МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ЧЕРНІГІВСЬКИЙ НАЦІОНАЛЬНИЙ ТЕХНОЛОГІЧНИЙ УНІВЕРСИТЕТ

АНГЛІЙСЬКА МОВА ЗА ПРОФЕСІЙНИМ СПРЯМУВАННЯМ

МЕТОДИЧНІ ВКАЗІВКИ

до практичних занять та самостійної роботи для студентів напряму підготовки 6.050902 «Радіоелектронні апарати» денної форми навчання

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Англійська мова за професійним спрямуванням. Методичні вказівки до практичних занять та самостійної роботи для студентів напряму підготовки: 6.050902 «Радіоелектронні апарати», денної форми навчання / Укл.: Яковенко Т.М., Кормільцина С.Ю. – Чернігів: ЧНТУ, 2015. - 63 с.

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ЗМІСТ

Вступ

У зв'язку зі значним зростанням контактів нашої держави з іншими країнами виникає нагальна потреба у вивченні міжнародної термінології у сфері радіоелектроніки.

Методичні вказівки призначені для студентів вищих навчальних закладів за спеціальністю «Радіоелектронні апарати» денної форми навчання за напрямом підготовки: 6.050902 «Радіоелектронні апарати».

Мета методичних вказівок до практичних занять та самостійної роботи для студентів денної форми навчання – забезпечення цілісного й послідовного засвоєння англійської лексики та термінології у сфері радіоелектроніки і вироблення вмінь та навиків роботи з фаховою літературою, а також розширення знань студентів у сфері радіоелектроніки, що ґрунтуються на читанні та перекладі текстів за фахом і виконанні вправ, творчих завдань, які додаються до текстів. Ці вправи сприяють швидкому засвоєнню лексики та удосконаленню мовленнєвих умінь.

Методичні вказівки складаються з семи розділів. Кожен розділ містить сучасний фаховий текст та завдання різного ступеня складності, які дозволяють перевірити рівень сформованості граматичних та лексичних навичок та умінь писемного мовлення, читання та говоріння для висловлення власних думок щодо професійних проблем, розглянутих у даному розділі. Читання запропонованих фахових текстів та виконання завдань сприятиме розвитку розуміння та тлумачення різних аспектів мовної поведінки у професійному середовищі, а також розвитку вмінь, характерних для поведінки в різних професійних ситуаціях.

Матеріал, вміщений у методичних вказівках, спрямований на формування у студентів лінгвістичної та фахової компетенції, дає інструменти для використання англійської мови у професійній діяльності та має привчити їх до читання оригінальної літератури за професійним спрямування з мінімальним використання словника.

1 RADIO IN OUR LIFE

1.1 Word-formation

1.1.1 Practise the reading of the following words:

inquiry [ɪn'kwaɪərɪ], physicist ['fɪzɪsɪst], discharge [dɪs'tʃɑ :ʤ], genius ['ʤi:nɪəs], medium ['mi:dɪəm], ether ['i:θə], circuit ['sə:kɪt], to impinge [ɪm'pɪnʤ] diaphragm ['daɪəfræm] , interference [ˌɪntə'fɪərəns] , disturbance [dɪs'tə:bəns] , to distinguish [dɪ'stɪŋgwɪʃ], audience ['ɔ:dɪəns], to supervise ['su:pəvaɪz], circumference [sə'kʌmfərəns], convenience [kən'vi:nɪəns].

1.1.2 Make sure if you can read the words correctly and say what Ukrainian words help you to guess their meaning:

gigantic, phenomenon, stress, reality, concept, theory, component, battery, apparatus, centre, radius, technique, natural, idea, definition, genius, history, diaphragm, experiment, polarization, radio, diffraction, atmosphere, interference, system, telegraph, communication, telephone, radiation, limit, mathematics.

1.1.3 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 (детектувати – 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.

1.1.4 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.

1.1.5 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. The train **leaves** at six in the evening. Will you go to the Crimea on leave? 5. We

must **set** the time for the beginning of the experiment. Give this worker a **set** of tools. 6. **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.

1.1.6 Define the parts of the following simple sentences. Translate the sentences into Ukrainian:

1. In the first year the students have many general subjects. 2. This article is about the story of radio. 3. She began to translate the text yesterday. 4. Every student is present at the lecture today. 5. The methods of radio engineering are now used in various fields of science and technology. 6. There are thousands of radio amateurs different countries. 7. One cannot read such articles without a dictionary. 8. It is necessary to help him. 9. We usually take measurements with great accuracy. 10. It becomes cold in autumn. 11. There were many explanations of the phenomenon of light. 12. In January, it snowed all the time. 13. Several types of microphones are in wide use now. 14. Nobody could solve this problem. 15. One may determine the wave frequency. 16. Let us take part in the expedition. 17. To read is necessary. 18. Energy is the ability to work. 19. By reading English books we increase our vocabulary. 20. They offered me some interesting work. 21. There exist various types of radio receivers. 22. Every day at 8 o'clock in the morning the students come to the Institute.

1.1.7 Define the tense-forms of the verbs in the following sentences and translate them:

1. Yesterday the students of our group **came** to help me with mathematics. 2. Our scientists **will** further **develop** various kinds of computers. 3. Radio waves **are** the longest members of the family of electromagnetic waves. 4. Where **did** the first international conference on radio **take** place? 5. Modern orbital stations **weigh** up to 20 tons. 6. If you **work** much, you **will get** good results. 7. My friend **does not like** sports. 8. Will you go to the library tomorrow? 9. When the lectures **are over,** we **shall go** to the reading hall. 10. We shall **meet** tomorrow at the same place. 11. According to the time-table, the train **gets** in at half past eight. 12. I left school three years ago. 13.1 completely **agree** with your opinion. 14. She not only sings, she **plays** the guitar as well. 15. You **found** the lost book, **didn't** you? 16. He **spoke** to me in a very friendly way. 17. Which part of the concert **did** you **like** most? 18. It **was** so warm a day that we **decided** to go to the river. 19. She **speaks** English well. 20. Electricity cables **stretch** over the fields. 21. We **shall** not **leave** home until you **come.** 22. She never **listens** to the advice which I **give** her. 23. If the water **continues** to rise, these fields **will be** under water.

1.1.8 Translate the following sentences into Ukrainian:

1. 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. 8.1 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.

1.1.9 Say the following sentences in the Past Indefinite 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)

1.1.10 Translate the sentences into Ukrainian. Pay attention to the verbs in the Indefinite Passive:

1. Sounds **are produced** by the vibration of matter. 2. The translation from one language into another **will** soon **be performed** by 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 Institute **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.

1.1.11 Say the following sentences in the Indefinite 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. 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. 16. Their laboratory occupies **a separate part of the building.** 19. Radio devices perform **various communication tasks.** 18. **We** use **such devices** for amplification of radio signals.

1.1.12 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.

1.1.13 Match up the words 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.

1.1.13 Listen to the tape-recorded lexical programme. Try to memorize the words and word-groups:

■ to take a step forward – зробити крок вперед ■ to put forward a theory – висунути теорію ■ merely – тільки, всього лиш ■ to make a discovery – зробити відкриття ■ essential – основний ■ to give rise to – сприяти ■ loose – вільний ■ mouthpiece – мікрофон ■ to suggest a method – запропонувати метод ■ to turn to – звернутися ■ thereby – за допомогою цього ■ to include – включати в склад ■ persistent – наполегливий ■ convenience – зручність ■ point – точка.

1.2 The history of Radio

1.2.1 Study text A. Try to understand all details. Use a dictionary if necessary:

Text A
The Story of Radio

1. Without understanding the inquiries of pure science[1], 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[2], 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[3]. 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[4], merely differing in wave length.

2. 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.

3. 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.

4.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[1] 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[5]. Popov became the inventor of the radio, May 7 being celebrated each yearas "Radio Day" in many countries.

5. Marconi invented a system of highly successful wireless telegraphy, and inspired and supervised its application.

6. 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. It was a

patient, persistent inquiry into natural laws and it was animated by the love of knowledge[6].

7. During the first years of its development, radio communication was called "wireless telegraphy and telephone". This name was too long for convenience and was later changed to "radio" which comes from the well-known Latin word "radius" – a straight line drawn from the centre of a circle to a point on its circumference. Wireless transmission was named radio transmission, or simply "radio".

8. The term "radio" now means the radiation of waves by transmitting stations, their propagation through space, and reception by receiving stations. The radio technique has become closely associated with many other branches of science and engineering and it is now difficult to limit the word "radio" to any simple definition.

NOTES

1. without understanding the inquiries of pure science – не знаючи джерел чистої науки
2. by purely mathematical reasoning – за допомогою чисто математичних роздумів
3. does not exist in reality – насправді не існує
4. both being the same kind of waves – обидва є хвилями одного типу
5. distinguished audience – авторитетна аудиторія
6. to be animated by the love of knowledge – бути сповненим любові до знань

1.2.2 Say whether the following statements are true or false:

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.

1.2.3 Answer the following questions on paragraph I:

1. Who discovered the oscillation of electrical discharges? 2. Does "the ether" exist in reality? 3. What did the concept of an ether help Maxwell in?

