МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ЧЕРНІГІВСЬКИЙ НАЦІОНАЛЬНИЙ ТЕХНОЛОГІЧНИЙ
УНІВЕРСИТЕТ

АНГЛІЙСЬКА МОВА

Методичні вказівки до практичних занять
та самостійної роботи
студентів денної форми навчання
спеціальності 172 Телекомунікації та радіотехніка

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на засіданні кафедри іноземних мов
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Бараненкова Наталія Анатоліївна, кандидат філологічних наук, доцент, доцент кафедри іноземних мов професійного спрямування

Відповідальна за випуск: Литвин С.В., завідуюча кафедрою іноземних мов професійного спрямування, кандидат педагогічних наук, доцент

Рецензент: Литвин С.В., кандидат педагогічних наук, доцент завідуюча кафедрою іноземних мов професійного спрямування,

Зміст

Вступ

Методичні вказівки з англійської мови орієнтовані на студентів спеціальності 172 Телекомунікації та радіотехніка денної форми навчання, які володіють англійською мовою в межах нормативної граматики і соціально-побутової лексики на рівні середньої школи та призначаються як для опрацювання в аудиторії, так і для самостійної роботи студентів.

Методичні вказівки відповідають вимогам програми курсу «Іноземна мова для немовних внз» (2005 р.) та навчального плану для студентів денної форми навчання спеціальності 172 Телекомунікації та радіотехніка факультету електронних та інформаційних технологій.

Головна мета вказівок — розвиток вмінь розуміння й аналізу текстів професійного спрямування, накопичення словникового запасу, формування у студентів лінгвістичної та фахової компетентності.

Методичні вказівки включають 12 основних розділів та розділ для самостійної роботи. Кожен розділ містить тексти фахового спрямування та завдання до них. Опрацювання студентами професійно спрямованого лексичного матеріалу значно полегшує розуміння тексту та виконання завдань. Вправи мають на меті розширення активного словника студентів, розвиток вмінь аудіювання, усного та писемного мовлення. Запропоновані навчальні матеріали можна використовувати для групової та індивідуальної роботи студентів, вони також можуть стати у пригоді студентам, які мають певні проблеми з окремих положень англійської граматики і потребують матеріалу для практичних вправ.

Методичні вказівки допоможуть студентам сформувати та вдосконалити вміння розуміння фахових текстів англійською мовою з мінімальним використанням словника. Комплексна структура методичних вказівок забезпечує ефективне формування та вдосконалення вмінь читання, перекладу, аудіювання та використання професійно орієнтованої лексики в спілкуванні англійською мовою.

Text 1. The Story of Radio

Read and translate the text.

Without understanding the inquiries of pure science, we cannot follow the story of radio. It begins perhaps with Joseph Henry, an American physicist, who discovered in 1842 that electrical discharges were oscillating. A gigantic step forward was taken by James Maxwell, a Scottish physicist and one of the great mathematical geniuses of the 19-th century. By purely mathematical reasoning, Maxwell showed that all electrical and magnetic phenomena could be reduced to stresses and motions in a medium, which he called the ether. Today we know that this "electrical medium" does not exist in reality. Yet the concept of an ether helped greatly, and allowed Maxwell to put forward his theory that the velocity of electric waves in air should be equal to that of the velocity of light waves, both being the same kind of waves, merely differing in wave length.

In 1878, David Hughes, an American physicist, made another important discovery in the pre-history of radio and its essential components. He found that a loose contact in a circuit containing a battery and a telephone receiver (invented by Bell in 1876) would give rise to sounds in the receiver which corresponded to those that had impinged upon the diaphragm of the mouthpiece.

In 1883, George Fitzgerald, an Irish physicist, suggested a method by which electromagnetic waves might be produced by the discharge of a condenser. Next we must turn to Heinrich Hertz, the famous German physicist, who was the first to create, detect and measure electromagnetic waves, and thereby experimentally confirmed Maxwell's theory of "ether" waves. In his experiments he showed that these waves were capable of reflection, refraction, polarization, diffraction and interference.

A.S.Popov (1859-1906) was in 1895 a lecturer in physics. He set up a receiver in 1895, and read a paper about it at the Meeting of the Russian Physico-Chemical Society on April 25 (May 7, New Style) 1895. He demonstrated the world's first radio receiver, which he called "an apparatus for the detection and registration of electric oscillations". By means of this equipment, Popov could register electrical disturbances, including atmospheric ones. In March 1896 he gave a further demonstration before the same society. At that meeting the words "Heinrich Hertz" were transmitted by wireless telegraphy in Morse code and similarly received before a distinguished scientific audience.

Marconi invented a system of highly successful wireless telegraphy, and inspired and supervised its application. Such is the story of the many inventors of wireless telegraphy, working with each other's equipment, adding new ideas and new improvements to them.

1.1. Say whether the following statements are true or false and prove your idea.

1. H. Hertz was the first to create electromagnetic waves. 2. A.S.Popov could not register atmospheric disturbances. 3. A.S. Popov is the inventor of the radio. 4. The words "Heinrich Hertz" were transmitted by wireless telegraphy in Morse code.

***1.2. Translate the following sentences into Ukrainian*:**

He will give you the book when you need it. 2. If we put water into a tube, it will take the shape of the tube. 3. I'll solve this equation if you help me. 4. Unless it is too late, we shall go there. 5. The circle will become an ellipse after you compress it. 6. We shall use this substance in the experiment provided it has the necessary properties. 7. As soon as you return from the lab, we'll begin our work. 8. I won't be able to explain this phenomenon if I do not analyse all the data. 9. Your experiment will not give good results until you change the speed of the reaction. 10. My friend will translate the text if you give him your dictionary. 11. I shall do it if it is necessary. 12. If he concentrates his attention on his studies, he will pass his exams successfully.

1.3. Say the following sentences in the Pas t Simple Active. Don't forget to make the necessary changes:

Example: *He usually has his breakfast at 8 o'clock, (yesterday, at 9 o'clock)*
Yesterday he had his breakfast at 9 o'clock.

1. John often tells me about his holidays, (yesterday afternoon, his family). 2. The postman usually comes at half past seven, (the day before yesterday, at six). 3. We go to the seaside for a week every August, (last autumn, into the country). 4. She always arrives at the office a few minutes before nine o'clock, (yesterday morning, at nine o'clock). 5. They sometimes go to the theatre, (last month, to the circus). 6. She often writes to her mother, (last week, two letters). 7. His sister regularly attends evening classes at the Institute, (two years ago, an open-air pool). 8. He is always at home on Sunday, (last Sunday, at the library). 9. Lessons begin at nine o'clock, (on Monday, at half past nine)

1.4. Translate the sentences into Ukrainian. Pay attention to the verbs in the Simple Passive:

Sounds are produced by the vibration of matter. 2. The translation from one language into another will soon be performed by the computers. 3. Waves are carried in all directions from the vibrating body. 4. The first-year students are not taught special subjects. 5. Many problems of great interest are discussed at our seminars. 6. A lot of us were invited to the conference. 7. The methods of radio engineering are now applied in various fields of science and technology. 8. The agreement was signed ten years ago. 9. The research will be carried out over a period of four months. 10. Much attention is given to the development of radio engineering. 11. Lasers are now used for many scientific, medical and industrial purposes. 12. The laboratories of our university are equipped with modern devices. 13. The results of these experiments will be published in a scientific journal. 14. The importance of sport is known to

everybody. 15. We were provided with the necessary literature. 16. The equations were solved by the machine. 17. The young scientist was invited to take part in the conference.

1.5. Make sure if you remember the following verbs. Consult a dictionary:

to follow, to show, to reduce, to exist, to differ, to correspond, to impinge, to suggest, to. measure, to confirm, to appear, to inspire, to supervise, to change, to add, to draw, to mean, to reason, to create, to call, to hold, to develop, to broadcast, to use.

1.6. Form nouns adding the suffix -ness to the given adjectives. Translate them.

Example: *complete — completeness*

great, effective, useful, light, bright, ready, soft, black, thick, rough, weightless, shapeless, exact, unique, hard, harmful, empty, brief.

1.7. State what parts of speech the words in heavy type belong to. Translate the sentences:

1. He **works** as a teacher. One of Mendeleev's important **works** is his book "Principles of Chemistry". 2. He thought about his future **work.** The book contained his thoughts about further development of national economy. 3. **Charge** this battery, please. Education in our country is free of **charge**. 4. Your **answer** to the question was not logical. You **answer** the questions really well. 5. These **houses** are nine stories high. Our laboratory **houses** various kinds of equipment. 6. A centimetre is **a measure** of length. We **measure** energy in the form of heat. 7. I like music and have many **records**. The instrument **records** the changes of temperature. 8. If you have no book, you may **use** mine. What's the **use** of doing it? 9. **Use** a piece of copper wire to repair the instrument. Wire the day of your arrival. 10. How many **seconds** are there in a minute? The **second** experiment was very interesting for its results. 11. Einstein gave all his life to **the increase** of human knowledge. The discoveries in physics **increase** our possibilities in other sciences. 12. Men and women in Ukraine have equal **rights**. **A right** angle equals 90°.

