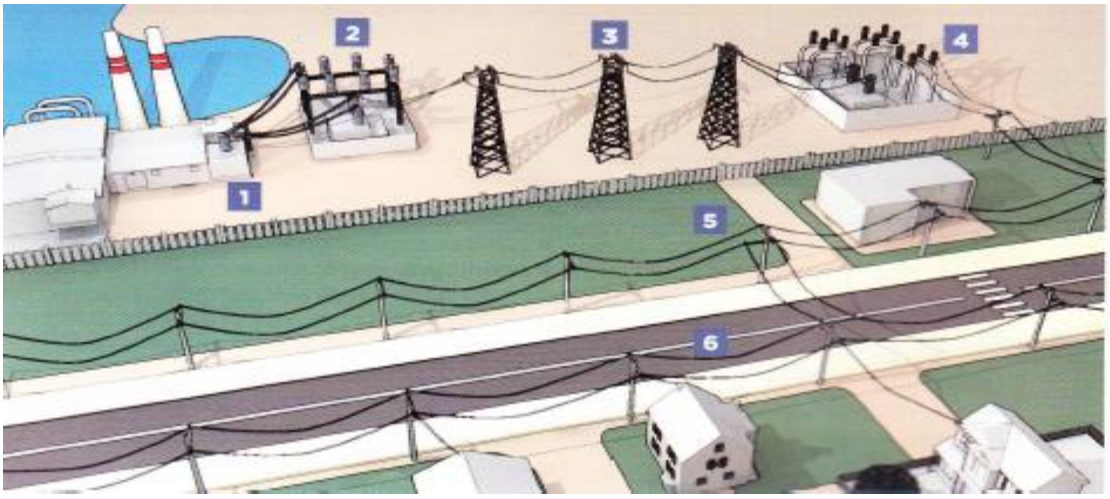
Electricity distribution is the final stage in the (1) of electricity to end users. In order to be able to use electric power for our daily activities, electricity must be transmitted from the (2) _____ to other areas where it can be distributed to different (3) _____ The electricity generated by power plants is increased or stepped up at substations and distributed through (4) _____ transmission lines, in order to minimize energy losses and to economise on the material needed for conductors. Transmission lines use voltages as high as 765,000 volts and they are usually connected in a (5) _____. This means that if a station receives an unexpected (6) for electric power, it can call on the other stations to help to meet the demand.

Then electrical power is converted from high voltage to (7) thanks to step-down transformers which turn electricity into different power levels. Once it is sent to your neighbourhood, another small (8) mounted on a (9) converts the power to even lower levels to be used at home. The final voltage is between 110 volts - for lights, TVs, and other smaller appliances – and 240 volts for larger (10) _____.

Exercise 6. Reorder the different stages in the distribution system and match them to the numbers in the picture.

a) Transmission lines carry high-voltage electricity to different substations.

b) Electricity leaves the power plant.
c) Electricity is **stepped down** by transformers.
d) Current at lower voltages is transmitted to homes and offices.
e) The voltage is increased at a step-up station.
f) Power levels are lowered by small transformers mounted on poles.



Exercise 7. Read the text again and match each sentence with its ending.

1. Power plants generate
2. Transmission lines are used
3. High voltages mean
4. Step-down transformers
5. Substations can help each other
6. The current transmitted by poles

a. convert electricity from high voltage levels to lower levels.
b. in case of an expected demand for electric power.
c. a reduction in energy losses during transmission.
d. power and distribute **it** to substations.
e. can be safely used in businesses and homes.
f. to distribute high-voltage electricity to a network of substations.

THEME 15. WHAT IS ELECTRONICS?

Topic vocabulary

breadboard – макетная плата
broadcasting - радиовещание
to convey - передавать
to decode - расшифровывать
further - дальнейший
huge - огромный
incoming - поступление
layer – слой, пласт
operating system – операционная система
outgoing – исходящий
to pave the way – прокладывать путь
peripheral – внешнее устройство
signal – команда, знак, сигнал
slice – часть, доля
soldering - запайка
to speed up - ускорять
spring clip – пружинная обойма
tiny - крошечный
wave – волна
application – применение, приложение
certain - определенный
compatible - совместимый
computing - вычислительный
to demand - требовать
digitization - переход на цифровой формат
to increase - увеличиваться
inside - внутри
previously - прежде
purpose - цель
to reduce - уменьшать

Exercise 1. Read the text and complete the table with the missing information.