1.2.4 Find the information dealing with the discovery made by David Hughes. Relate this information to your partner.

Which paragraph contains the information directly connected with the invention of radio. Render this information.

1.2.5 Translate paragraph 5-6 into Ukrainian.

1.2.6 Read paragraph 5 and speak about Marconi's contribution to the development of radio.

1.2.7 Explain the origin of the word "radio".

1.2.8 Speak about the story of radio using the information from the text.

1.3 Some facts from the history of radio engineering

1.3.1 Look through the list of the English words and their Ukrainian equivalents , facilitating reading Text B:

to concern – відноситись, стосуватися; to design – конструювати; equipment – обладнання; home-made – вітчизняний; electronic valve – електронна лампа; broadcasting station – радіостанція; superpower oscillator valve – надпотужна генераторна лампа; under the guidance – під керівництвом; special-purpose radio station – радіостанція спеціального призначення; amateur designer – радіолюбитель (конструктор); radio-controlled models – модель на радіоуправлінні; remote control ─ дистанційне управління; far-away Galaxies – віддалені Галактики.

1.3.2 Skim through text B and say in Ukrainian or in English what it is about. You are given 3 minutes.

Text B

Nowadays local radio stations broadcast their own programmes in addition to relaying central radio broadcast programmes. Dozens of thousands[1] of various special-purpose radio stations are in operation in aeroplanes, trains, ships, etc. There are also thousands of radio amateurs who use short-wave radio sets for long-distance contacts, "fox-hunters" (a special kind of sport), amateur designers constructing radio-controlled models of aeroplanes and ships as well as many other types of different purpose radio equipment.

In the late 1930s and especially after World War II other branches of radio engineering developed rapidly: television, remote control of different equipment by means of radio (telecontrol), radio-location (radar), radio navigation, etc.

The methods of radio engineering are now used in various fields of science and technology, e.g. in physics, chemistry, geology, medicine, astronomy, mathematics, etc. At present there is no branch of science where use is not made of[2] some kind of radio equipment. Distant areas of the Universe are studied with the help of radio. Spacecrafts are guided by radio. Radio devices have made it possible the information to be obtained[3] about the mysterious and amazing phenomena taking place in far-away Galaxies as well as inside atomic nuclei.

NOTES

1) dozens of thousands – десятки тисяч

2) use is not made of – не використовується

3) have made it possible the information to be obtained – дали можливість отримати інформацію

1.3.3 Look through the text again and say:

a) what branches of radio engineering rapidly developed after World War II;

b) in what branches of science and technology the methods of radio engineering are used now.

1.4 The First International Radiotelegraph Conference

1.4.1 Look through the list of the English words and their Ukrainian equivalents for text C:

unlike – на відміну; to assign – визначати; appropriate – відповідний; preliminary – попередній; to undertake – вжити заходів; to exchange – обмінюватись; to man – комплектувати; to stir – викликати; to originate – брати початок, відправляти; to destine – призначувати; distinction – відмінність; latter – останній(із перелічених); to accept – приймати; subsequent – наступний.

1.4.2 Read text C carefully. While reading look for the answers to the following questions:

1. Do electromagnetic waves know man-made frontiers? 2. What was the reason for calling the preliminary international radio conference? 3. What principles became the basis for the regulation of radio communication? 4. What principles were accepted at the First International Radiotelegraph Conference?

Text C

The First International Radiotelegraph Conference

1. The very nature of radio[1] made it international, right from its beginning. Unlike the cables of the telephone or the wires of the telegraph, electromagnetic waves know no man-made frontiers[2]; once emitted from their antenna, only their strength decides to what distance they travel. Throughout the history of radio it has always been the aim to choose and assign appropriate frequencies by international agreement, to lay down the rules[3] for the operation of radio stations and to approve standards for apparatus and their operators.

2. Preliminary International Conference on Radio took place in Berlin as early as 1903[4]. A.S.Popov was one of the chief Russian delegates. Nine countries met to undertake preliminary studies for the international regulation of radio. Part of the reason, if not the major one[5], for calling this conference was to stop the attempt of Marconi to monopolize radio. In order to establish his monopoly, he had given instructions to his operators only to exchange wireless signals with other stations also manned by Marconi operators, and it was this action[6] by a private company which stirred up most opposition.

3. In the Final Protocol of the Preliminary Berlin Conference it was laid down that "Coast stations should receive and transmit telegrams originating from or destined for ships at sea without distinction as to the system of radio used by latter". In spite of[7] the very elementary state of radio in 1903, this principle and the others of the Final Protocol became the basis for the regulation of radio communication.

4. 29 nations came to the First International Radiotelegraph Conference in Berlin, 1906. It accepted the Radio Convention, Radio Regulations and the fundamental structure for all subsequent conferences.

NOTES

1) the very nature of radio – сама природа радіо
2) man-made frontiers – штучні перешкоди
3) to lay down the rules – встановити правила
4) as early as 1903 – ще в 1903 році
5) part of the reason, if not the major one – одна з причин, якщо не найголовніша
6) it was this action ... which – саме цей вчинок
7) in spite of – незважаючи на

1.4.3 Say what made radio international.

1.4.4 Explain why electromagnetic waves have no man-made frontiers.

1.4.5 Find the information about the necessity of the international agreement on appropriate wave frequencies. Say what other points of such an agreement are mentioned in this part of the text.

1.4.6 Unite paragraphs 2 and 3. Propose the most suitable title for this part out of the following ones:

1. Preliminary International Conference on Radio.
2. Marconi's Monopoly on Radio.
3. The Decisions of the Preliminary International Conference on Radio.

1.4.7 Give two main reasons for organizing the Preliminary International Conference on Radio.

1.4.8 Say

a) how Marconi tried to monopolize radio;
b) what the decisions of the Preliminary Conference were.

1.4.9 Which paragraph contains the information directly connected with the title of the text? Render this information.

1.4.10 Imagine that you are to make a report. While preparing it use the main information of texts A, B and C (Write 10-13 sentences.) The following plan is available:

1. First important discoveries in the field of radio.
2. A.S.Popov's contribution to the development of radio.
3. Problems discussed at the first radio conference.

2 KIND OF RAYS AND WAVES

2.1 The electromagnetic waves

2.1.1 Practise the reading of the following words:

exclamation [ˌekskləˈmeɪʃ(ə)n], acquaintance [əˈkweɪnt(ə)ns], experience [ɪksˈpɪərɪəns] , occurence [əˈkʌr(ə)ns], bullet [ˈbʊlɪt], microwave [ˈmaɪkrəweɪv], equipment [ɪˈkwɪpmənt], frequency [ˈfri:kwənsɪ], wavelength [ˈweɪvleŋθ], intelligence [ɪnˈtelɪdʒ(ə)ns], message [ˈmesɪʤ], to occur [əˈkə:], cancer ['kænsə], nothing [ˈnʌθɪŋ], ultraviolet [ˈʌltrəˈvaɪəlɪt].

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

guide, cycle, spectrum, to register, reason, organization, position, to start, satellite, typical, electronics, to characterize, interval, activity, vibration, object, programme, hospital, machine, radar, distance, problem, antenna, sport, form, interesting, element, progress, result, test.

2.1.3 Give the initial words of the following derivatives:

different, communication, cooker, technological, invisible, equipment, vibration, quickly, responsible, relatively, typical, ceaselessly, probably, magnetic, ultraviolet, announcement, occurence, transmitter, receiver, organization, hunter.

2.1.4 Form nouns adding the suffix -ness to the given adjectives. Translate them into Ukrainian:

Example: complete – completeness

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

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

1. He **works** as a teacher. One of Mendeleyev'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. 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 our country have **equal** rights. A right angle **equals** 90°.

2.1.6 Make sure if you remember the three forms of the following verbs. Translate the verbs into Ukrainian:

be – was/were – been; bear – bore – born; begin – began – begun; buy – bought – bought; feed – fed – fed; find – found – found; get – got – got; give – gave – given; hold – held – held; hear heard – heard; know– knew – known; lie – lay – lain; make – made – made; meet – met – met; run – ran – run; say – said – said; send – sent – sent; sit – sat – sat; take – took – taken; understand – understood – understood.

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

1. Belarusian people **are developing** the economy of the country. 2. The output of the factory **will be growing** during the current five-year period. 3. Our 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.

2.1.8 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. Our 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.

2.1.9 Translate the following word-groups. Pay attention to the tense forms of the predicates:

the problem occupied; the century began; they are obtaining; the scientists understood; the satellite was on its orbit; the property depended; the program is being broadcast; the physicist was searching; a new radio set was demonstrated; the elements constituted; the man thought; new results are being obtained; the chemist wrote; the discovery established; the particle became; the scientist was applying; the point of view differed; the engineer is measuring; the concept explains; the idea was supported; the particle will be divided; the phenomenon was explained; astronomy is studying; the telescope is built; the power plants were being controlled; the observation shows; the energy was converted; the data will be checked.