1.8. Define the tense-forms of the verbs in the following sentences. Translate the sentences into Ukrainian:

1. Our nation is developing the economy of the country. 2. The output of the factory will be growing during the current five-year period. 3. The scientists are using the energy of atom in various spheres of life. 4. The engineers were attaching the wires to the devices when I came in, 6. At present they are studying various aspects of this problem. 7. When we listen to a radio programme we are using the rays that are called radio waves, 8. The scientist was solving a new problem when we visited his laboratory last week. 9. What is she doing this week? 10. John was reading a book when I came to see him. 11. My friend is writing an article for the newspaper. 12. The student was carrying out this experiment for twenty minutes. 13. The plane was flying over the Ukraine. 14. I'm working too hard this year. 15. Molecules in a gas are constantly moving. 16. The electron is circling in an orbit around a nucleus.

Text 2. Seven Rays, One Family

1. "Isn't it a small world."[1] You have probably heard this exclamation many times. People often say it when they find that acquaintances they had met at different times and places, and whom they never connected with each other, turn out to be related to each other. Scientists often have a similar experience with occurrences in nature[2]. Things or events that at first seem to have nothing to do with[3] each other turn out to be related after all. We shall repeat this experience with seven kinds of rays. We find them in different places, and use them in different ways, but they are close relatives. They are members of one family, the family of electromagnetic waves.

2. The kind of ray that mankind has known for the longest time is light. It helps us see the objects that surround us, when the objects reflect the light into our eyes. Because our eyes can detect light, we call it a visible ray. The other rays are invisible.

3. We find three types of invisible rays in use in our homes. When we listen to a radio programme, we are using the rays that are called radio waves. When we cook a meal on an electric cooker, we are using infrared rays, sometimes referred to as heat rays. When we sit under a sun-tan lamp, we are using ultraviolet rays. We meet the other three types of rays outside the home. Inside the hospital we shall find X-rays, produced by X-rays machines, and used for taking pictures of the insides of our bodies. At airports everywhere we shall find microwaves used with radar equipment to detect planes in the air, or guide them in to land. Also in hospitals we find gamma rays used as invisible bullets to kill cancer cells.

4. These Seven types of rays resemble each other in that they are all electromagnetic waves. What makes them different from each other is their frequency or their wavelength. The distance that the wave moves during the time it takes for one complete cycle of vibration is called the wavelength of the wave. The frequency is the number of cycles ina second. Notice that radio waves are the longest of the electromagnetic waves and have the lowest frequency.

Notes:

1. Isn't it a small world — Світ тісний.
2. occurrences in nature — природні явища.
3. things or events that at first seem to have nothing to do with ... — речі та події, котрі на перший погляд, не мають нічого спільного з...

2.1. Say whether the following statements are true or false:

These seven types of rays do not differ from each other. 2. Seven kinds of rays are close relatives. 3. We find three types of invisible rays in use in our homes. 4. We meet three types of rays outside the home. 5. These seven types of rays differ from each other in their frequency. 6. The frequency is the number of cycles in a second. 7. Radio waves have the highest frequency.

2.2. Find the information explaining why we call light a visible ray. Read the information to y our partner.

2.3. Answer the questions.

1. What do we deal with when we listen to a radio programme? 2. How are infrared rays referred to sometimes? 3. What rays do we use when we sit under a sun-tan lamp? 4. What kind of rays can we find inside the hospital? 5. Are microwaves used with radar equipment? 6. Which rays have the highest frequency ? 7. Can we see and feel electromagnetic waves?

2.4. Read the following sentences and say which of them are in the Active and which are in the Passive Voice. Translate them into Ukrainian:

1. While the experiment was being carried out nobody left the laboratory. 2. A new type of computing equipment is being produced at our plant. 3. At present scientific work is being done mostly by large groups of researchers. 4. The apparatus will be working when you come. 5 The scientists who are carrying out research into nuclear physics deal with the most difficult problems. 6. For twenty minutes the air in the laboratory was being purified by two ventilators. 7. The solar battery is converting the energy of sun rays directly into electric energy. 8. This experiment was being carried out under low pressure. 9. For a long time the electronic devices were being used for control. 10. An interesting research in the field of electronics is being done at our Institute. 11. Prospects of the usage of solar energy are already understood by everybody. 12. Now solar energy is being studied by a lot of research groups. 13. The scientists and engineers are developing new types of electronic and cybernetic devices. 14. We were looking for a more simple method of solution but could not find it. 15. The engineers will discuss the advantages of this new system. 16. Our laboratory is housed in an old building.

2.5. Match up the words which similar in meaning:

purpose, in the sphere of, to make, important, aim, proper, common, to work out, to vary, time, in the field of, significant, ray, to define, to operate, to develop, to differ, to show, method, to function, to demonstrate, technique, device, to determine, standard, to produce, suitable, beam, period, instrument

2.6. State what parts of speech the words in heavy type belong to. Translate the sentences into Ukrainian:

1. The **study** of this phenomenon is very important. The physicists **study** the structure of matter. 2. Energy can have many **forms**. What **forms** the basis of this compound? 3. We **time** our clock by radio. It is high **time** to go to the Institute. 4 We must **set** the time for the beginning of the experiment. Give this worker a **set** of tools. 5 **Air** is a mixture of gases. **Air** the room, please. 7. The generator **charges** the batteries. The **charges** of an electron and of a proton are equal in strength. 8. The experiment may **result** in a new scientific concept. The **result** of the process was the release of the energy. 9. **Point** out a mistake in this translation. Speak to the **point**. 10. It is **light** in the room. Don't **light** the lamps.

Texts 3.

Read and translate the following texts.

Cognitive Radio

The airways are getting crowded, thanks to smartphone and tablet data transmission that doubles every year. One solution: cognitive radio devices, whose signals automatically jump back and forth between frequencies in a fraction of a second to find open spectrum. A prototype developed at Rutgers University can switch to a new frequency in less than 50 microseconds while sending eight times the data of a typical home wireless system, taking advantage of openings on the AM and FM radio, TV, and cellular frequency bands. And Florida-based xG Technology has already set up a demo network in Fort Lauderdale, Fla., that uses cognitive radio for mobile broadband and VoIP links. Crucially, the FCC announced in September a pending rule change that will pave the way for spectrum-sharing technologies such as cognitive radio to use previously restricted frequencies.

Inductive EV Charging

It's not terribly complicated: An electric current in one coil of wire generates an electromagnetic field, and that induces a voltage in another nearby coil of wire. Presto, you've just charged your battery with no wires! And it's not terribly new either. (Remember the Palm Pre's optional inductive charger back in 2009? Exactly.) But it's looking like 2013 could be the year when wireless inductive charging finally reaches critical mass. Infiniti plans to release a model in 2014 that charges from a coil embedded in the ground under your parking spot. The technology is also showing up in consumer electronics, including Nokia's new Lumia phones. The critical question: Will the Wireless Power Consortium, an organization that aims to impose standards so any wireless charger can work with any device, manage to get companies to cooperate so that everyone's parking spots and portable devices can play nice?

3.1. Find synonyms to the following words:

device, set up, crucially, to release, to aim to, to use, to show up.

3.2. Say the following sentences in the Simple Passive. Use the words in heavy type as the subjects of your sentences:

Example: *Scientists use crystals in electronic devices.*

Crystals are used by scientists in electronic devices.

1. Our scientists developed several types of lasers. 2. I shall inform you about the new discovery. 3. Solar batteries generate electricity. 4. The researcher carries out the experiments at high temperatures. 5. You always make the same mistakes. 6. He will bring the book next time. 7. Radio employs electrical energy to transmit sounds, images and signals. 8. The lecturer spoke about the latest works in the sphere of radioelectronics. 9. He showed me the articles from the latest magazine. 10. Mendeleyev presented his table in 1869. 11. New data will support the results of our research. 12. These devices distribute the electric energy. 13. Heat converts ice into

water. 14. A.S.Popov invented the first radio receiver. 15. The engineer will check the apparatus in the lab.

3.3. Change active constructions into passive according to the model. Pay attention to the tenses of the verbs:

***Model*: This** furnace **converts** the chemical energy **in** the fuel into heat.

St.: The chemical energy in the fuel is **converted** into heat by this furnace.

1. We cool most vehicle engines by water. 2. Our engineers **have** designed modern motor-cycles almost exclusively with air-cooled engines. 3. Mendeleyev **arranged the** elements in order of ascending atomic weight. 4. Chemists **will** probably **discover** many new elements. 5. Professor Petrov was making a new experiment when we came in. 5. Radio devices perform various communication tasks. 6. We use such devices for amplification of radio signals.

3.4. Match up the words which are similar in meaning:

to begin, to call, to reduce, essential, to start, to decide, to receive, definite, to name, velocity, to produce, to decrease, to apply, quickly, speed, to operate, research, to suggest, to obtain, to propose, investigation, to make, to use, certain, rapidly, principal, to work, to solve.

3.5. Translate the following sentences into Ukrainian paying attention to the predicates in the Perfect Passive:

1. This theory has been used for analysing the experimental data. 2. In my opinion this result has not been proved by anybody. 3. The apparatus used in our research has been described recently. 4. We must compare our data with those that have been obtained by other investigators. 5. Many difficulties had been overcome before the researcher succeeded in his work. 6. After the new device had been tested it was installed in our laboratory. 7. The construction of this television centre will have been completed by the end of the next year. 8. In our country great progress has been achieved in developing all branches of science and engineering. 9. Many different devices have been created in order to improve the performance of communications. 10. The information has been based on the data received from a computer. 11. Much research has been carried out in order to establish the causes of this phenomenon. 12. This question has already been discussed at the conference. 13. By the end of the year a large variety of semiconductor devices will have been produced. 14. This equipment had been repaired before you came. 15. This text has just been translated. 16. Mendeleyev's periodic law has been accepted as a universal law of nature.