MAIN INVENTIONS IN ELECTRONICS

Electronics is the branch of science which controls electricity in order to convey a signal using semiconductor materials. These signals represent numbers, letters, sounds, pictures, computer instructions or other information. Radio systems were developed to read and understand these signals and in 1920 radio broadcasting started , making it possible for electromagnetic waves to travel long distances.

More sophisticated devices were needed during the Second World War and the invention of radar (Radio Detection and Ranging) represented a further step in electronics, making it possible to determine the altitude, direction and speed of moving and fixed objects.

The invention of television in the 1920s was one of the most revolutionary and popular inventions in history and it showed the importance of electronics in certain branches of industry. For the first time in history it became possible to transmit images and sound over wire circuits.

The first computer appeared in 1946. This machine, which could solve a wide range of computing problems, was built over a period of three years by a team of American scientists working at the University of Pennsylvania. It was a huge machine weighing almost 50 tons.

The first transistor was assembled in 1957 by a team of scientists working at the Bell Laboratories in the U .S.A, and it was a real coming of age in the science of electronics because it replaced the use of valves. Transistors are very small, easy to handle, cheap, and they use little power.

The silicon chip - which followed the transistor in the 1960s – can contain up to several thousand transistors packed and interconnected in layers beneath the surface. It is really tiny (usually less than one centimetre square and about half a millimetre thick) and it has paved the way to microelectronics.

Electronics has influenced and improved the way information is

stored, processed and distributed. Social and personal life has been deeply affected by these inventions and many financial, business, medical, education and political routines have been speeded up.

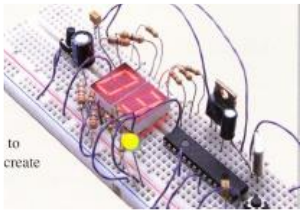
Invention	Year	Function
		read and understand electronic signals
Radar		
	1920s	

Exercise 2. Read the text and answer the questions.

DIFFERENT KINDS OF ELECTRONIC CIRCUITS

A conventional electronic circuit is made of separate components attached to a base called a printed circuit board (PCB). Before being finalised and manufactured, the electronic circuit must be tested many times on an experimentation board called a breadboard. It consists of a perforated block of plastic with several spring clips connected by copper wires. It doesn't require soldering as its components can be pushed straight into the holes, so it is easy to change connections and replace pieces. It is generally used to create temporary prototypes and experiment with circuit design.

The integrated circuit, also known as a chip, is one of the most important inventions of the 20th century. Integrated circuits are used in almost all electronic equipment today, for example watches, calculators and microprocessors. It consists of millions of transistors and other electronic components combined to form a complex set on a thin slice of silicon or other semiconductor material. Chips are becoming tinier and tinier and they are produced in large quantities so that costs are reduced. Since signals have to travel a short distance, they work faster, consume less power and generate less heat. They are also more reliable given the limited amount of connections which could fail.



The microprocessor is the heart of any normal computer: it is a logic integrated circuit chip which can carry out a sequence of operations when it receives instructions from different input devices . As it doesn't contain a large memory, it can't work alone but needs to be supported by other integrated circuits to be connected with peripherals.

Most microprocessors are found inside computers and are called the CPU (Central Processing Unit). In order to work properly, the microprocessor needs to receive instructions from a memory chip. These instructions are then decoded, executed and elaborated so as to get the results available. The most sophisticated microprocessors can contain up to 10 million transistors and run 300 million cycles per second. It means that the computer can perform about a billion instructions every second. As technology continues to evolve, microprocessors are becoming tinier and tinier.

1. What is a conventional circuit made of?
2. What does PSB stand for?
3. What is a breadboard?
4. What does a chip consist of?
5. What is a chip made out of?
6. What are the advantages of chips compared to conventional electronic circuits?
7. What is a microprocessor?
8. How many instructions can computers perform?

Exercise 3. Read the text again and match the words with their definitions.

1.	prototype	a. to convert an electrical signal into another code
2.	perforated	b. the act of joining metallic parts
3.	soldering	c. an original model used to test a circuit or a product
4.	to fail	d. to perform ineffectively
5.	peripheral	e. having a series of holes
6	to decode	f. an auxiliary device that works with a computer

Exercise 4. Read the text and complete it with the words in the box.

cell	lines	microprocessor	photos	radio signals
flash emails		antenna	movement	

MOBILE PHONES

A cellular phone (or mobile phone) is designed to give the user freedom of (1) _____ while using a telephone. It uses (2) _____ signals to communicate between the phone and the (3) _____. The server area is divided into smaller areas called cells and an antenna is placed within each cell and connected by telephone (4) _____. These lines connect cellular phones to one another: a computer selects the antenna closest to the telephone when a call is made. If the phone moves to one serving (5) _____ to another, the radio signal is transferred to the actual cell without interrupting the conversation.