2.1.10 Analyse the functions of the verb to be. Translate the sentences into Ukrainian:

The results of the experiment are of great importance for our further work. 2. There are no chemical plants in our town. 3. The substance that we are speaking about is water. 4. We are to translate technical literature in the second year. 5. It was the study of natural phenomena that made it possible to formulate various laws. 6. Probably the most important use of electricity in the modern house is producing light. 7. Technical progress is now impossible without high-quality materials. 8. Electronics is being used more and more throughout the industry. 9. The electron is a particle. 10. The machine is of five parts. 11. Our task is to finish the test by 7 o'clock. 12. Radio was invented by a talented Russian scientist A.S.Popov. 13. Words in a dictionary are in alphabetical order. 14. Smoking is dangerous. 15. The temperature is three degrees above zero. 16. My friends are mostly students. 17. It is the only positive solution. 18. The British are very proud of their sense of humour. 19. This scientific discovery was the result of six years' research. 20. Our aim is to accomplish this task as soon as possible. 21. He will be an engineer in two years. 22. Their house is in the middle of the village.

2.1.11 Match up the words which are 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.

2.1.12 Try to memorize the words and word-groups:

■ probably – можливо, ймовірно ■ exclamation – наголошення ■ to be related to – мати відношення до ■ to have similar experience – мати подібний досвід ■ to have nothing to do with – не мати нічого спільного з ■ to turn out – опинятися ■

after all – в кінці кінців ■ to listen to a radio programme – слухати програму по радіо ■ to refer to – посилатися ■ sun-tan lamp – лампа для загару ■ to guide – направляти, вести ■ bullet – куля ■ cancer – рак, ракова пухлина ■ to resemble – мати схожість, нагадувати ■ complete – повний, завершений.

2.2 Definition of seven rays

2.2.1 Read the title of the following text. Can you guess what the text might be about?

2.2.2 Study text A. Try to understand all details. Use a dictionary if necessary:

Text A

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 . 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 hurried rays, sometimes referred to as heat rays. When we sit under a suntan 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 in a 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 – явище в природі

3.things or events that at first seem to have nothing to do with ... – предмети чи події, які, як здається на перший погляд, не мають нічого спільного...

2.2.3 Say whether the following statements are true or false:

1. 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.

2.2.4 Find the information explaining why we call light a visible ray. Read the information to your partner.

2.2.5 1) Answer the questions on paragraph 3:

1. What rays 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?

2) Name the types of invisible rays we find in use: a) in our homes-, b) outside the home.

2.2.6 In paragraph 4 find the English equivalents to the following words:

промінь, тип, частота, відстань, нагадувати, довжина хвилі, період, повний(завершений), рухатися, називати, довгий, низький, кількість.

2.2.7 Speak about the electromagnetic waves using English words from the logical diagram.

2.2.8 Say briefly what each paragraph is about.

2.2.9 Read paragraph 4 again and say what makes the seven rays different from each other.

2.3 Radio waves

2.3.1 Look through the list of the English words and their Ukrainian equivalents for better understanding text B:

subtle – тонкий, невловимий; to occur – траплятися; to convert – перетворювати; receptive – чуттєвий; beyond – за межами; wavelength – довжина хвилі; to range – коливатися в межах; frequency – частота; to approach – наближатися; beam – пучок; промінь; to fan out – розходитись, поширюватись.

2.3.2 Read text B. Find out the main information of the text.

Text B

Radio Waves

During the last few decades, a subtle change has occurred which none of our senses[1] can register. Radio waves, bearing messages in many tongues[2], flow ceaselessly around us, through us and above us. We can only hear and see them if we convert them to other waves to which our ears and eyes are receptive.

Radio waves are the longest members of the family of electromagnetic waves. In the spectrum, in which the waves are arranged in order of increasing wavelength[3], they lie beyond the infrared waves. Their wavelengths range from about three hundredths of a centimetre to about 300 kilometers. Radio broadcasts today are made by two different methods known as AM (amplitude modulation) and FM (frequency modulation). The frequencies of the waves used are expressed in kilocycles or megacycles. The vibrating current is fed into an antenna from which the radio waves are broadcast into space.

Microwaves are the smallest radio waves. In the spectrum of electromagnetic waves they lie between infrared rays and the long radio waves. The shortest microwaves have a wavelength of about three hundredths of a centimetre and a frequency of one million megacycles. The longest microwaves have a wavelength of about three metres and a frequency of one hundred megacycles.

The first microwaves made by man were the two-foot waves produced by Heinrich Hertz. It is interesting that they were the last to be put to a practical use. Long waves were easier to produce and send out over long distances. Scientists had to return to the use of short waves in order to solve a problem[4] that came up during World War II. The problem was "How can you detect an approaching enemy plane while it is still far away? " A possible answer to the problem was to send a beam of radio waves. Long radio waves could not be used for this purpose because they fan out too quickly from the broadcasting antenna. Very short waves were necessary to make the radar system work. So new transmitters and receivers were designed to make and use microwaves.

NOTES

1) none of our senses – жодне із наших відчуттів
2) bearing messages in many tongues – які несуть повідомлення на багатьох мовах
3) in order of increasing wavelength – в порядку збільшення довжини хвилі
4) in order to solve a problem – щоб вирішити проблему

2.3.3 Find answers to the following questions:

1. Can we hear and see radio waves? 2. What place do radio waves occupy in the spectrum of electromagnetic waves? 3. Who produced the first microwaves? 4. Were the microwaves the first to be put to a practical use? 5. What kind of problem came

up during World War II?

2.3.4 Speak about the characteristics of radio waves and microwaves.

2.4 Radio Sport: a Serious Business

2.4.1 Look through the list of the English words and their Ukrainian equivalents:

activity – діяльність; to support – підтримувати; to administer – керувати; responsible – відповідальний; announcement – оголошення; to intend – мати намір; to remain – залишатися.

2.4.2 Before you read the text study the questions. Then read the text to yourself to find out which questions the author answers:

1. What is the name of the organization responsible for administering radio sport in Great Britain? 2. What word is the key one in radio sport? 3. Is radio sport supported by the government? 5. Do "foxes" identify themselves every five minutes? 6. Is the competitive spirit typical of Ukrainian electronics?

Text C

Radio Sport: a Serious Business

1. In Ukrainian vocabulary the electronics enthusiasts are known as "radio sportsmen". Radio sport is a highly organized, serious activity supported and administered by the government. The organization responsible for administering radio sport is called the Radio Sports Federation. In radio sport, the key word is competition. The highest award, one held by a relatively few sportsmen, is "Master of Radio Sport". One particularly interesting form of radio competition is called "Fox Hunting". This is a contest in which teams of "hunters" (young people carrying portable direction finders) race against time[2] to find "foxes" (hidden transmitters). The rules call for[3] the three "foxes" to take up positions one or two miles apart in a large wooded area. At the starting signal, the "foxes" begin identifying themselves by voice announcements[4] at one-minute intervals, each "fox" therefore being on the air[5] once every five minutes. The announcements, which are very brief, are made on amateur bands[6] by means of low-powered transmitters, usually homemade. The winning "hunter" is the one who first locates all three "foxes" in sequence[7]. The kind of competitive spirit[8] that characterizes radio sport is typical of electronics in general. Whether it be the technological state of the art, TV via communication satellite, or techniques for electronic training, the our people are fully aware of the importance[9] of communications-electronics in the space age, and they intend to remain competitive in every possible way.

Notes

l) a portable direction finder – переносний радіопеленгатор

2) race against time – беруть на час
3) the rules call for – правила вимагають
4) identify themselves by voice announcements – дають знати про себе голосом
5) on the air – в ефірі
6) amateur band – радіолюбительский діапазон частот
7) in sequence – послідовно, одна за іншою
8) competitive spirit – дух змагань
9) are fully aware of the importance – цілком розуміють важливість

2.4.3 Say whether the following statements are true or false:

1. In radio sport the key word is competition. 2. One particularly interesting form of radio competition is called "Fox Hunting". 3. Each "fox" is on the air once every five minutes. 4. The announcements, which are very long, are made on amateur bands. 5. The winning "hunter" is the one who last locates all three "foxes" in sequence. 6. They are fully aware of the importance of communications-electronics in the space age.

2.4.4 The text contains three main ideas. Divide the text into three logical parts and say briefly what each part is about.

2.4.5 Say how radio sport is characterized in the introductory part.

2.4.6 a) What is the main principle of radio competition called "Fox Hunting"? b) Find the information in the text about the rules of "fox hunting" and answer the following questions:

1. What do the "foxes" do at the starting signal? 2. How often do "the foxes" identify themselves? 3. What devices do "the foxes" use to make voice announcements? 4. The winning "hunter" is the one who first locates all three "foxes" in sequence, isn't he?

2.4.7 Can you say in what way the competitive spirit that characterizes radio sport shows itself in the development of electronics.

2.4.8 Retell briefly the information you have learned from the text.

2.4.9 Imagine that you are going to take part in a scientific conference. The theme of your report is "The Family of Electromagnetic Waves". While preparing the report use the information of texts A, B, C and the following plan:

1. Seven kinds of rays are close relatives.
2. The use of electromagnetic waves.
3. Characteristics of radio waves.
4. Short waves and their application in radio sport.