3.6. Translate the following word-groups into Ukranian, pay attention to the tense-forms of the verbs:

the scientist has suggested; the motion had been caused; the theory has advanced; the methods have been developed; he has been developing; the progress has been made; the suggestion has been applied; the observation has shown; the question has been solved; the error will have been determined; the point of view has

influenced; the chemist has written; the number has exceeded; the energy had been converted; the radio has been transmitting.

3.7. Compare the use of the Past Simple and the Present Perfect in the following sentences, translate them:

1. I have written several letters today. I wrote several letters yesterday. 2. They have made a new experiment this week. They made a new experiment last week. 3. She has been to the theatre this month. She went to the theatre last month. 4. Have you ever been to London? Yes, I've been there once. I went there in 1980. 5. Have you ever seen "Hamlet"? Yes, I've seen "Hamlet" several times. I saw it at our theatre three years ago and at Kiev theatres in 1975 and 1980. 6. He has graduated from the Kiev University. He graduated from the Kiev University in 1978. 7. He has seen this film. He saw this film yesterday. 8. He **has** improved his device; you may use it. He improved his device a week ago. 9. He prepared his report ahead of time. Have you prepared your report? 10. The results of this research were published long ago. My friend has already published the results of his discovery**.**

Text 4. Nature of Electric Current

In the modern conception of the **constitution** of matter it **is composed** of atoms. The atom **is made up of** a positive **nucleus** surrounded by negative **charges** of electricity, called electrons, which revolve about the nucleus at tremendous **speeds.** The nucleus consists of a number of protons, each with a single positive charge, and, except for **hydrogen,** one or more neutrons, which have no charge. The atom is neutral when it contains equal numbers of electrons and protons. A negatively charged **body** contains more electrons than protons. A positively charged body is one which contains fewer electrons than its normal number.

When the two ends of a **conductor** are connected to two points at different potentials, such as the **terminals** of a **battery,** we say that there is an electric current in the conductor. What actually happens?

The conductor has equal numbers, of positive and negative charges in its atoms, and we want to know how the charges can be made to produce a current. The atoms in metals are packed so closely that they overlap to some extent, so that it is comparatively easy for the **outer** electrons to pass from one atom to another if a small force is applied to them. The battery **causes** a potential difference between the ends of the **wire,** and thus **provides** forces that make the negative electrons in the wire move toward the point of higher potential. This electron **flow** toward the positive electrode is the electric current. Naturally materials differ considerably in the ease with which electrons can be made to migrate from atom to atom.

The current will not flow unless there is an electric **circuit.** The **magnitude** of the current depends simply on the **rate** of flow of electrons along the conductor.

4.1. Get ready to answer the following questions:

1. What is an atom? 2. When is the atom neutral? 3. What is a negatively charged body? 4. What is a positively charged body? 5. What is an electric current? 6. What does the magnitude of the current depend on?

4.2. Form your own sentences using the following word combinations:

a negatively charged body; from negative to positive; from one atom to another; a number of protons; a single positive charge; equal number of electrons and protons; to differ in the ease.

4.3. Use the sentence in all the forms and tenses adding suitable adverbial modifiers where necessary:

The electric current flows from the negative to the positive terminal.

4.4. Change the following sentences according to the model:

Model: An insulator **is known to contain** few free electrons.

St.: **It is known** that an insulator **contains** few free electrons.

1. An electric current is known to be a stream of electrons driven through a conductor. 2. The electric current is considered to flow from the negative to the positive terminal. 3. The electrons are said to pass from one atom to another. 4. Different substances are known to differ markedly in electrical conductivity. 5. Every student is supposed to know such fundamental terms as intensity of the current, voltage, electromotive force (e.m.f.), and resistance.

4.5. Form verbs with an opposite meaning adding the prefix dis- and translate them:

Example: *to approve — схвалювати*

to disapprove — не схвалювати

to cover, to appear, to place, to continue, to agree, to charge, to connect, to close, to arrange, to assemble, to mount, to join.

4.6. Translate the following sentences into Russian paying attention to the emphatic construction it is (was)... that (who):

1. It is electronics that produced radar. 2. It was Einstein who provided a new conception of time, space and gravitation. 3. It was A.S.Popov who invented the radio. 4. It was from radio that the subject of electronics was born. 5. It was radioelectronics that produced cybernetics, cosmonautics and nuclear physics. 6. It was in the laboratory that I found him. 7. It was D.I.Mendeleyev who formulated the Periodic Law. 9. It was in 1868 that D.I.Mendeleyev formulated the Periodic Law of Elements. 10. It is automation that improves working conditions. 11. It was in 1944 that the first relay machine was completed. 12. It is the programme that ensures the execution of all operations assigned to the computers. 13. It was in the 20th century that electronic computers appeared.

Text 5. Practical Units

The main **units** in electrical **engineering** are those relating to current, **pressure** or voltage, **resistance, power** and energy.

Current is that which flows along the conductors forming the electric circuit. It is measured in amperes. Pressure, potential, voltage, or **electromotive** force is that which causes a current to flow between two points when they **are joined** by a conductor. The unit is the volt.

The total pressure generated by a **cell** or generator is called its electromotive force (e.m.f.). The difference in pressure between any two points in a circuit is simply known as the potential difference, voltage, or pressure of the circuit. The opposition which a **substance offers** to the flow of current through it is called its resistance. Substances having a small resistance, such as metals and most liquids, are called conductors, those offering a high resistance are called insulators. The unit of resistance is the **ohm,** represented by the Greek letter Q. A megohm equals one million ohms.

When resistances are connected **in succession** to form a circuit, they are said to be connected in **series.** The total resistance of such a circuit is the sum of all the resistances. Resistances connected to the same terminals are said to be **in parallel.**

In a circuit in which a steady direct current is flowing there is a direct relation between the current, voltage, and resistance, temperature remaining constant, and this is expressed by what is known as Ohm's law.

The law is represented by the following **equation:**

I = E/R

I — current in amperes
E — resistance in ohms
R — voltage in volts

The power in a d. c. circuit is found from the **product** of the amperes flowing in it the pressure at its terminals. The unit of power is the watt. It is the power in a circuit when a current of one ampere flows under a pressure of one volt.

The practical unit of electrical energy is the kilowatt-hour (kW / h). It is the energy **transformed** in a circuit when the power is one kilowatt and the time taken is one hour. In general practice this **value** is spoken of as a unit, and is the basis of charges for electrical energy.

5.1. Get ready to answer the following questions:

1. What is an ampere? 2. What is a volt? 3. What is a watt? 4. What is the practical unit of electrical energy? 5. What is electromotive force? 6. What types of resistance connections do you know?

5.2. **Make up your own sentences with the following expressions.**

The difference in pressure, connected in succession, temperature remaining constant.

5.3. Translate into Ukrainian:

1. Petrov is known to be a good student. 2. He is said to have worked at this plant. 3. The delegation is likely to come tomorrow. 4. The mine is sure to receive new machines. 5. The kilowatt-hour (kW / h) is known to be the practical unit of electrical energy.

5.4. Translate into English:

1. Матерія складається з атомів. 2. Атом складається з позитивно зарядженого ядра і негативно заряджених електронів, що рухаються навколо ядра. 3. Електрони можуть переходити від одного атома до іншого. 4. Струм тече по провідниках, утворюючи електричний ланцюг. 5. Студент повинен знати такі терміни, як струм, напруга, Э.Д. С. і опір.

5.5. Ask questions on all the parts of the following sentence:

In modern form, a transformer consists of two coils of wire wound on a core of iron strips

Text 6. Electricity and Magnetism

Much has been learned about electric currents through their effects. We all are familiar with incandescent filament in the ordinary electric lamp bulb (heating effect), with the vibrating hammer of the electric bell when ringing (magnetic effect), with the decomposition of acidulated water into hydrogen and oxygen (chemical effect), and with the mechanical forces acting in the electric motor used for starting an automobile engine (mechanical effect).

Electricity is completely intermingled with magnetism. We must know these fundamental properties of a magnet well: a magnet attracts pieces of iron, nickel and cobalt; the magnetic property is concentrated more in the poles: if freely hung the magnetic needle sets itself with one pole toward the north; like poles repel each other, unlike poles attract each other; magnetism can be induced; a magnetic line of force is the path along which an independent north pole would tend to move; a magnetic field is a space in which there are magnetic lines; permeability refers to the ease with which lines of force may be established in any material, and reluctance is the resistance which a substance offers to magnetic lines of force, i. e. to magnetic flux.

Many practical applications have resulted from the utilization of the magnetic effects of electric currents. These effects are employed in motors, in most electric meters (ammeters, voltmeters and galvanometers), in electromagnets, and in practically all electromechanical apparatus.

6.1. Translate into English using words and expressions:

1. Радіоелектроніка динамічна у своєму розвиткові та багатогранна в застосуванні. 2. Електроніка взаємозв’язана та взаємодіє з багатьма найновішими відкриттями та технічними досягненнями. 3. Лазерний промінь може передавати значно більшу інформацію за одиницю часу, ніж кабель. 4.