The circuit board is the heart of the system. A chip translates the outgoing and incoming (6) _____ from analogue to digital and back from digital to analogue. The (7) _____ handles all the functions for the keyboard, the display and the loudspeakers, and it controls the signal to the base station.

Other (8) memory chips provide storage for the operating system.

A cellular phone is not only a phone but it provides an incredible amount of functions:

- store information;
- use a calculator;
- send and receive (9) _____
- surf the Internet;
- play simple games;
- play music, take (10) _____ and videos.

Can you imagine your life without your mobile phone?

Exercise 5. Decide if the following statements are true (T) or false (F).

1. Mobile phones use radio signals to communicate.
2. The server area is divided into smaller areas cal led stations.
3. An antenna is placed every two or three cells.
4. Communication with a mobile within a cell is independent from the base station.
5. There are interruptions when you move to one cell to another.
6. The antenna is the heart of the system .
7. The signal must be translated.
8. The flash memory hand les all the functions.
9. Loudspeakers are controlled by the microprocessor.
10. You can text and send emails with your mobile phone.

Exercise 6. Read and translate the text.

INDUSTRIAL ELECTRONICS

Hundreds of electronic equipments are now used for scientific, industrial and everyday purposes. They help to do jobs better or more rationally than before and take over jobs that couldn't be done otherwise. So, industrial electronics undoubtedly plays a very important role today. You can easily find many electronic equipments at home: a tape recorder, a TV set, an MP3 player, a computer and many others.

The application and use of electronic equipments demands a good knowledge of their fundamentals.

In meters and lamps electricity flows in the wire. But inside any transistor or microchip (and previously, in radio tubes) electric current passes through the space (or semiconductor) separating certain parts in this detail. Such action is called electronic. It's not difficult to imagine it because the same happens in lightning. There you actually see how electricity jumps through space.

The first electronic equipments used radio lamps. They were: a radio set, a TV set, computing machines (predecessors of modem calculators), computers (which occupied big rooms), tape recorders.

The next stage came when transistors were invented. The devices became more powerful and much smaller. The number of devices increased greatly, some multifunctional devices appeared (radio + tape recorder). Computers and calculators became smaller: cassette recorders and videocassette recorders appeared.

The next period was the period of microchips. They helped to reduce big parts of devices, computers and other devices.

The latest period of industrial electronics development is the period of total digitization of all electronic devices, making them compatible with the computer. Photos are no longer made on film but on memory cards, cassettes and video cassettes are out of use. Television is also becoming digital. Industrial electronics is a great part of our leisure time; it makes people's lives easier, and reduces their working time.

Exercise 7. Answer the following questions to the text.

1. For what purposes are electronic equipments used now? What do they help us to do?
2. Industrial electronics plays an important role today, doesn't it?
3. What electronic equipments are usually found at home? What can you find at home?
4. What is the difference between electric and electronic devices?
5. Where do you actually see how electricity jumps through space?
6. What were the first electronic equipments based on?
7. Did the first computers look like modem ones?
8. Did the next stage come when transistors or cassettes were invented?
9. Why did computers become smaller when microchips were introduced?
10. How is the latest period of industrial electronics development called?
11. What devices became compatible with computer?
12. What does electronics mean in our life?
13. Do you think that electronics does only good to people?
14. What will be the next period of industrial electronics development, in your opinion?

Exercise 8. Insert the missing words.

1. In lighting electricity _____through_____.
2. What do you like more: watching _____or listening to the _____?
3.I can't _____how people lived without _____devices.
4. Do you have any _____at home? No, I have only disks. I'm for _____.
5. Does this camera have much _____? No, this camera is not digital. It has a 5-millimetre _____.
6. Devices which have _____, and not tubes are much smaller and much more powerful.
7. The number of digital devices _____every year. We depend on _____more and more.

8. Many electronic devices are used for _____, not for work.
9. Computers and digital cameras are _____devices. It means that they can exchange information.

Exercise 9. Continue the following statements.