3 AUDIO SYSTEMS

3.1 The use of electromagnetic waves

3.1.1 Practise the reading of the following words:

knowledge [ˈnɒlɪʤ], record [ˈrekɔ:d], manual [ˈmxnjuəl], conversation [ˌkɒnvəˈseɪʃən], drum [drʌm], to shout [ʃaʊt], pattern [ˈpætn], to reverse [rɪˈvɜ:s], to reproduce [ˌri:prəˈdju:s], to wind [waɪnd], means [mi:nz], to store [stɔ:(r)], stereo [ˈsteriqʊ], channel [ˈʧxnl].

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

modern, person, phonograph, code, signal, telegraph, symbol, method, diaphragm, experiment, poem, to reproduce, stereo, process, principle, line, microphone, original, music, laboratory, energy, apparatus, instrument, diameter, type..

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

Example: beauty – beautiful – краса – прекрасний

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

3.1.4 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.

3.1.5 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.

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

to send, to cut, to represent, to notice, to sound, to happen, to find out, to consist of, to attach, to turn, to shout, to move, to hear, to store, to release, to repeat, to wear out, to transmit, to reproduce, to follow, to hit, to convert, to fit, to move, to represent, to wind, to claim, to damage, to link.

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

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. 4. **I have read** this book three times. 5. He **has** never **been** to the Carpathians. *6.* He **has seen** this film. 7. **Have** you ever **been** to St. Petersburg? 8. He **had** finished **his** work by 5 o'clock yesterday. 9. The technician **will have recorded** the data before you **come. 10. I have not seen** him since he **graduated** from the University. **11.** We **shall have completed** our experiments by the end of the week. 12. My friend **had prepared** his report before we spoke to you. 13. Electronics **has made** a rapid progress. 14. He **had published** his article by the end of the month. 15. We've **played** lots of matches this season, but we **haven't won** many. 16. She **has spent** a great deal of time in the Far East. 17. They'll **have finished** their work by lunchtime. 18. **Have** you **read** anything interesting lately? 19. They've probably **forgotten** the time. 20. They **have accepted** the scientist's suggestion. 21. Moscow Radio **has been transmitting** its programmes to other countries since the thirties. 22. We **had been conducting** this experiment for two hours before you **came.** 23. When she **arrived, I had been waiting** for two and a half hours. 24. It **has been raining** since two o'clock.

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

1. This theory **has been used** for analyzing 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.

3.1.9 Translate the following word-groups into Ukrainian, 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 problem 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.

3.1.10 Compare the use of the Past Indefinite and the Present Perfect in the following sentences, translate them into Ukrainian:

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 1998. 5. Have you ever seen "Hamlet"? Yes, I've seen "Hamlet" several times. I saw it at our theatre three years ago and at Moscow theatres in 1995 and 2000. 6. He has graduated from the Moscow University. He graduated from the Moscow University in 1988. 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.

3.1.11 Define the functions of the verb to have in the following sentences. Translate them:

1. They **have** already **passed** the examination in electrical engineering. 2. Automated systems **have** a number of advantages. 3. Our district **has** now **been transformed** into a big construction site. 4. Gamma rays **have** no electric charge. 5. Cosmic television **has** a great future. 6. He **had to work** hard to complete his investigation in time. 7. The engineer **will have to improve** the accuracy of this machine-tool. 8. A new method **has been used** in order to investigate this problem. 9. I **have to do** this work now. 10. We **had to repeat** the experiment. 11. Our planet **has** powerful sources of energy. 12. You **will have to go** to the library to get this book. 13. **I had to leave** early because I didn't feel well. 14. We've **got** a new teacher. 15. She **has** a lot of character and energy. 16. Yesterday I **had** a bad headache. 17. She **will have** many new subjects next term. 18. The scientist **had to stop** the experiment. 19. Besides literature, we **have to study** history and philosophy. 20. The electron **has** almost the same mass as the proton.

3.1.12 Define the functions of the word since in the following sentences. Translate them:

1. Colour television has been functioning in our country **since** 1967. 2. More

than a hundred years have passed **since** the day when A.S.Popov demonstrated his radio receiver. 3. Many expeditions have been here **since.** 4. I've known her **since** we were children. 5. **Since** you are here, I may go home. 6. There is no flow of electrons **since** the electric current is broken. 7. We've lived in three different towns **since** last year. 9. **Since** you weren't at the meeting, we took the decision without you. 9. How long is it **since** you left school? 10. London has been a capital **since** 1066. 11. **Telescopes are being** used **since** their invention. 12. People wished to handle atom **since** ancient times. 13. It's ages **since I** saw you last. 14. He left for the Crimea and has been living there **since. 15. Since** your first letter, we haven't heard from you. 16. **Since** you have not got anything to read, let's talk.

3.1.13 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.

3.1.14 Try to memorize the words and word-groups:

■ to have a good knowledge of – мати добрі знання ■ to play records – програвати платівки ■ in order to do this – щоб зробити це ■ a strip of paper – смужка паперу ■ to send messages – посилати повідомлення ■ much more quickly – набагато швидше

■ to be a true scientist – бути справжнім вченим ■ a little more complicated – трохи більш складний ■ speed – швидкість

■ to devise – винаходити, придумувати ■ needle – голка; стрілка

■ tin – олово ■ foil – фольга ■ certain – певний ■ to reverse – змінювати*(напрям)* ■ to wind (wound) – вертіти, крутити ■ accident – випадковість; випадок ■ to hit (hit) – ударяти.

3.2 The principle of tape-recorder's work

3.2.1 Before reading the text answer the following questions:

I. What is the English for "програвати"? 2. Do you know that the original record-player was called a phonograph? 3. Who invented the phonograph? 4. Do you know the history of the invention of the first phonograph?

3.2.2 Find some information about a modern record-player in the text:

Text A

The Record-player. How Does It Work?

1. You may know a lot about music: you may have a good knowledge of modern records: but how much do you know about the machine that plays your records? How, for example, does it work? It will help you to understand how record-players

work, if you go back to the person who invented the first phonograph, Thomas Edison.

2. He had been experimenting on ways of sending Morse Code[1] signal more quickly by telegraph: in order to do this, he built a machine which cut out small marks, representing the Morse symbols, into a strip of paper. By running the paper[2] through the transmitting machine at a very fast speed, he could send messages much more quickly than by the manual method. He noticed that the machine was making a noise which sounded like human voices[3] in conversation. Edison was a true scientist: if something unusual happened he wanted to find out why: so he decided to fit a diaphragm to the machine, to see what this would do.

After a few experiments, Edison devised a machine which consisted of two diaphragms on either side[4] of a drum of tinfoil. Each diaphragm was attached to a needle, which rested on the foil. Edison turned the drum by hand and shouted a poem into one of the diaphragms – the recording unit – which then cut a pattern into the tinfoil. This is because the diaphragm vibrations moved the needle in certain directions, which were recorded on the foil.

4. Edison then reversed the process so that the reproducing needle was at the start of the newly-cut needle path[5] and started winding the drum again. He then heard his own voice repeating the poem: the needle, following the path in the foil, vibrated its diaphragm which then reproduced the sounds that the other diaphragm had recorded.

5. This all happened in 1877, more or less by accident. In a hundred years of development and experimentation, the phonograph has developed into what we know now as the record-player. The principle is still the same, however, sound waves hitting a microphone (diaphragm) are then converted onto a record by mechanical or electronic means. The sound is then stored, it is released as vibration when the needle follows the path that has been cut, and reproduces the original message. Stereo sound is a little more complicated. Two microphones, each attached to its own recording systems, record the sound that is produced from the loudspeakers. It appears very similar to the original sound. Nowadays, by "mixing" the sound, and by changing it from one channel to the other, you can make the sound travel from one loudspeaker to the next one.

NOTES

1. Morse Code – алфавіт Морзе
2. by running the paper – шляхом пропущення паперу
3. like human voices – подібно до людських голосів
4. on either side – з обох сторін
5. the newly-cut needle path – щойно прорізана доріжка

3.2.3 Say whether the following statements are true or false:

1. Edison had been experimenting on ways of sending Morse Code signals more quickly. 2. The machine was making a noise which sounded like human voices in conversation. 3. Edison turned the drum by hand but couldn't shout a poem into the diaphragm. 4. The diaphragm vibrations moved the needle in certain directions. 5.

The work of the modern record-player is based on other principles. 6. One can make the sound travel from one loudspeaker to the next one.

3.2.4 Look through paragraph I and say in what connection the name of Edison is mentioned in it.

3.2.5 Read paragraph 2 attentively and retell its contents to your partner. You may use the following plan:

1. Edison made experiments on the ways of sending Morse Code signals (how?)
2. He made a special machine (what was this machine?) for his experiments.
3. While experimenting on his machine at a very fast speed he noticed some strange noise (what was the noise like?).
4. Edison wanted to find out why the machine was making a noise and ... (what did he decide to do?)

3.2.6 In paragraph 3 find the English equivalents for:

помічати, створювати шум, звучати, бесіда, справжній, голос, з'ясовувати щось, відбуватися, вирішувати, людський, незвичайний, через те.

3.2.7 Translate paragraph 4.

3.2.8 Describe the construction of the phonograph using the words:

phonograph to be drum of tinfoil to consist of 2 diaphragms to be attached to 2 needles to rest on foil.