Електронні обчислювальні машини різко підвищили ефективність інтелектуальних можливостей людини. 5. Широке застосування електроніки в плануванні та управлінні виробництвом дасть можливість різко підвищити ефективність використання матеріальних і трудових ресурсів. 6. Створення електронних обчислювальних машин знаменує собою вступ людства в нову еру – еру автоматизації розумової праці. 7. Застосування ЕОМ для навчання підвищать його якість і прискорять процес навчання.

6.2. Form adjectives adding the suffix -ful to the given nouns. Translate the nouns and adjectives into Ukrainian:

Example: beauty — *beautiful — красота — прекрасний*

harm, power, use, fruit, skill, purpose, wonder, care, success, truth hope, taste, respect, meaning, art, change, peace, watch, help.

6.3. Form adjectives adding the suffix -less to the given nouns. Translate the nouns and adjectives into Ukrainian:

Example: hope — *hopeless — надія — безнадійний*

wire, noise, help, motion, friend, aim, shape, branch, cause, character, sense, respect, object, ground, harm, change, power, colour, limit, meaning, voice, weight, life.

6.4. Read the words and say what suffixes they have and what parts of speech they belong to:

use, useful, usefulness; invent, inventor, invention; transmit, transmitter, transmission; work, worker; special, speciality, specialist; practice, practical; contain, container; lecture, lecturer; create, creative, creation; accelerate, acceleration, accelerator; determine, determination; proper, properly, property; science, scientific, scientist; discover, discovery, discoverer; important, importance; react, reaction, reactor, reactivity; arrange, arrangement; capable, capability; apply, application.

6.5. Define the tense-forms of the verbs in the following sentences. Translate them:

1. I have just turned the radio on. 2. Have you listened to the news? 3. He understood the text after he had read it again. 3. The technician will have recorded the data before you come. 4. I have not seen him since he graduated from the Institute. 5. We shall have completed our experiments by the end of the week. 6. My friend had prepared his report before we spoke to you. 7. Electronics has made a rapid progress. 8. He had published his article by the end of the month. 9. We've played lots of matches this season, but we haven't won many. 10. She has spent a great deal of time in the Far East. 11. They'll have finished their work by lunchtime. 12. Have you read anything interesting lately? 13. They've probably forgotten the time. 14. They have accepted the scientist's suggestion. 15. Radio has been transmitting its programmes to other countries since the thirties.

6.6. Make sure if you can read these words correctly and say what words in the Ukrainian language help you to guess their meaning:

transistor, crystal, crystalline, contact, classify, electric, electrode, compact, computer, combination, equivalent, acceleration, material, review, triode, evolution, hybrid, monolithic.

6.7. Give the initial forms of the following words:

devices, pieces, allowed, known, became, depended, rectifying, crystals, valves, reaching, receivers, understood, substances, semiconductors, insulators, invented, replacing, advantages.

6.8. State to what parts of speech the words in bold type belong:

1. A proton has a positive electrical **charge.** 2. Don't **charge** this battery. 3. The operating **range** of this device is broad. 4. The capacities of these stations **range** from 600 to 700 kilowatts. 5. The structure of the atom **is like** the structure of our solar system. 6. **I like** to watch TV evening programmes. 7. The room **houses** electronic devices. 8. The **houses** of the research institute are nearly in the centre of the city.

6.9. Translate the following compound nouns:

air-line, sunlight, airstream, radiosignal, waveform, wave-length, spaceship, typewriter, timerable, block-diagram, pipe-line, lifetime, radioreceiver, codeword, radio wave.

6.10. Translate the following sentences:

Note: to light — освітлювати;
light — світло;
light — світлий; легкий

Light weight metals are required in the manufacture of aircraft equipment. 2. Silver halides darken when exposed to white light. 3. The production of light is the secondary phenomenon in those cases in which the energy of activation is large. 4. Aluminium is **a light** metal, which exhibits a silvery luster. 5. The first electric power station built in this region **lighted** the houses and industrial enterprises. 6. The amount of light radiated by an atomic bomb is so great that one could hardly imagine it. 7. The laboratory is lighted very badly, there should be much more **light.** 8. All **light** metals are widely used in all the branches of industry.

Text 7. Laser Light

Read and translate the text.

How does laser light differ from ordinary light? *In brief*, it is much intense, directional, monochromatic and coherent. We know the light emitted by an ordinary source such as candle or an incandescent lamp to consist of uncoordinated waves of many different lengths, that is, it is incoherent and *more* or *less* white.

The scientists found the waves of laser light to be coordinated in space and time to have nearly the same Length. This coherence and chromatic purity and also intensity of laser light *result from the fact* that in a laser, excited atoms are stimulated to radiate light before they have had time to do so spontaneously and independently, The directionality of laser light arises from the geometry of the laser.

These properties of laser light suggest many uses for it both in technology and in physics. The scientists consider laser light to be different from ordinary light even when it merely illuminates a surface. The surface looks grainy and sparkles.

By means of some instruments it has become possible to examine, materials and physical phenomena m new ways, Among the most interesting applications of the laser the probing of materials by the study of scattering of light should be mentioned.

The laser is being applied to probe the internal structure and behaviour molecules by examining the *light-scattering phenomena*. Many investigators are working at the development of coherent light sources, those ones whose wave-length can be changed.

Many amplifiers and oscillators have been constructed for this propose lately, Laser light is applied in many fields such as medicine, biology, industry and so on. We can say scientists made laser light serve man. The scientists found the energy density of the image formed by a lense in a laser beam to be used to heat, melt or even vaporize small areas of any material. Laser is also used to pierce holes in diamond. Soon laser is to be used to cut a wide range of materials including wood and paper. The scientists work hard to use laser in all fields of science and life.

They expect laser to be widely used almost everywhere. It will be used for the well-being of people.

Notes:
1. in brief — коротко, стисло
2. more or less — більш-менш
3. result from the fact — відбувається через те, що
4. light-scattering phenomena — явище розсіювання світла

7.1. Change the following sentences as in the models:
Model I. *We expect* ***that they will solve this problem very soon.***
We expect ***them to solve this problem very soon.***

1. The scientists know that **this phenomenon is important.** 2. They suppose **that she will take part in this work.** 3. We consider that **he knows the subject well.** 4. Chemists know **that isotopes find wide application both in industry and**

agriculture. 5. They expect **the reaction will go to completion.** 6. We think **that he will help us in this work.** 7. We consider **that mercuric ions are colourless.**

Model II. *I thought* ***that he had returned.***
I thought ***him to have returned.***

1. We knew **that the delegation had arrived.** 2. They learned **that he had carried out the experiment by the end of the week** 3. They expected **that he had passed his last exam well.**

7.2. Form words of the same root using the prefixes "in-", "im-", "dis-", "un-"
direct, different, dependent, visible, possible, advantage, coordinated, definite.

7.3. Translate the following sentences paying attention to the meanings of "much":

This acid is **much** stronger than that you used before. 2. This reaction depends **much** on the surrounding air. 3. There is **much** iron in the Urals. 4. He works **much** in the laboratory. 5. He likes his work very **much. 6.** They had to work with the solution containing **as much as** 95% of organic solvents. 7. There is **much** glassware in our laboratory.

7.4. Match up the words which are opposite in meaning:

to stop, frequently, high, charge, to start, important, first, part, common, rarely, low, complicated, discharge, the whole, quick, transmitter, to heat, unimportant, increase, receiver, to cool, light, decrease, simple, heavy, to begin, slow, special, last, to finish.

7.5. Change active constructions into passive according to the model. Mind the tenses:

Model: *Mendeleyev* ***arranged*** *the elements in order of ascending atomic weight.*
St.: *The elements* ***were arranged*** *in order of ascending atomic weight by Mendeleyev.*

1. The magnet **is attracting** the iron dust. 2. Both iron and sulphur **retain** their original properties. 3. We **measure** the strength of a metal by means of tensile tests. 4. We **expressed** tensile strength in pounds per square inch. 5. They **will cool** the liquid in a crucible. 6. The workers of our shop **have used** special machines to produce wire.

7.6. Find the roots of the following words:

using, electrical, relatively, pulsing, easily, digital, alternately, conduction, construction, addition, equipment, operating, interference, carrier, resistance, regenerator.

7.7. Give the Ukrainian equivalents of the following English compound adjectives with the suffix -ed:

a fair-sized vessel, a great-faced clock, yellow-coloured walls, thick-lensed spectacles, high-priced equipment, light-flooded sky, good-humoured sarcasm, an ice-coated sign, a narrow-sheeted newspaper, a grey-roofed house, an oval-shaped vase, solid-headed lines.

7.9. Form compound adjectives with the suffix -ed, corresponding to the following word combinations:

Example: *a building of red brick — a red-bricked building*

a machine-tool of medium size, an alphabet of Greek letters, a cover of soft leather, zig-zags of a red pencil, mixture of thick oil, a box with thin walls, a house of small size, a clock with a dark face, a figure with sharp angles, a person of high culture, a man with narrow mind.

Texts 8.

Read and translate the following texts.

A. Magnets

All magnets, no matter how small, exhibit a north and south end.

The exact location of the two poles of a given magnet cannot be determined. Each pole is located approximately near each end of the magnet. One end of a compass needle will point toward the north when the needle is suspended horizontally by a fine thread. That end of the compass is called its north pole.

When the north pole of one magnet is placed near the south pole of another magnet, each magnet will experience a force of attraction; when two similar poles are placed near each other, each magnet will experience a force of repulsion.

A magnet modifies the magnetic characteristics of the space surrounding it. Charges in motion (electric current) give rise to a magnetic field.