1. Electronic equipments are used for ...
2. You can find many electronic equipments at home: a ТУ set ...
3. Inside any transistor electric current passes ...
4. In lightning you actually see ...
5. The first electronic equipments used .. .
6. The devices with transistors become .. .
7. Microchips helped to reduce ...
8. The latest period of industria1 electronics development is ...
9. Photos are no longer made on 5-millimetre film, but ...
10. Industrial electronics makes people's life ...

Exercise 10. Write an essay on one of the following topics.

1. The role of (industrial) electronics in modern society.
2. Digitization and its influence on peop1e's leisure time.
3. The fundamentals of electronics.
4. The first electronic equipments.
5. Transistors and microchips and their influence on the size and productivity of the electronic equipments.

THEME 16. TECHNICAL ASSISTANCE

Topic vocabulary

to aim at – направлять, стремиться
alignment – расположение на одной линии, настройка
behavior – режим работы
bolt - болт
brake – тормоз, рукоятка
brake pad – тормозная накладка (колодка)
chassis – каркас, монтажная панель
consultancy - консультирование
due to – по причине, в связи
to entail - вызывать
exposure – изучение, представление
failure – отказ в работе, дефект
fouled - загрязненный
glove compartment – ящик для мелких вещей
hinge - lock – механизм узла держания
lubrication - смазка
overhaul – тщательно проверять, осматривать
to schedule – график, расписание
service book – книга тех.обслуживания
to set off – запускать, включать
spare wheel – запасное колесо
spark plug – свеча зажигания
steering wheel – рулевое колесо
to tighten – затягивать, сжимать
to tow - тащить
trailer – жилой автоприцеп
tyre - wear – износ шин
windshield – ветровое стекло

Exercise 1. Read the text and answer the questions.

MAINTENANCE

Any machine and device must be controlled regularly in order to avoid the risk of damage or breakdown of single parts due to long usage. Sometimes, if a proper maintenance is not done, a fault could occur, with negative consequences on the production process and on the workers' safety. The primary goal of maintenance is to avoid or mitigate the consequences of failure of equipment. This includes performing routine actions to keep the device in working order and prevent the failure before it actually occurs (preventive maintenance), or fixing equipment after breakdown (corrective maintenance).

Preventive maintenance is designed to preserve and restore equipment reliability by replacing worn components before they actually fail. It includes maintenance activities such as partial or complete overhauls at specified periods, oil changes and lubrication. The ideal preventive maintenance is a combination of technical, administrative and managerial actions to prevent all equipment failure. If carried out properly, preventive maintenance can extend the life of the equipment.

Corrective maintenance, sometimes simply called 'repair', is carried out to get equipment working again. It aims at restoring the functionality of a machine so that it can continue to perform its work. This type of maintenance can be very expensive because sometimes equipment needs to be replaced, with substantial costs for the company.

Generally, maintenance is scheduled according to:

- the original equipment manufacturer's recommendations;
- codes and legislation within a country;
- consultancy advice;
- previous maintenance ;
- most important measured values and performance indications.

1. Why is maintenance important?
2. What are the main types of maintenance?
3. What is the function of preventive maintenance?
4. Which activities does it include?
5. What is maintenance called if it occurs after a failure?
6. Why can corrective maintenance be expensive?

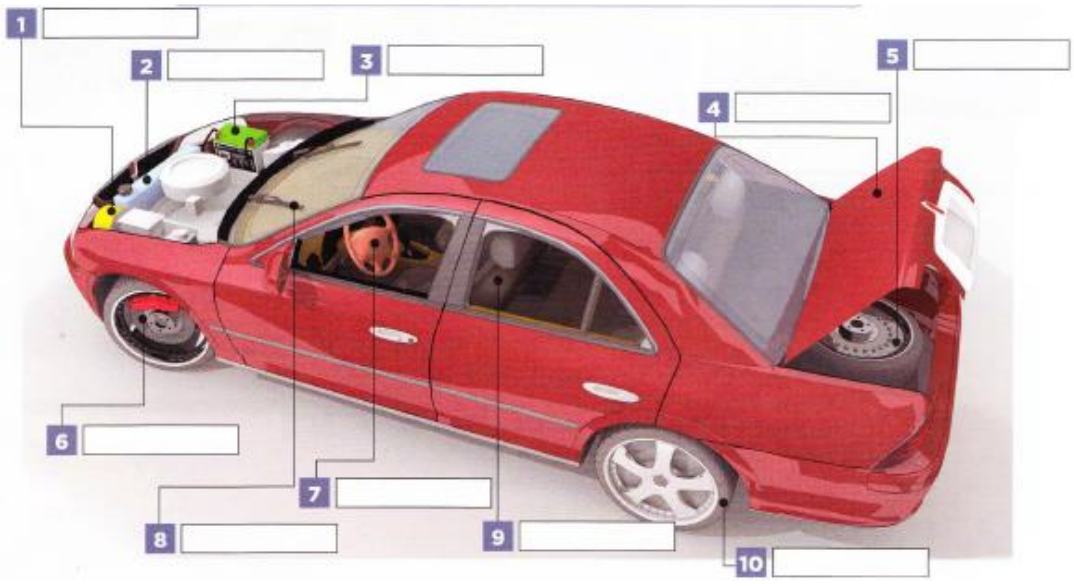
Exercise 2. Read the text again and match the words with their definitions.