3.2.9 Write out of paragraph 6 the words which can be used for describing how modern record-players work.

3.2.10 Tell the story of the record-player and the principle of its work.

3.3 Stereo system

3.3.1 Look through the list of the English words and their Ukrainian equivalents for text B:

disappointing – який викликає розчарування; properly – правильно; як слід; inwards – всередині; lead – дріт; amplifier – підсилювач; feedback – зворотній зв'язок; record-deck – електропрогравач; stylus – (відтворювальна) голка ; socket – гніздо, розетка.

3.3.2 Read the following text and entitle it. Compare your title with the title given by the author.

Text B

Have you or your family got a stereo system? If you have, are you sure that

you're getting the best from it? Expensive equipment can sound very disappointing if it isn't set up properly. Here are some points to check.

The stereo area is the part of the room in which the listener can hear exactly the right sound. Put the two loudspeakers about two metres apart (more in a very large room, less in a small one). Turn them slightly inwards. Now imagine a line from the centre of each speaker. Where the lines meet is the stereo area and the best place to sit and listen.

There are two important points to remember when you're deciding where to put the rest of the system. First the lead between the amplifier and the tape or record deck should be as short as possible[1]. A long lead will give poor sound. The leads between the amplifier and the speakers can be as long as you like. Secondly watch out for feedback. This is the sound you hear when vibrations from the music (or even footsteps) affect the record deck. Feedback can spoil the sound of the record or make the stylus jump. The answer is to make sure[2] the record deck is on a wall shelf or a heavy piece of furniture.

If the sound of your stereo is still disappointing, perhaps you've mixed up the leads. If you've accidentally put a left-hand lead into a right-hand socket, you won't get a stereo sound. The quickest way to test your stereo system for this and other problems is to buy a test record, which will have all kinds of sound tests on it.

NOTES

1.as short as possible – щомога коротше
2.to make sure – переконатися

3.3.3 Name the author's recommendations on making your stereo system sound properly.

3.4 Compact disks

3.4.1 Look through the list of the English words and their Ukrainian equivalents:

to coat – покривати; digital – цифровий; to claim – стверджувати; distortion – викривлення; background hiss – фоновый шум (шипіння); studio master – студійний диск; tough – міцний; careful handling – дбайливе ставлення; to damage – завдавати шкоди, псувати; to wear out (wore, worn) – зношуватися; conventional – звичайний; hi-fi system – high fidelity system – система з високою точністю відтворення.

3.4.2 Scan text C and say where compact disks are used.

Text C

Compact Disks

1. You have not only heard about Compact Disks (CD), you've been using them here and there in your everyday life. The invention of Sony has very quickly become popular all over the world.[1]. A CD consists of a piece of aluminium coated with

transparent plastic, 12 cms across, for producing sound. It's similar[2] to an ordinary record, except that it's "read" by a laser beam, and the information recorded on the aluminium is digital.

2. The makers claim that a CD can reproduce the original sound perfectly, without any distortion or background hiss. As the system is computerized, there's no loss of quality between the studio master and the record you buy. Also, a CD is much tougher than a vinyl record, so it doesn't need such careful handling. Dust and dirt won't damage it, and as there's no contact between the laser and the disk, it will never wear out.

3. The CD player produces an audio signal which you can amplify through a conventional hi-fi system, to produce the best sound possible. The technique became a new exciting development in hi-fi, linking sound recording with the computer revolution: What has **followed it?**

NOTES

1. Sony – Соні *{японська фірма по виготовленню радіоапаратури)*
2. It's similar to – він схожий на

3.4.3 Say what a compact disk looks like.

3.4.4 Write out of paragraph I two peculiarities of CD disks.

3.4.5 Try to answer the following questions about ordinary disks:

1. How is an ordinary record "read"?
2. In the new design the information is digital. What about ordinary disks?

3.4.6 Look through paragraph 2 again and speak about:

1) the construction of a compact disk: 2) the peculiarities of it; 3) the advantages of it; 4) the principle of operation.

3.4.7 Count the number of advantages of new records mentioned in paragraph 2 and name them.

Use the information of texts A, B and C for preparing a report on the theme "Everything about record-players".

4 TELEVISION

4.1 The means of transmitting

4.1.1 Practise the reading of the following words:

to alter [ˈɔ:ltq], objective [qbˈʤektɪv], specific [spɪˈsɪfɪk], enterprise [ˈentqpraɪz], stage [steɪʤ], primarily [ˈpraɪmqrɪlɪ],whole [hqʊl], evident [ˈevɪd(q)nt], to foresee [fɔ:ˈsi:], comparison [kqmˈpærɪs(q)n], to scatter [ˈskætq], rivalry [ˈraɪv(q)lrɪ], controversy [ˌkɔntrqˈvq:sɪ], priority [praɪˈɔrɪtɪ], incentive [ɪnˈsentɪv], response [rɪsˈpɔns].

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

history, technology, television, complex, electricity, telegraphy, photography, period, realization, social, material, special, generation, phase, test, phosphor, control, operator, patent, disc, logical, lamp, colour, to sort, nature, master, to stimulate, pulse, specific, fact.

4.1.3 Give the initial words of the following derivatives:

primarily, considerable, selective, comparison, investment, separately, mobility, industrial, invention, development, actively, transformation, logical, clearly, communication, transmission, original, digital, researcher, information.

4.1.4 Form adverbs adding the suffix -ly to the given adjectives and translate them:

Example: sure —surely

separate, objective, quick, primary, active, considerable, complete, evident, social, competitive, mechanical, great, general, definite, absolute, different, automatic, sure, easy, similar, certain, frequent, constant, direct, main, probable.

4.1.5 Form adjectives adding the prefix -un to the adjectives and translate them:

Example: natural — unnatural

important, usual, complicated, completed, conventional, human, interesting, stable, economic, able, reliable, happy, available, limited, productive, balanced, like, easy, fortunate, original, sophisticated, true, natural, disciplined, discovered

4.1.6 Read the words and say what parts of speech they belong to:

produce, product, production; frequent, frequency; physics, physical, physicist; act, active, activity; develop, development; nature, natural; measure, measuring, measurement; direct, director, directive, direction, directness; operate, operating,

operation, operative, operator; relative, relatively, relation, relativity; mean, meaning, means; technical, technique, technician; system, systematical, systematically; electron, electronic, electronics; consider, consideration, considerable, considerably.

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

to alter, to depend, to separate, to involve, to seek, to introduce, to create, to become, to transform, to pass, to replace, to improve, to apply, to describe, to convert, to foresee, to relate.

4.1.8 Translate the sentences paying attention to the sequence of tenses:

1. He wanted to know what powerful radio stations were being built in Ukraine. 2. The students asked how the strength of the radio wave had been measured. 3. The engineer said they would carry out an experiment with the new transistor device. 4. The reporter asked if the scientific group was working out the design of this new installation. 5. They wished to know what these radio-electronic systems would ensure. 6. I told him that I should let him know the date of the conference. 7. The newspaper wrote that in the modern world people could not imagine their life without radio and television. 8. The teacher said we might complete our drawings next week. 9. The lecturer said that television played an important role in our life. 10. The engineer informed that all the equipment was functioning normally. 11. The chief engineer said that the reconstruction of the plant would begin next year. 12. I was asked whether I could take part in the research work. 13. The students were told that they didn't need to translate the text. 14. We asked if we should have a lecture on electronics next week.

4.1.9 Change the sentences from direct into indirect speech. Mind the rule of sequence offenses:

Example: She said, "I am going to the theatre with my brother."
She said that she was going to the theatre with her brother.

I. She said, "I'll be ready in a few minutes." 2. He said to me, "My sister has not finished her homework yet." 3. My brother said, "These photographs are not very good." 4. Her friend said, "This letter is full of interesting news. It reached me two days ago." 5. She asked, "Has it been raining all day? " 6. The librarian asked, "Have the books come? 7. She said to me, "I have never been to London." 8. The student said, "I'll work at my diploma design next year." 9. He said, "I am studying English at the University." 10. The professor said to the students, "The next lecture will be on linear motion." 11. My scientific adviser said to me, "You'll go to Moscow to take part in the conference." 12. She asked the student, "Can you translate this article? "13. The teacher said to us, "Don't look up the words in a dictionary when you translate such an easy text." 14. In 1905 Albert Einstein declared, "Matter can be converted into energy." 15. I.V.Kurchatov said, "I am happy to be born in Russia."

4.1.10 Say the following sentences in Ukrainian. Take into account the possible ways of translating the passive constructions:

1. The participants of the conference were shown the photographs made in outer space. 2. In the previous section you were given some facts to illustrate this phenomenon. 3. The new information was much spoken about. 4. The discovery of radium was followed by other important inventions. 5. All the machines were looked at with great interest. 6. The construction of this generator was paid great attention to. 7. Einstein's theory of relativity is often referred to by a great number of researchers. 8. We were informed about the report to be made by our professor. 9. The results of this investigation can be relied upon. 10. It is said that his theory produced revolution in science. 11. Use is made of electronics everywhere. 12. The engineer of our laboratory was offered new research work. 13. His report was followed by a short film. 14. Synthetic materials used in space technology are not affected by changes in temperature. 15. The electronic computer will be dealt with in the next chapter. 16. She was listened to with great attention. 17. Why don't you answer when you are spoken to? 18. My letter was answered immediately. 19. Nothing was heard from him.