A current in a circular loop of wire gives rise to a magnetic north pole on one side of the loop and a south pole on the other side.

B. Magnetic field and current

A magnetic field exerts a force on a current carrying wire. The left- hand rule is used to determine the direction of the force. A magnetic field exerts a force on a moving charge. Charged particles move in circular orbits when the velocity of the particle is perpendicular to the magnetic induction B.

Relative motion between a magnet and a wire causes an induced e. m. f. in the wire. If the wire is a closed loop, the induced e. m. f. causes an induced current.

Lenz’s law explains the conservation of energy principle when applied to induced voltages and currents.

The operation of a voltmeter, ammeter, and motor is based on forces produced by a current in a wire that is located between the poles of a magnet. These forces produce torques.

8.1. Answer the following questions embracing the contents of the Text A and the Text B.

What do all magnets exhibit? 2. Where is each pole located? 3. Where does one end of a compass needle point to? 4. When will each magnet experience a force of attraction? 5. When will each magnet experience a force of repulsion? 6. What gives rise to a magnetic field? 7. What does a magnetic field exert? 8. What is used to determine the direction of the force? 9. Does a magnetic field exert a force on a moving charge? 10. When do charged particles move in circular orbits? 11. What causes relative motion between a magnet and a wire? 12. What does Lenz's law explain?

8.2. Translate and find Participle I.

1. The falling water has kinetic energy. 2. While testing the motor we put down the results. 3. There is no simple explanation of the functioning of transistors. 4. Obtaining new data engineers can improve their knowledge. 5. Look at the reading of the device. 6. Robots are helping research scientists to answer many difficult questions. 7. By the beginning of the 20th century man had learned something of the structure of the atom. 8. When applying these automatic devices we shall be able to control automatic lines. 9. The applying of lasers enables us to amplify electromagnetic waves. 10. A person beginning some experiment should be very careful and attentive.

8.3. Match up the words, which have an opposite meaning:

conductor, before, solid, alternating, early, high, receiver, new, important, advantage, little, light, possible, reliable;

impossible, unreliable, heavy, much, disadvantage, insulator, after, liquid, direct, late, low, transmitter, old, unimportant.

8.4. Define the function of Participle I in the following sentences and translate them:

1. The scientist **working** at this design is well known. 2. **Carrying** out the experiment he made use of some new instruments. 3. These new devices are **replacing** their older equivalents. 4. **Speaking** about the new method of work the engineer told us many interesting details. 5. Radio occupies one of the **leading** places among the greatest achievements of modern engineering. 7. **Being cooled** water turns into ice. 8.The electric current **passing** through a wire will heat it. 9. Transistors contain no **moving** parts. 10. The scientist is **carrying** on an important research. 11. **Developing** the new method they achieved good results.

8.5. Translate the following sentences:

1. Having improved this device they could use it for many purposes. 2. When making the experiment he made notes. 3. The vibrations of a voice speaking into the microphone of a telephone cause vibrations in an electric current. 4. This varying current is carried along a wire to a receiver. 5. Electronics in our country has developed into hundreds of research institutes and laboratories employing tens of

thousands of people. 6. Power engineering develops much faster than welding. 7 Having been discovered many years ago this metal found a wide application in industry only last year. 8. While being checked the motor showed good performance. 9. Our country today is building high-capacity atomic power stations. 10. The man introducing this famous scientist is the dean of our faculty. 11. Cybernetics is gaining a growing importance.

8.6. Change the complex sentences given below according to the examples and translate them:

Example A: *While she was preparing for her physics exam she looked through all the notes of the lectures.*

While preparing for her physics exam she looked through all the notes of the lectures.

1. **When he was translating** the article he used a dictionary. 2. **While the student was working** at the problem he made many experiments. 3. **When the scientist was carrying out** research in the field of nuclear physics he came to Dubna to work there. 4. **When the worker was applying** the new method of work he got better results. 5. **While he was experimenting** with this substance he was very careful. 6. **When the engineer was improving** the design he made many calculations. 7. **While the man was describing** this phenomenon he illustrated it with numerous examples. 8. **When these scientists were working** in our laboratory they obtained good results.

Example B: *The scientists who are carrying out research into nuclear physics deal with most difficult problems.*

The scientists carrying out research into nuclear physics deal with most difficult problems.

1. The scientist who is working at the method is well known. 2. The students who are listening to the taped lesson study at the evening faculty. 3. These postgraduate students who are watching the experiment work in our laboratory. 4. The worker who is repairing the machine is very skilled. 5. The engineer who is carrying out these investigations is a well-known inventor. 6. The students who are doing the laboratory work are from various faculties. 7. The workers who are building this house will soon finish their work.

Text 9. Conductivity

Read and translate the text.

It will be interesting to note that an iron wire of the same Length as a copper one has a greater resistance. Under the same conditions the copper wire allows more current flowing than the iron wire, Copper has a greater conductivity. Conductivity means the ability of carrying the current.The unit of conductivity is the Ohm.

In 1826 Ohm found a simple correlation between resistance, current and voltage. He also observed that if the voltage remains the same, the greater the resistance, the smaller the current is.

So, it can be stated: the current that flows in a circuit is directly proportioned to the voltage and inversely proportioned to the resistance.

9.1. Translate the sentences paying attention to the herds in bold type:

1. In a crystal of copper, in which the atoms are packed together, the electrons spread themselves over the wide **range.** 2. In contrast to copper, the atoms of the semiconductor germanium **turned out** to be together, by forming covalent bonds. 3. It is advisable to use a solution whose resistance will be of about the same **order** of magnitude as the resistances in the previous solution. 4 **On account of** the resistance of tin to the action of air and water, it is used to coat other metals. 5. Having finished measuring, you should **turn off** the light. 6. How can this phenomenon be **accounted for.**7. **In order to** understand this process one should read some papers before starting his work. 8. In either of these cases the solubility of lead will be **lowered** practically to zero. 9. **On account of** its resistance to corrosion copper is widely used. 10, **Traces** of aluminium which dissolve in solid copper greatly reduce the electrical conductivity. 11. If this substance is heated and **turned red,** cupric oxide is formed. 12. If concentrated hydrochloric acid is added to a solution of cupric chloride, the green solution **turns brown** owing to the formation of the complex anion. 13. Because of uniform expansion over a wide **range** of temperature, mercury is used in thermometers. 15. As a **rule,** if the length of a conductor is doubled, the resistance is doubled too.

9.2. Find the pairs of antonyms and remember them.

suitable, significant, impure, increase, cool, conductor, light, decrease, insulator, insignificant, unsuitable, warm, dark, pure.

9.3. Insert prepositions:

1. When you leave the laboratory don't forget to turn ... the light and gas. 2. Mercury is a good conductor ... heat and electricity. 3. This can be accounted ... the increase of temperature and pressure. 4. They resistances in ohms of these and other frequently used conductors turned ... to have been carefully measured. 5. When we turn ... the light and our electric lamp is burning, the tungsten of the lamp has about 30 times the resistance that it had. 6. The impact of light has an effect ... electrical

resistivity. 7. The resistance ... some conductors was much greater when they carried a large current.

9.4. Form nouns adding the suffixes -er, -or to the given verbs. Translate the nouns and verbs into Ukrainian:

Example: *to design — a designer (конструювати – конструктор),*
to detect — a detector (виявляти – детектор)

to build, to operate, to contain, to receive, to read, to produce, to transmit, to invent, to discover to drive, to translate, to visit, to convert, to regulate, to accumulate, to react, to use, to vibrate, to record.

9.5. Give the initial words of the following derivatives:

Example: *wireless — wire;*
transmission — to transmit

greatly, discharge, lecturer, atmospheric, successful, improvement, inventor, radiation, definition, equipment, purely, economic, powerful, development, operation, rapidly, information, atomic, magnetic, agreement, regulation, instruction, communication, technological, considerable, generation, separately, production, industrial, historic, logical, researcher.

9.6. Translate the following sentences into Ukrainian pay attention to the model verbs.

1. Heat is a form of energy and may be measured in the units in which energy is measured. 2. We must say that the discovery of atomic energy is as important as the discovery of fire. 3. Electronic machines can add, subtract, multiply and divide much quicker than man. 4. The origin of automation can be traced back to the early days of the first industrial revolution. 5. She may use different methods in her research work. 6. For a long) time scientists could not discover the secret of the atom. 7. This equipment can work with high accuracy. 8. You may use these devices in your research work. 9. The atom is a great force that must be used for the good of mankind. 10 Naturally, this circuit can be modified if necessary. 11 This kind of energy must find application in transport.

9.7. Choose the sentences where the verbs **to have** ***and*** **to be** ***are used in the functions of modal verbs and translate them:***

1. These devices have been used in our experiment. 2. Scientists have to work hard to create a new atomic technique. 3. A modern computer has two main parts: a memory and a computing unit. 4. As the known resources of coal and oil are limited, man has to find new sources of power. 5. Very difficult calculations in mathematics and electrical engineering have to be solved by computers. 6. People of good will have to struggle for peaceful use of atomic energy. 7. When technique reaches a very high stage of development, new methods of work will become possible. 8. We are to take into consideration all the advantages and disadvantages of this device for the future work. 9. We are to take special steps to reduce the weight of this mechanical part.