1. fault	a. damaged and in poor condition as a result of much use
2. to mitigate	b. a set of rules about how something must be done
3. to fix	c. expert advice within a particular field
4. overhaul	d. applying a greasy substance to reduce friction
5. worn	e. a break or other defect in a piece of machinery
6. lubrication	f. to do the necessary work to repair something that doesn't work properly
7. code	g. to make something less severe or unpleasant
8. consuItancy	h. a careful examination of a machinery or system that must be repaired

Exercise 3. How well do you know the components of a car? Look at the picture and label each part with the words in the box.

Auto maintenance

seat battery radiator tyre spare wheel steering wheel
disk brake oil filter trunk windshield wiper



Exercise 4. In pairs, take this quiz about car maintenance, then read the text to check your answers.

Cars are not just a luxury item to purchase one day and forget about until something happens. A properly maintained car not only lasts longer, but it is also less likely to break down unexpectedly. Take this quiz and test your knowledge of car maintenance!

1. Auto maintenance doesn't entail replacing

5. If a car is exposed to extreme

fluids.
True __ False __

2. It is not possible to do preventive maintenance to cars.
True __ False __

3. Car maintenance must be scheduled keeping
in mind different factors .
True __ False __

4. The distance travelled every day doesn't affect
the functionality of a car.
True __ False __

weather conditions it must be checked more often .
True __ False __

6. It is not possible to replace windshield wipers.
True __ False __

7. Brake fluid lasts forever.
True __ False __

8. Car maintenance tasks should never be
combined in one single service.
True __ False __

Exercise 5. Read the text and match the correct maintenance task with each picture.

AUTO MAINTENANCE

Auto maintenance describes the act of inspecting or testing the condition of car subsystems (e.g.: engine, brakes, radiator, etc.) and replacing parts and fluids. Thanks to regular maintenance it is possible to ensure the safety, re liability and comfort of a car, while during preventive maintenance, a number of parts are replaced to avoid major damage or for safety reasons.

Car maintenance is usually scheduled according to different factors, such as the year or model of the car, its driving condition and driver behavior. When scheduling auto maintenance, car manufacturers recommend keeping in mind some factors that may affect the functionality of car subsystems. Some of these factors are: the number of trips and the distance travelled every

day; the exposure to particular climate conditions (extreme hot or cold); long-distance cruising and whether the car has to tow a trailer or other heavy loads.

Common car maintenance tasks include:

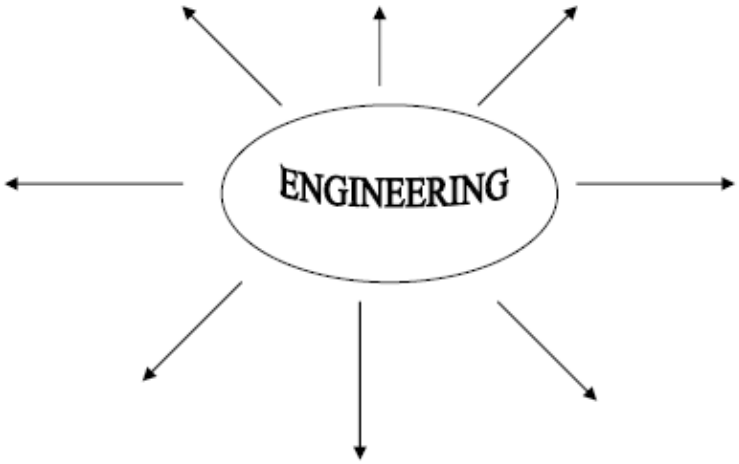
- car wash
- check or replace the engine oil and oil filters
- inspect or replace windshield wipers
- inspect tyre pressure and wear
- check wheel alignment
- check, clean or replace battery terminals
- inspect or replace brake pads and fluids
- inspect or replace air filter
- lubricate locks and hinges
- check all lights
- inspect or replace spark plugs
- tighten chassis bolts

Some tasks that have equivalent service intervals can be combined into one single service known as a tune-up. In

modern cars, where electronics control most of the car's functions, the traditional tune-up has been replaced by incorporated software that takes care of the engine by constantly checking thousands of sensor Signals. Completed maintenance services are then recorded in a **service book** which is very useful for keeping track of the car service history.