4.1.11 Translate the sentences. Mind the different meanings of the word for:

1. One must be very attentive in experimenting, **for** accuracy is indispensable here. 2. He has not been taking English lessons **for** several months. 3. The problem we are dealing with is very important **for** our laboratory. 4. Colonial countries fight **for** their independence. 5. I.V. Kurchatov was a passionate fighter **for** peace. 6. He brought some papers **for** me to look them through. 7. It is difficult **for** him to solve this problem by himself. 8. We stayed in London **for** nine days. 9. I shan't do it **for** the world. 10. My friend left **for** Moscow yesterday. 11. This room serves me **for** a study. 12. We all hoped **for** a change of the weather. 13. This young lady has a weakness **for** fine clothes. 14. He will prepare everything **for** the experiment. 15. I went to England **for** the first time ten years ago. 16. He always answered all students' questions **for** there were no foolish questions for him.

4.1.12 Match up the words which are similar in meaning:

to take place, to operate, various, to arrive, to control, nearly, to explore, to obtain, actually, ordinary, dimension, to research, complex, to occur, to join, to come, to work, to get, type, almost, conventional, to calculate, size, complicated, different, really, to regulate, kind, to connect, to compute.

4.2 The history of television

4.2.1 Study text A. Try to understand all details. Use a dictionary if necessary:

Text A

The History of Television as a Technology

1. It is often said that television has altered our world. The invention of television was no single event or series of events. It depended on a complex of inventions and developments in electricity, telegraphy, photography and motion pictures[1], and radio. It can be said to have separated out as a specific technological objective in the period of 1875-1890, and then, after a lag, to have developed as a specific technological enterprise from 1920 through to the first public television systems of the 1930s. Yet in each of these stages it depended on inventions made with other ends in view[2].

2. Television, as an idea, was involved with many of these inventions. It is difficult to separate it, in its earliest stages, from phototelegraphy. The means of transmitting still pictures and moving pictures were actively .sought and to a considerable extent discovered. The list is long even when selective[3]: Carey's electric eye in 1875, Nipkow's scanning system in 1884; Braun's cathode-ray tube in 1897; Rosing's cathode-ray receiver in 1907.

3. Through this whole period two facts are evident: that a system of television was foreseen, and its means were being actively sought[4], but also that, by comparison with electrical generation and electrical telegraphy and telephony, there was very little social investment to bring the scattered work together[5]. In 1923 Zworykin introduced the electronic television camera tube. Through the early 1920s Baird and Lenkins, separately and competitively, were working on systems using mechanical scanning. There was great rivalry between systems and there is still great controversy about contributions and priorities[6].

4. What is interesting throughout is that in a number of complex and related fields, these systems of mobility and transfer in production and communication were at once incentives and responses within a phase of general transformation. The decisive transformation of industrial production and its new forms created new needs but also new possibilities, and the communications systems, down to television[7], were their outcome.

NOTES

1.motion pictures — кіно

2.with other ends in view — з іншими цілями

3. the list is long even when selective — перелік довгий, навіть якщо він зроблений вибірково

4.its means were being actively sought — були залучені активні пошуки коштів

5.to bring the scattered work together — об’єднати окремі роботи

6.there is still controversy about contributions and priorities - все ще відбувається полеміка щодо ступеню участі та пріоритету

7.down to television — до самого телебачення

4.2.2 Say whether the following statements are true or false:

1. The invention of television was no single event or series of events. 2. In each of the stages the development of television depended on inventions made with other ends in view. 3. It is not difficult to separate television, in its earliest stages, from phototelegraphy. 4. The means of transmitting still pictures and moving pictures were discovered. 5. There was great rivalry between systems, but there is no controversy about contributions and priorities. 6. The decisive transformation of industrial production created new needs and possibilities.

4.2.3 Answer the questions on paragraph 1:

1. Has television altered our world? 2. What did the invention of television depend on? 3. Television has developed as a specific technological enterprise, hasn't it?

4.2.4 Find the information dealing with scientists′ contribution to the development of television. Say it to your group-mate

4.2.5 In paragraph 3 find the English equivalents for:

очевидний, передбачати, шукати, засоби, у порівнянні з , соціальні вклади, розрізнений, окремо, розгортка, суперництво, отримання, полеміка, внесок, пріоритет, активно, також.

4.2.6 Translate paragraph 3 into Ukrainian.

4.2.7 Read paragraph 4 and say what the decisive transformation of industrial production and its new forms resulted in.

4.2.8 Write out of the text the words and phrases describing the history of television.

4.2.9 Make an outline of the article.

4.2.10 Speak about the history of television.

4.3 Television. How does it work?

4.3.1 Look through the list of English words and their Ukrainian equivalents facilitating reading text B:

sophisticated – складний; live transmission – пряма передача; picture scanner — аналізатор зображення; value — обсяг, значення; photosensitive cell – фоточутливий елемент; to trace out a line — розмічати рядок; frame frequency — частота кадра; crude — нестиглий; scanning speed — швидкість сканування; to retain an image — зберігати зображення; succession — послідовність; uninterrupted flow – неперервний потік; to glow – світитися; to strike (struck) –

бити, вдарятися; allocated dot – необхідна крапка.

4.3.2 Skim through the text. Try to understand the main contents(you are given 15 minutes):

Text B

Television. How does it work?

The principles of television aren't as complicated — or as modern — as you might think. TV technology has become more sophisticated than ever, but the basic method of sending a television picture is quite simple.

The first live transmission was made by John Logie Baird, the TV pioneer, in - 1924. Television had come a long way since 1884, when Paul Nipkow from Germany patented a mechanical picture scanner. This system formed the basis for Baird's historic, transmissions.

Nipkow's invention depended on a rotating disc. Light passing through the holes on the disc was transformed into electric values by photosensitive cells. The path of each hole in the disc was different, and thus traced out a different line, and read the entire frame in a logical order. At the receiving end, a lamp was used to send out corresponding impulses of light, which then passed through a further rotating disc, identical to the one at the transmitting end, and synchronized with it. The light passing through the disc was projected onto a screen to recreate the original object[1].

These attempts at televising objects were very crude, because the scanning speed was slow. A comparable system is used today except that electronic scanning equipment is much faster. Approximately 25 frames per second are scanned. Frame frequency is important in allowing television– and films to create moving pictures. The eye retains an image for about 1/16-th of a second, so the mind experiences[2] this succession of pictures as an uninterrupted flow. The large number of lines on modern television make clearly defined pictures possible.

The cathode-ray tube patented in 1897 is used, in its refined form[3], in present-day television sets. Its importance lies in its capacity to produce pictures. The tube has a screen which glows when struck by a stream of electrons from an electron gun inside the tube. Each point of the screen emits more or less light according to how long the beam is aimed at it[4].

A colour television has three electron guns — one for each of the primary colours, red, blue and green. They bombard a screen of phosphor dots, arranged in groups of three — one dot for each colour — while a masking device sorts the beams so each one falls on its allocated dot. A colour television camera also has three cathode tubes and electron guns.

NOTES

1.to recreate the original object — для відтворення первинного об’єкту
2.the mind experiences — мозок сприймає
3.in its refined form — в удосконаленому вигляді
4.how long the beam is aimed at it – як довго промінь направлений на нього

4.3.3 Answer the following questions:

1. Are the principles of television complicated? 2. When was the first live transmission made? 3. What did Nipkow's invention depend on? 4. How was light transformed into electric values? 5. Was the light projected onto a screen to recreate the original object? 6. What does the importance of cathode-ray tube lie in? 7. How many electron guns does a colour television have?

4.3.4 Look through the text again and try to speak about the frame frequency used in television.

4.4 New trend in television

4.4.1 Look through the list of English words and their Ukrainian equivalents. You'11 need them to understand text C better:

digital – дискретний, цифровий; to encode – кодувати; error – помилка; audio – звуковий; available – доступний; span – відрізок часу, довговічність.

4.4.2 Read the text carefully and find the information about the advantages of digital television:

Text C

New Trend in Television

1. The so-called analogue systems of television are to be replaced by digital systems in the near future. In time all stages of TV broadcasting — from the camera to the TV tube – will be digitalized. New systems make it possible to encode and compress tremendous flows of visual information. The advantages of digital techniques, first of all, improve the quality of the picture. Digital recording is almost free of signal errors. This applies fully to both video and audio signals.

2. Turning an old medium to a digital, 'interactive' one seems to be even more difficult than introducing completely new technologies. The digitalization of television is a process of translation. The 'script' attached to television as we know it has to be changed – but this involves more than the technical issues of switching from analogue to digital signals and receivers. So far, the efforts to translate television have been centered around the figure of, 'interactivity and the notion of a value-added' television, where digital technique allows new interactive features and services added on top of the familiar medium. The new interactive uses of television have been envisioned to include, e.g.

– a wider choice of program content by selecting channels or programs from video-on-demand services

– simultaneous transactions – electronic shopping or betting related to the program content

– value-added information services – either relating to the program or more

general (citizen information services)

– cross-media programs spanning a combination of media channels such as TV, Internet, mobile phone

– poll-type interaction using the return path or telephony

– interactive programs and games where the storyline and actions are modified by the user in a dynamic or exploratory way.