9.8. Translate and give the main idea of the text.

William Crookes first discovered plasma in 1879, he did not propose any use for the stuff. Crookes found that he could make gas behave differently than other forms of matter by stripping electrons from it with electrodes. What we now call plasma is used in arc-welding torches, neon signs and high-end television screens. Scientists are still finding novel ways to manipulate plasma. For example, Jamey Jacob, an aerospace engineer from Oklahoma State University, has replaced mechanical parts on the wings of aircraft with arrays of tiny actuators. The actuators form jets of plasma that can speed up airflow across the surface to increase lift or, if the plumes are pointed into the airflow, increase drag. Jacob is testing the system on small unmanned aerial vehicles.

Text 10. Transistors and Semiconductor Devices

Try to understand all details. Use a dictionary if necessary.

Devices consisting of solid pieces of crystalline material which allowed alternating current to flow more readily in one direction than the other were known long before the invention of the thermionic valve. The crystal set[1] which became so well known in the early days of radio depended on the rectifying action at the point of contact between the surface of certain crystals and a fine wire. Crystal valves[2], using silicon crystals, were found to be more efficient for the very high frequency signals reaching radar receivers than any thermionic valves. The action of these devices was not understood, but they were all made from materials which we now classify as semiconductors: substances which let electric current pass through them more easily than insulators do but much less easily than do true conductors.

In 1948 Bardeen and Brattain invented the point-contact transistor and Shockley invented the junction transistor shortly after. The transistor is a semiconductor triode possessing characteristics which are similar in many respects to those of thermionic triodes. At present transistors are widely used in amplifiers, receivers, transmitters, oscillators, TV sets, measuring instruments, pulse circuits, computers, and many other types of radio equipment.

The invention of transistors and solid-state devices led to an acceleration in the growth of electronics. Why were these new devices so important and why are they steadily replacing their older equivalents? A brief review of their advantages compared with thermionic devices will provide the answers to these questions. Transistors are made from parts which do not wear out. Transistors waste very little power. They require no heating to generate their free electrons. This means that equipment made with transistors is more efficient, lighter than comparable valve equipment. A transistor is an active semiconductor device with three or more electrodes. By active we mean that the transistor is capable of current gain, voltage, amplification and power gain. A transistor is an electron device in which electronic conduction takes place within, a semiconductor.

A semiconductor is an electric conductor with resistivity in the range between metals and insulators, in which the electrical charge carrier concentration increases with increasing temperature over some temperature range.

The resistivities of semiconductors and insulators decrease rapidly with rising temperatures, while those of metals increase relatively slowly. Unlike metals and insulators, the resistivity of semiconductors depends upon the direction of current flow. The direction of easiest current flow or lowest resistivity is called the forward direction, the direction of restricted current flow or highest resistivity is known as the reverse or back direction.

Semiconductors, such as the elements germanium and silicon, possess two types of current carriers, namely, negative electrons and positive holes. A hole is a mobile vacancy in the electronic valence structure of a semiconductor which acts like a positive electronic charge with a positive mass.

Notes:
crystal set — детекторний приймач
crystal valve — кристалевий прилад

Text 11. On Semiconductors

A semiconductor is often defined as an electric conductor that has a conductivity intermediate between that of an insulator and that of a metal. The more important semiconductors are: boron, germanium, silicon, selenium, phosphorus, gray tin and others.

The mechanical properties of semiconductors vary greatly. However, in hardness, brittleness, and fracture strength, semiconducting crystals resemble insulating crystals more than they do metals. Besides their electric properties, which in themselves may be of great variety, semiconductors vary in such physical qualities as magnetism, specific heat and thermal conductivity.

Semiconductors are widely used in electronics. They challenge vacuum tubes in many applications in the electronic industry. Engineers and physicists are going to solve many engineering problems by means of semiconductors.

11.1. Say whether the following statements are true or false:

1. Devices consisting of crystalline materials were known long before the invention of the thermionic valve. 2. The crystal set became known in the early days of radio. 3. Crystal valves were found to be less efficient rectifiers than thermionic valves. 4. The action of semiconductor devices was understood well.

11.2. Give positive or negative answers:

1. Is a semiconductor defined as an electric conductor? 2. Do semiconductors vary greatly in appearance? 3. May transistors replace vacuum tubes? 4. Does the state of substances depend on temperature and pressure? 5. Will you study electronics

this year? 6. Have many human activities played an active part in scientific inventions? 7. Did the ancients know anything about electricity?

11.3. Combine the following sentences according to the model:

Model: *Steam does mechanical work. It loses heat energy.*

St.: *While (when)* ***doing*** *mechanical work, steam loses heat energy.*

1. Yablochkov experimented with various materials. He wanted to find some substance glowing in a vacuum. 2. An electric motor does mechanical work. This motor must overcome some force. 3. Motors work in exposed situations. They require enclosure of working parts. 4. Greek philosophers discussed the structure of matter. They called its smallest particles atoms. 5. Ancient Greeks rubbed amber with wool or fur. They noticed that amber could attract light object.

11.4. Translate into English.

1. Напівпровідник визначається як провідник електричного струму, який має провідність, проміжну між провідністю ізолятора та метала.
2. Вчені всього світу почали працювати над створенням напівпровідникових діодів в кінці XIX століття.
3. Напівпровідники та напівпровідникові діоди використовуються в різних цілях і в різних галузях промисловості.
4. Українські вчені зробили великий внесок у дослідження фізики напівпровідників.
5. Українські вчені були першими, хто застосував провідники для безпосереднього перетворення тепла та світла в електроенергію.
6. Напівпровідники широко застосовуються в радіотехніці та електроніці.
7. Сьогодні важко знайти сферу людської діяльності, де б не використовувалась техніка.

11.5. Substitute the following word-combination for one word of identical meaning:

Model: *to take smaller→ to reduce*:

to make large, to make possible, to use instead of, to make steps forward, to work out, to carry out, to make contribution, to make progress, to gain victory, to draw dividing lines, to make sure.

11.6. Arrange the following words according to:

a) *similar meaning*: transformation, quick, basic, progress, various, perform, versatility, many, ensure, changing, a lot of, main, many-sideness, advance, different, carry out, guarantee, rapid.

b) *opposite meaning*: difficult, similar, past, easy, various, static, specific, dynamic, simple, common, present, complex.

Text 12. Historical Background of Robots

Read and translate the text.

For years robots have been quite familiar figures in our minds in the form of mechanical-driven dolls, or the heroes in children's cartoons who exhibit superhuman qualities. However, the image of industrial robot used in manufacturing processes is far different from such. Among industrial robots, there are different types ranging from hand-operated "magic hands" to others equipped with intelligent faculties by incorporating micro-computers. Hence, there is no clear-cut definition for industrial robots. In general, however, the robots which we refer to as such include those that display a complex motion with a high degree of freedom just like an arm or a hand and those that are equipped with cognitive and such sensory functions, as sight, and tactual sense, and are capable of acting independently.

Robots can be considered as substitutes for men, and they must possess the functions not only of hands but also legs. At present technological levels, however, the industrial robot is unable to have legs as yet and is equipped only with a hand and rather infantile intelligence. And this robot is called an industrial robot.

The origin of the word 'robot' is said to have appeared first in a play called RUR (Rossum's Universal Robots) written by a Czech playwright, Karel Chapec. Men riding on a fully-packed train in the outskirts of Prague were just like machines lacking in individuality, Chapec called such men robots in his play by parodying the word “robota” meaning slave labour.The word “robot” came into being by the bitter satire of the condition of man who was deprived of his humanity and became like a machine.

The three principles of a robot were set forth, they determined the character of robots. These three principles were: a robot must do no damage to man, a robot must be subordinate to man, and a robot must protect itself from damage.

Those who work with robots must assume the responsibility both for solving the short-range technical problems and for assessing and minimizing the social difficulties of robotization.

In this day of flexible automation, industrial robots are increasingly seen as a significant factor in further automating production systems and enhancing economic activity. The use of industrial robots has produced a number of economic and social advantages. Among them are the improvement in productivity, greater humanization of working life, prevention of labour accidents, improvement of product quality and the development of new industries.

12.1. Say whether the following statements are true or false:

1. There is no clear-cut definition for industrial robots. 2. Robots can't be considered as substitutes for men. 3. The origin of the word “robot” is said to have appeared first in a play written by a German playwright. 4. The use of industrial robots has produced a number of economic and social advantages.

12.2. Form adjectives by adding the suffix -al to the following nouns, making changes where necessary:

Example: *form — форма;*
formal — формальный

optics, theory, electricity, digit, nation, idea, music, conversation, principle, structure, practice, notion, logics, vocation, profession.

12.3. Change the following sentences according to the model:

Model A.: *If this mixture is placed in a test tube, it* ***will glow*** *dull red.*

Model B.: *If this mixture* ***were*** *placed in a test tube in two hours, it* ***would glow*** *dull red.*

Model C.: *If this mixture* ***had been*** *placed in a test tube two hours ago, it* ***would have glowed*** *dull red.*

1. If metals are heated, oxides will be formed. 2. If any liquid is in a vessel, it will take the shape of the vessel containing it. 3. If some air is allowed to mix with hydrogen, the reaction will take place with a characteristic sound.

12.4. Translate into Russian paying attention to the word 'since':

1.**Since** diamond is the hardest substance known, it must be polished with diamond dust. 2. Many years have passed **since** Mendeleyev made his great discovery. 3. This method of mixing has been used **since** the days of World War II. 4. This process was developed twenty years ago, **since** then it has been used in many countries. 5. Carbon is one of the most important and interesting elements, **since** its compounds are widely distributedin nature and play such an important part in daily life.