THEME 17. THE FUTURE OF THE ENGINEERING PROFESSION

Exercise 1. What comes to your mind when you hear a word "Engineering".



Exercise 2. Read and translate the text.

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.

Exercise 3. Answer the following questions.

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?

Exercise 4. Please discuss with your group advantages and disadvantages of your future profession. Do you think that engineering profession is prestigios? Is it well-paid? How difficult is it to find a good work in this field?

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.

Mikhail Vasilyevich Lomonosov

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 colored-glass factory. Most of his achievements, however, were unknown outside Russia.

Dmitry Ivanovich Mendeleyev

D. I. Mendeleyev, the great Russian chemist, was born in Siberia on February 8, 1834. When seven years old he went to gymnasium in Tobolsk. He studied very hard, he especially liked mathematics, physics and history. At the age of 16 he entered the Pedagogical Institute in St. Petersburg, physicomathematical department. He graduated from the Ins-.itute in 1855 and began to teach chemistry at the Technological Institute and then at the University In 1865 Mendeleyev was

granted the Doctor of Science degree for the thesis on the combination of alcohol with water. This work was both *of* great theoretical and practical significance. Soon after that D.I.Mendeleyev was appointed Professor of General Chemistry of St. Petersburg Jniversity. Despite lectures and supervision of the laboratory, D. I. Mendeleyev carried on great research work.

Mendeleyev's greatest discovery was the Period c Law. The Periodic Law suggested by Mendeleyev stated that the properties of the elements were a periodic function of their atomic masses. He presented this work to the Russian Chernical Society. Mendeleyev's Periodic Law *opened* a new era in the history of chemistry.

Mendeleyev was interested in many branches of science, indeed there is hardly any field *of* science that was not enriched by his contribution. His numerous *works* dealt with many subjects: properties of liquids, theories of solutions, the development of the gas law, the use *of* oil and many others, D. I. Mendeleyev was a great patriot. He did everything for the development and progress of his country.

D. I. Mendeleyev continued his research *work to* the very last day of his life. He died in 1907.

The world is thankful to Mendeleyev for his great contribution to the world science. At present there is hardly anybody who doesn't know this Russian scientist and his Periodic Law. D I Mendeleyev did very much for his country, for the development of the world science.

Sikorsky Igor Ivanovich

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

Tupolev Andrey Nikolayevich, famous aircraft designer, was born in 1888. 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.

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.

Alfred Bernhard Nobel

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, 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 динамит. He later produced one of the first smokeless powders (порох). At the time of his death he controlled factories for the manufacture of explosives (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.

James Prescott Joule

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 William 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.

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.

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 Alien, his partner in computer language development. While attending Harvard in 1975, Gates together with Alien 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.

Литература

1. Агабекян И.П. Английский для технических вузов /И.П,Агабекян, П.И.Коваленко. – Ростов н/Д: Феникс, 2015
2. Голубев А. П. Английский язык для технических специальностей = English for Technical Colleges: учебник для студ. Учреждений сред. проф. образования / А. П. Голубев, А. П. Коржавый, И. Б. Смирнова. — 4-е изд., стер. — М.: Издательский центр «Академия», 2015
3. Иванова Н.К. Обучение чтению научно-технической литературы: Учеб. пособие для студентов I курса технических специальностей (английский язык)/ Иван. гос. хим.-технол. ун-т. – Иваново, 2016
4. Карпова Т.А. English for Colleges. Английский для колледжей: Учебное пособие. – 6-е изд., перераб. и доп. – М.: Издательско-торговая корпорация «Дашков и К», 2009
5. Mark Ibbotson English. Technical Engineering for Professionals. – UK: Cambridge University Press, 2017
6. Sabrina Sopranzi Flash on English for Mechanics, Electronics and Technical Assistance, Italy, Ell S.r.1, 2015
7. Elliott Quenley Vocabulary: Science and Technology Words. - USA: Saddleback Educational Publishing, 2002