It is obvious that the new interactive television services will affect the way we watch, use and think of television. Along with the new services, the existing and developing television user cultures also have an influence on what kinds of television content will succeed and what forms they will take. With the onset of digital television, changes in user behavior are to be expected, just like the introduction of remote control led to rapid channel changing (the 'zapping' phenomenon). The changes in television watching habits can in turn lead to changes in production: the zapping phenomenon led to changes in the design and placement of commercials and greater segmentation of content within programs. Thus interactive television has been mostly addressed as a media technology and as a collection of programs and services.

4.4.3 Which paragraph contains the information directly connected with the title of the text? Render this information.

4.4.4 Explain why analogue systems of television will be replaced by digital systems in the near future.

4.4.5 Find the information about how electronics experts have succeeded in better organizing the information flows.

4.4.6 Name the advantages of digital television over the analogue one.

4.4.7 You have read three texts containing some information about television. Summarizing the general ideas developed in texts A, B and C, prepare a report on the theme "Television. History and new trends in its development". The following plan will help you:

1. The invention of television — the result of a complex of inventions.
2. Nipkow's invention as the basis of the first live transmission.
3. The mechanical picture scanner and the principle of its work.
4. Some characteristics of modern TV sets.
5. The advantages of digital television.

5 ELECTRONICS

5.1 Introduction

5.1.1 Practise the reading of the following words:

discovery [dɪs'kʌv(ə)rɪ], investigation [ɪn,vestɪ'geɪʃ(ə)n], decisive [dɪ'saɪsɪv], radar ['reɪdə], nucleonics [ˌnju:klɪ'ɔniks], unprecedented [ʌn'presɪd(ə)ntɪd], sensitivity [ˌsensɪ'tɪvɪtɪ], structure ['strʌktʃə], automation [ˌɔ:tə'meɪʃ(ə)n], adequate ['ædɪkwɪt], cybernetics [ˌsaɪbə(:)'netɪks].

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

electron, revolution, physical, cathode, atom, structure, civilization, exploitation, diode, microscope, vacuum, radio, diagnosis, energy, industry, industrial, generate, instrument, social, combine, base, control.

5.1.3 Give the initial form of the following words:

followed, developed, electrons, produced, communications, locked, expanding, pouring, receivers, combined, enabled, applied, generating, given, offers, leading, senses.

5.1.4 State to what parts of speech the following words belong:

discovery, investigation, physical, rapidly, directly, receiver, communication, decisive, shaping, computer, sensitivity, extension, structure, visible, optical, significant, industrial, treatment.

5.1.5 a) Form verbs adding the suffix -en to the given adjectives, translate them:

Example: fast – міцний
to fasten – прикріпити
bright, dark, sharp, wide, less, broad, deep, short, weak, hard.

b) Form verbs with an opposite meaning adding the prefix un-. Translate them into Ukrainian:

Example: to cover – покривати
to uncover – розкривати

to close, to load, to tune, to tie, to fasten, to charge, to balance, to fix, to lock, to pack, to bend.

5.1.6 Make sure if you remember the meaning of the following verbs.

Consult a dictionary:

to follow, to lead, to apply, to develop, to combine, to produce, to represent, to give, to examine, to receive, to offer.

5.1.7 Define the functions of the Infinitive in the following sentences. Translate them into Ukrainian:

1. Our task is **to study** well. 2. The idea **to use** this substance is not new. 3. He described the device **to be used** in all modern systems. 4. The apparatus **to be assembled** is very complicated. 5. **To translate** the text without a dictionary is difficult. 6. **To make** the experiment you must **improve** the device. 7. The engineer wanted **to be sent** to the conference. 8. Lodygin was the first **to invent** the electric lamp. 9. In order **to solve** these problems, scientists must **make** many experiments. 10. **To carry out** this research work requires special knowledge.

5.1.8 Translate the following sentences into Ukrainian paying attention to the functions of the Infinitive:

1. We shall consider a very simple example in order **to explain** this phenomenon. 2. Computer science is **to be regarded** as a new discipline. 3. It is quite necessary for him **to make** a great number of calculations **to solve** the problem. 4. We know silver **to be** the best of conducting materials. 5. Michael Faraday had little chance **to get** an education. 6. An attempt **to form** a theory of such systems was made by Professor W. 7. We expect the article **to be published** next year. 8. I believe him **to have changed** his plans. 9. Radio and television continue **to develop** and **to find** wider application in science and industry. 10. I saw the workers **repair** the machine. 11. The fastest way **to detect** an artificial satellite is by radio. 12. We watched the robot **perform** many operations. 13. We are **to study** the main laws of physics. 14. A computer has **to be used to make** these calculations.

5.1.9 Change the following complex sentences given below according to the example and translate them:

Example: The process **which will be described** in this article is known as ionization. The process **to be described** in this article is known as ionization.

1. The method **which will be used** is reliable. 2. The results **which will be received** will be published next month. 3. The data **that are to be obtained** will be of great interest. 4. The measurements **that must be made** should be accurate enough. 5. The experiments **which will be demonstrated** are closely related to our research. 6. The problem **that must be solved** is very difficult. 7. The work **that must be done** is of great importance. 8. The method **that will be used** was developed in our laboratory. 9. The equipment **that is to be installed** is very effective. 10. The instrument **which will be used** must make precise measurements.

5.1.10 Translate the following sentences into Ukrainian paying attention to the Infinitive Constructions:

1. The professor made the students repeat the experiment. 2. We want them to receive this information as soon as possible. 3. We know the first atomic power station to have been built in the Ukraine. 4. The only thing for you to do is to use a microscope. 5. A material which allows electricity to flow through it is called a conductor. 6. We did not see them make this experiment. 7. For him to take this decision was not easy. 8. We think this work to be completed in a month. 9. Our professor wants us to use these data. 10. It was easy for our mechanic to repair this device. 11. Electronics enabled scientists to take pictures of the moon. 12. For the decision to be correct all facts must be considered.

5.1.11 Change the following complex sentences according to the example. Translate them into Ukrainian:

Example: Yablochkov was **the first who realized** the advantages of the alternating current.

Yablochkov was **the first to realize** the advantages of the alternating current.

1. Franklin was the first **who developed** a new theory of electricity. 2. Lomonosov and Franklin were the first **who made** their experiments in the field of atmospheric electricity. 3. The engineer was the last **who made** the report at the conference. 4. The famous scientist was the first **who proved** this theory. 5. Newton was one of the first **who studied** light. 6. Lodygin was the first **who invented** the electric lamp. 7. These metals were the first **that were used** in industry. 8. This scientist was the first **who developed** the new process. 9. These devices were the first **that were tested** in our laboratory. 10. This radio station was the first **that was built** in our country.

5.1.12 Match up the words which have an opposite meaning:

a)to cover, directly, old, much, more, rapidly, small, visible, powerful, long, before, to take, significant, effective;

b) to uncover, ineffective, to give, after, powerless, short, large, invisible, slowly, less, little, new, indirectly, insignificant.

5.1.13 Match up the words which have a similar meaning:

a) investigation, rapidly, valve, shape, immense, to expand, speed, to examine, to receive, to apply, significance, efficient;

b) importance, research, to use, effective, to get, to study, velocity, to extend, form, tube, fast, tremendous.

5.1.14 Try to memorize the words and word-groups:

■ discovery – відкриття ■ investigation – (наукове) дослідження; пошук, вивчення ■ pure science – чиста наука ■ vacuum techniques – вакуумна техніка ■

cathode rays – катодні промені ■communication – зв'язок, сполучення ■ on a world scale – у світовому масштабі ■ a decisive factor – вирішальний фактор ■ nucleonics – нуклеоніка (ядерна фізика та ядерна техніка) ■ store – запас ■ a branch of science – галузь науки ■ significant – значний, важливий ■ advance – прогрес, успіх ■ treatment – лікування ■ to play the leading role – грати вирішальну роль.

5.2 The Age of Electronics

5.2.1. Study text A. Try to understand all details. Use a dictionary if necessary:

Text A

The Age of Electronics

1. The discovery of the electron, and the investigations into its nature which followed, led to a revolution in physical science.

The revolution in pure science rapidly bore fruit[1] in many fields of applied science and technology, especially in the applied science of electronics. The vacuum techniques developed for the study of free electrons and cathode rays led directly to the radio valve and the television receiver. The new electronics combined with the older techniques of the telegraph and telephone produced a revolution in communications on a world scale. If the discovery of the electron had led only to radio and television it would still represent a decisive factor in the shaping of our civilization – but it led to much more.

2. Electronics produced radar. It led to nucleonics and hence to the exploitation of the immense store of energy locked in the atom. It gave birth[2] to the electronic computer. By the middle of the twentieth century a rapidly expanding, world-wide electronics industry was pouring out millions of parts for radio and television receivers and instruments for every branch of science and technology – instruments capable of unprecedented speed and sensitivity[3].