12. 5. Translate into English.

1. Машини, автомати та роботи беруть на себе основну виробничу роботу.

1. Вчені та інженери розробляють роботи, які можуть бачити, чути й підкорятися словесним інструкціям.

3. Звільняючи людину від одноманітної (рутинної) фізичної праці, роботи значно змінюють зміст праці людини.

4. Виробництво промислових роботів різних типів у нашій країні різко збільшується з кожним роком.

5. Речовина, яка повинна була використовуватися, була ретельно досліджена.

6. Цінна інформація, яку повинні зібрати супутники, допоможе поліпшити раніше отримані результати.

7. Для того щоб вирішити цю проблему, вони використали комп'ютери.

12.6. Ask questions on all the parts of the following sentences:

1. Semiconductors will replace vacuum tubes in many applications.
2. The more important semiconductors may be classified into three groups.

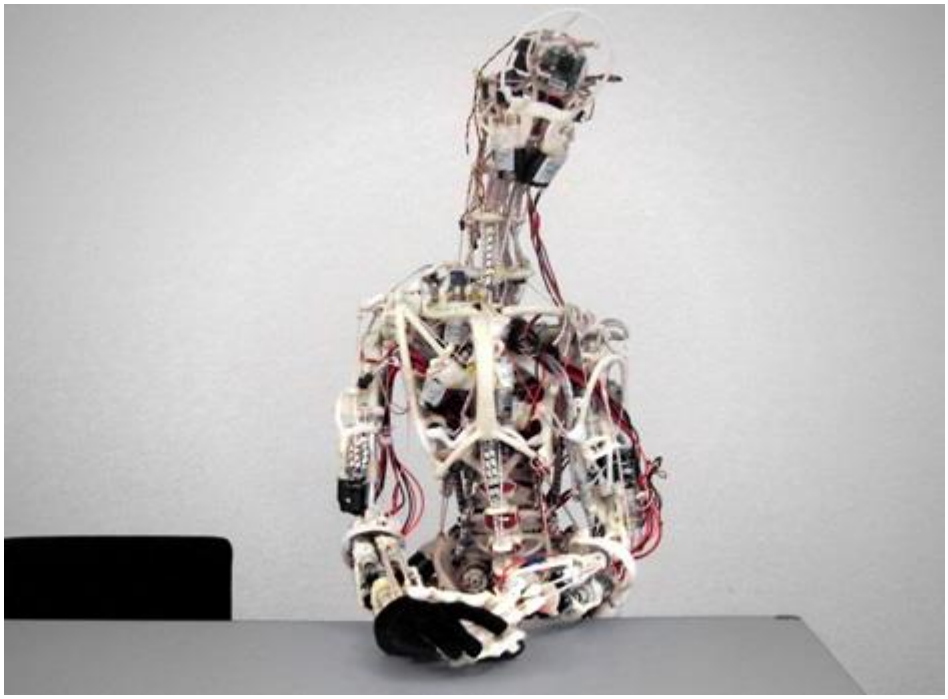
12.7. Make the sentences interrogative and give short answers. Mind the tenses:

1. Coal is the main source of power. 2. The history of coal mining in England goes back to a period 800 years ago. 3. The first written record about underground surveys had come from Alexandria. 4. Every mine should have a complete set of survey plans. 5. We can carry out survey measurements of mine workings by simple methods. 6. Large quantities if coal have been formed in nature by the slow decomposition of vegetable matter. 7. Natural conditions must be thoroughly studied.

ADDITIONAL TEXTS

Ten Tech Concepts You Need to Know for XXI century

1. Anthropomimetic Machines



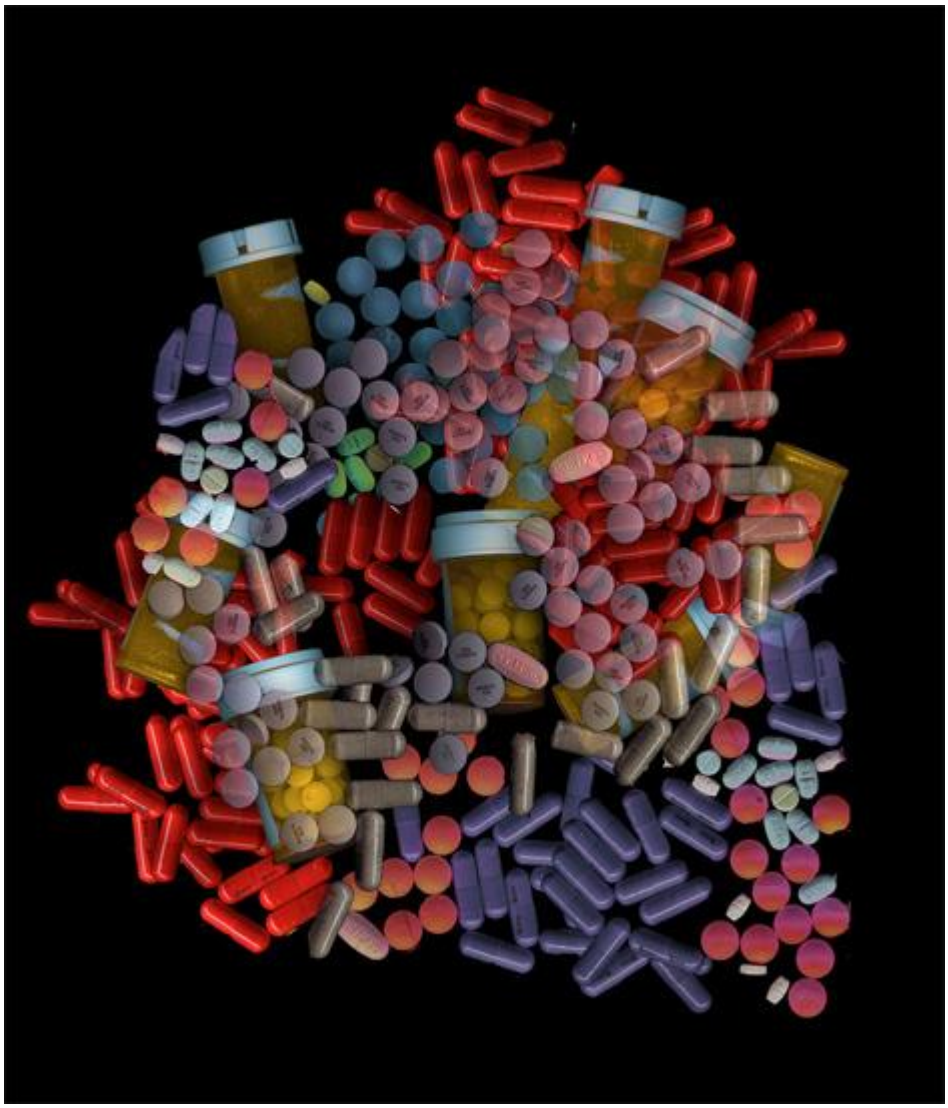
No matter how closely a robot resembles a human on the outside, if you crack it open, the jumble of wires is unlikely to bear much resemblance to our insides. A group of European researchers aims to bridge that gap – its robot prototype is anthropomimetic, meaning it mimics the human form. There's a skeleton made of thermoplastic polymer, actuators that correspond to each muscle and kiteline as tendons. The goal is to create a more human-like robot that interacts with and responds to environments the way we do.

2. Direct Carbon Fuel Cell

Yesterday's fuel cells, like those seen here on Spacelab, require a hydrogen infrastructure.

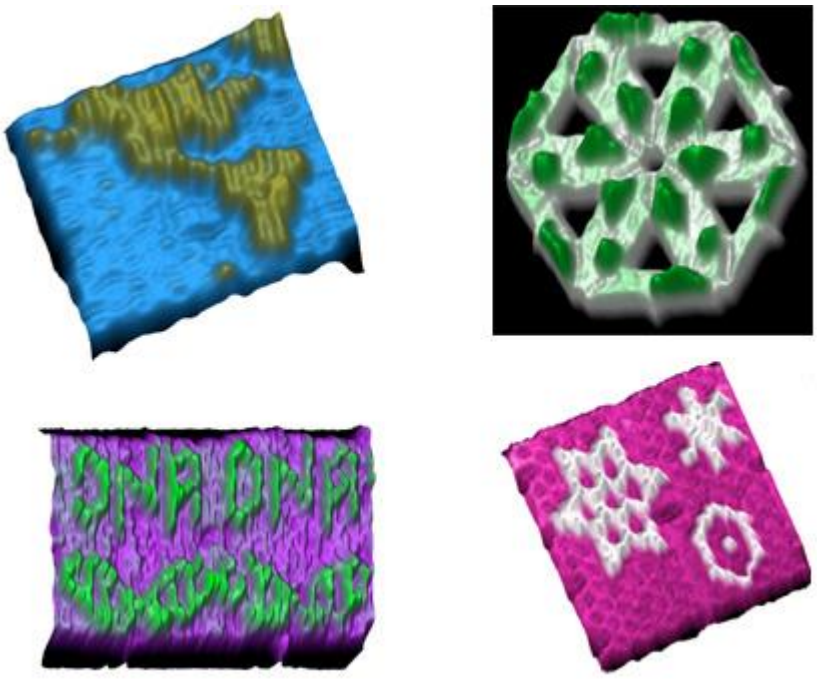
Coal is dirty, and fuel cells run on hydrogen – that is the conventional wisdom. However, a new generation of "direct carbon" fuel cells challenges that. Instead of relying on hard-to-produce hydrogen, these cells pull their power from an electrochemical reaction between oxygen and pulverized coal (or some other source of carbon, like biomass). The advantage: carbon-based energy production that requires no combustion, allowing it to operate at about twice the efficiency of a typical coal-fired power plant. California-based Direct Carbon Technology expects to have a 10-kilowatt prototype running on biomass in 2010, while Ohio-based Contained Energy hopes soon to use the tech to power a small light bulb. Eventually, the companies hope to build modular fuel cells that can be stacked in order to create new small-scale power plants or add clean capacity to existing plants.

3. Metabolomics



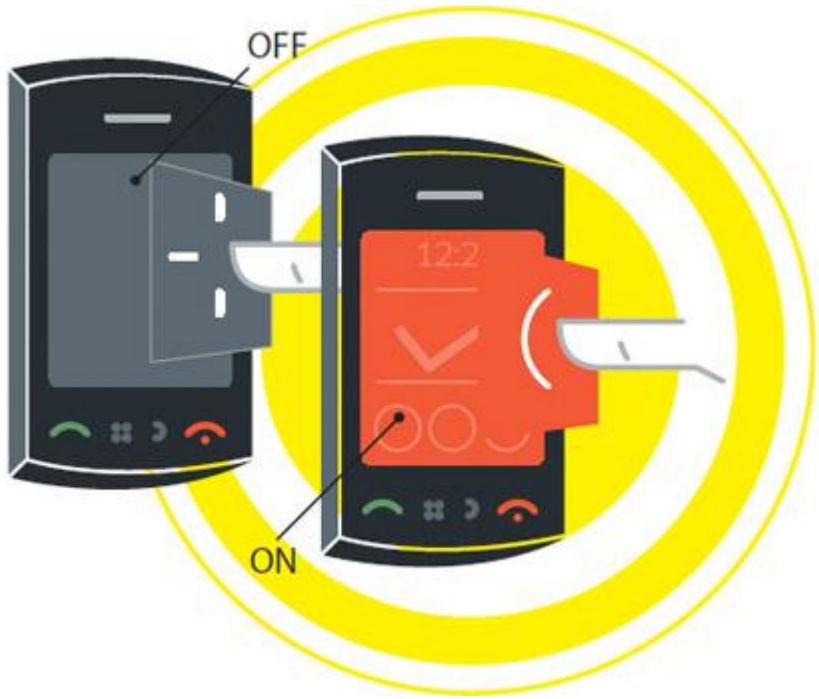
For the past five years, scientists at the University of Alberta in Edmonton have been working on the Human Metabolome Project, a database of the 8000 naturally occurring metabolites (that is, small molecules involved in chemical reactions in the body), as well as 1450 drugs, 1900 food additives and 2900 toxins that turn up in blood and urine tests. With this information, researchers can analyze a patient's metabolomic profile, allowing them to tell from a drop of blood or urine whether somebody likes chocolate – or is likely to develop a life-threatening disease. Today, these tests require million-dollar pieces of equipment that are mostly confined to research labs. The Project's database, which was first released in 2007, is already being used in commercial applications such as drug discovery and disease diagnosis, making quick and easy tests for personalized health and medical guidance possible.

4. DNA Origami



Scientists at Caltech have been folding microscopic strands of DNA into interesting shapes for the past few years. A cool party trick for sure, until a breakthrough last summer suggested that the folded strands could be used to create ultrasmall computer chips. That is when the scientists teamed up with IBM researchers and showed that they could strategically position folded DNA shapes, such as triangles, along the sort of silicon wafer used in microchips. This should allow them to use pieces of the DNA strands as anchor points for tiny computer-chip components that could be built as little as 6 nanometers apart – a huge improvement over the current standard of 45 nm.

5. Piezoelectric Display

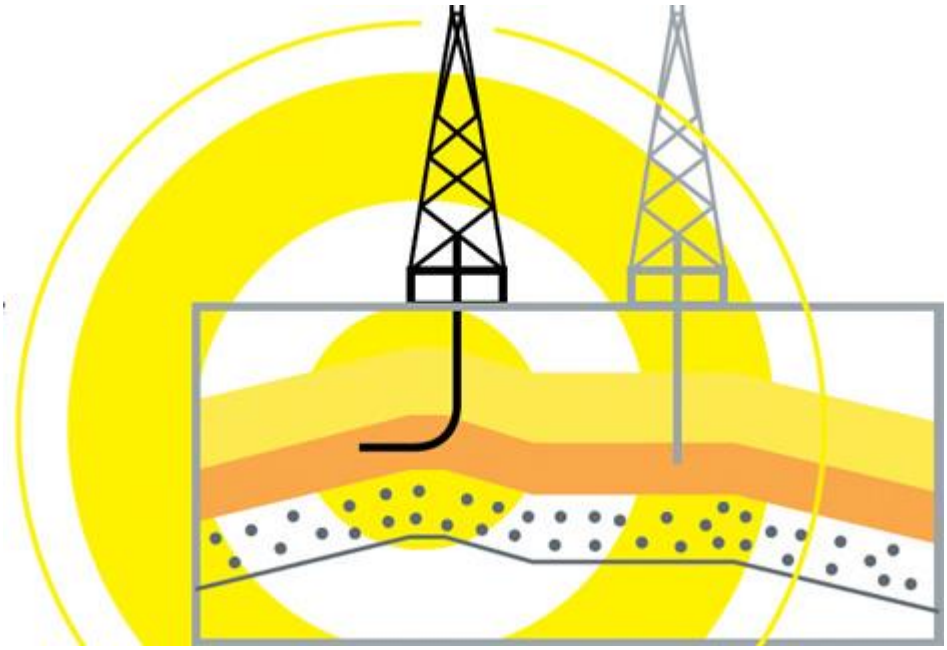


Scientists have long known about naturally occurring piezoelectric materials, which have the ability to transform electrical energy into physical stress and vice versa. But by building the property into electronic displays, companies can now create screens that can change shape or texture. This year, the technology is expected to make the leap into mainstream consumer products, offering the potential for mobile devices with screens that can harden protectively when turned off, and soften into a depressible touchscreen when turned on.

6. Osseointegration

The ideal prosthetic limb would behave like part of the natural body. Osseointegration allows prosthetics to fuse with a patient's living bone – it works by taking advantage of the fact that bone cells attach to titanium instead of rejecting it. The technique has already been used for small-scale dental and facial implants, and researchers are now bringing it to full-scale limb prosthetics. After a successful lower-leg implant in 2008 on a German shepherd named Cassidy, veterinary surgeons at North Carolina State University have six more leg operations on amputee dogs planned for 2010, and are considering a case involving an ocelot at the North Carolina Zoo. But the big challenge ahead is to implement the technology in human limbs.

7. Horizontal Drilling



Trillions of cubic feet of natural gas in the United States lie buried within layers of shale as much as 11,000 feet deep. Much of this gas is inaccessible through ordinary wells – the dense rock makes it flow too slowly. The answer: wells that drill vertically down to the shale bed, then make a gradual 90-degree horizontal turn through the shale deposit. It is an old idea, but higher energy prices and better technology have suddenly made it a hit. In 2008, Chesapeake Energy deployed 14 horizontal drilling rigs in the South's massive Haynesville Shale deposits, and they expect to have 40 rigs up by the end of 2010.

8. Kinetic Hydropower

Traditional hydroelectricity requires dams – massive engineering works that remake local landscapes and ecosystems. A less intrusive solution: kinetic hydropower, which uses underwater turbines to capitalize on the natural flow of rivers and tides. Since 2006, Verdant Power has been testing six underwater turbines in New York's East River to prove the technology's potential. In 2010, the company expects to receive licensing for a major build-out of 30 underwater turbines in the river, to the east of New York's Roosevelt Island, that will feed 1 megawatt of power into the grid. Other projects around the world are expected to complete testing soon and begin full-scale operation, including three installations that tap some of the highest tidal ranges in the world, in Canada's Bay of Fundy.

9. Nanoyarn

Carbon nanotubes have been touted as the next big thing ever since their discovery in 1991. The appeal lies in their strength (they are up to 100 times stronger than steel) and their ability to conduct both heat and electricity. But, until now, they've been too difficult to manufacture in useful quantities. That is finally changing: New Hampshire-based Nanocomp Technologies is weaving nanotubes into lengths of yarn that can be built into commercial applications. The company recently delivered more than 6 miles of nanoyarn to a major aerospace client, and successful bullet-stopping tests last spring have the Pentagon excited about the prospect of next-gen body armor that is both lighter and thinner than Kevlar.

10. Ultracapacitors

The biggest challenge for electric cars is energy storage: Batteries are better than ever, but they are still expensive, slow to charge and have fairly limited life spans. The solution may be ultracapacitors, which hold less energy than batteries (at least as the technology currently stands) but have virtually none of their drawbacks. That means longer life spans, no messy chemical reactions, no issues with battery memory and far greater durability. Researchers have been trying to perfect automotive ultracapacitors for several years (MIT is working on nanotube-based ultracaps, while Argonne National Laboratory is exploring battery-ultracap hybrids), but the big move could come from the secretive Texas-based company EEStor, which announced in April that its barium-titanate design had passed a crucial test. Though the company's claims have aroused skepticism, EEStor's automotive partner, ZENN Motors, is hyping the release of an ultracapacitor-powered car in 2010.

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