3. Electronic devices give immense extension to our senses. We can now examine structures too small to be visible in even the most powerful optical microscope and receive signals from radio stars which started their long journey through space ages before there was any life on our planet. Electronics combined with rocketry has enabled scientists to take close-up pictures[4] of the moon. Electronics applied to medicine has already produced significant advances in diagnosis and treatment.

4. Electronics plays the leading role in automation which is generating a second industrial revolution of wider social significance than the first.

5. Electronics has also given birth to cybernetics which offers, for the first time in history, an effective science of government based on adequate information and communication.

6. It seems very probable that electronics will dominate technology even in the distant future.

NOTES

1. to bear fruit – приносити плоди, давати результати
2. to give birth – народити, породити
3. unprecedented speed and sensitivity – небувала швидкість та чутливість
4. to take close-up pictures – робити знімки з близької відстані

5.2.2 Say whether the following statements are true or false:

1. The revolution in pure science rapidly bore fruit in many fields of applied science and technology. 2. The new electronics produced a revolution in communications. 3. The discovery of the electron led to a revolution only in physical science. 4. Electronics doesn't play the leading role in automation.

5.2.3 Answer the following questions on paragraph 2:

1. What did electronics produce? 2. What did it lead to? 3. What did it give birth to? 4. What was electronics industry pouring out by the middle of the twentieth century?

5.2.4 Translate paragraph 3 into Ukrainian.

5.2.5 Read paragraph 4 and say where electronics plays the leading role.

5.2.6 In paragraph 2 find the English equivalents of the following words:

електроніка, радар, запас, електронна обчислювальна машина, частина, прилад, телевізійний приймач, галузь, чутливість, технологія, відтворювати.

5.2.7 Write out of the text the words and phrases describing general uses of electronics.

5.2.8 Make an outline of the text.

5.2.9 Speak about the age of electronics using your outline.

5.3 Electronics in Industry

5.3.1 Look through the list of English words and their Ukrainian equivalents. You will need them for better understanding text B:

radio tube – радіолампа; wire– дріт, провід; layer – пласт; junction – з'єднання, зчленовування; перехід; a solid-state diode – твердотільний діод; sound picture – 1. звукове кіно; 2. звуковий кінофільм; long-distance telephone call – міжміський телефонний виклик; seek – шукати; to adapt – пристосовуватися; control – управління; регулювання; image – зображення; to respond – реагувати; to detect – помічати, виявляти.

5.3.2 Skim through text B and choose the best title for it:

1. Electronics in Industry.
2. Electronics and the Second Industrial Revolution.
3. General Uses of Electronics.

Text B

Electronics is the science or practice of using electricity in devices similar to transistors and radio tubes so as to get results not possible with ordinary electrical equipment.

Most persons know how electric current flows in motors and transformers; here the electricity always flows in the copper wire or other metal parts. When electricity passes through space as occurs within a tube, such action is called electronic. More recently, when layers of semiconductor metals are joined together so that current flows through the junction in one direction only, as in a solid-state diode or a transistor, such action is also called electronic. If a device passes its stream of electrons through internal space, or through the junction where certain different metals meet, the device is called electronic.

Without electronics there might be no radio, television, sound pictures or long-distance telephone calls. Most of these familiar equipments serve to carry or give information; so communication early was a main purpose of electronics and still holds interest of many workers and students in this field.

Meanwhile industry seeking faster and more accurate methods of production has adapted electronic equipment to its own needs. Gradually during the past fifty years industrial plants have installed electronic equipment to give better operation of motors along with control of varied operations.

Some people believe that electronic devices can hear, see, feel, smell or even think; this is true only when the sound, image, feeling or thought can be changed into electrical signal, to which the transistor or tube-operated device[1] can then respond. Much of the success of electronics depends on the methods used to obtain an electric signal that can be used to stimulate the electronic device into action[2]. The electronic circuit can be made to detect such a signal, increase its strength and put it to useful work[3].

NOTES

1.tube-operated device – прибор, що керується лампою
2.to stimulate into action – спонукати до діяльності
3.to put to useful work – змусити виконувати корисну роботу

5.3.3 Answer the following questions:

1. What is electronics? 2. What device is called electronic? 3. What was a main purpose of electronics? 4. What has industry adapted to its own needs?

5.3.4 Give the main points of text B in 4-5 sentences.

5.3.4 Speak about the use of electronics in industry.

5.4 Vacuum Tubes

5.4.1 Look through the list of English words and their Ukrainian equivalents facilitating reading text C:

solid-state device – твердотільний прилад; vacuum tube– електронна лампа; thermionic valve – термоелектронна лампа; shape – форма; конфігурація; evacuate – відкачувати; розріджувати; to emit – емітувати, випромінювати; to attract – приваблювати; to charge – заряджати; grid – сітка; high power – висока потужність; amplifier – підсилювач; to transistorize – збирати на транзисторах; переводити на транзистори.

5.4.2 Scan text C and find the information about the uses of vacuum tubes.

Text C

Vacuum Tubes

1. The science of electronics now deals almost exclusively with transistors and other solid-state devices. However, vacuum tubes were the principal building blocks[1] of electronic circuits until approximately 1955. Briefly, a vacuum tube .consists of several metal electrodes of various shapes all packaged inside a glass or metal envelope[2] which is highly evacuated. Vacuum tubes are often called thermionic "valves". A red hot metallic electrode (the filament or cathode) emits electrons which are attracted to a positively charged electrode called the plate or anode. The electrons pass through the spaces in a metallic grid electrode on their way to the plate, and the voltage on the grid controls how many electrons reach the plate. A simple thermionic valve is called a diode because it has two electrodes. A triode is a valve with three electrodes, an anode, a cathode and a control grid. A tetrode has four, and a pentode – five electrodes.

2. Vacuum tubes are still used in oscilloscopes, television sets, high power high frequency radio transmitters, and in some special low noise amplifiers. However, every year sees a larger number of applications being transistorized. It is probably safe to say that this trend will continue in the future, as there is presently a great deal of technological development being put into solid state electronics and rather little put into vacuum tube electronics.

3. As a general rule, vacuum tubes are inferior to modern solid state devices[3] in many ways. Vacuum tubes are much larger. They require considerably more electric power to operate. However, they can handle high voltages and high powers[4] at high frequencies somewhat more easily than solid state devices. They are also capable of withstanding temporary overloads[5] in voltage or current which would permanently destroy[6] a solid state device and then returning to normal operation.

NOTES

1. principal building blocks – основні стандартні блоки

2. packaged inside an envelope – розміщений у балоні

3. inferior to modern solid state devices – поступаються сучасним твердо тільним приладам

4. to handle high voltages and high powers – оперувати високою напругою та високою потужністю

5. to withstand temporary overloads – витримувати тимчасові перевантаження

6.would permanently destroy – незмінно руйнує.

5.4.3 Say what principal blocks electronic circuits were made of before 1955.

5.4.4 Give reasons for replacing vacuum tubes by transistor devices.

5.4.5 Which paragraph contains the information directly connected with the title of the text. Render this information to your partner.

5.4.6 Imagine that you are to make a report on the theme "The Age of Electronics". Use the information of all three texts A, B and C. The following plan will help you:

1. The discovery of the electron.
2. The revolution in pure science.
3. The revolution in technology.
4. General uses of electronics.

6 SEMICONDUCTORS AND CIRCUITS

6.1 Introduction

6.1.1 Practise the reading of the following words:

current [ˈkʌrənt], alternating [ˈɔːltəneɪtɪŋ], amplify [ˈæmplɪfaɪ], rectify [ˈrektɪfaɪ], surface [ˈsɜːfɪs], frequency [ˈfriːkwənsi], substance [ˈsʌbstəns], conductor [kənˈdʌktə(r)], semiconductor [ˌsemikənˈdʌktə(r)], insulator [ˈɪnsjʊleɪtə(r)], measure [ˈmeʒə(r)], delay [dɪˈleɪ].

6.1.2 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.

6.1.3 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.

6.1.4 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.

6.1.5 Translate the following compound nouns:

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

6.1.6 Form verbs with an opposite meaning adding the prefix dis– and translate them:

Example: to approve – затвердити
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.

6.1.7 Make sure if you remember the three forms of the following verbs:

become – became – become; understand – understood – understood; lead – led – led; mean – meant – meant; do – did – done; wear – wore – worn; set – set – set; let – let – let; cost – cost – cost; find – found – found; spread – spread – spread.

6.1.8 Translate the following sentences paying attention to the functions of the verb to do:

1. He will **do** the work himself. 2. Where **does** he study? 3. Semiconductors **do** possess many wonderful properties. 4. Semiconductors let electric current pass through them more easily than insulators **do.** 5. I **don't** understand the action of this device. 6. Perfect science **does** exist. 7. **Don't** change the temperature. 8. Energy is defined as ability **to do** work. 9. **Do** you know this engineer? – Yes, I **do.** 10. He **does** obtain amplification (усиление) with this device.

6.1.9 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.

6.1.10 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. The power engineering in the USA develops much faster than that of some other developed countries, including Great Britain. 7. Having been discovered many years ago this metal found a wide application in industry only last decade. 8. While being checked the motor showed good performance. 9. The European Union today is building high-capacity atomic power stations. 10. The man introducing this famous scientist is the dean of our faculty. 11. Cybernetics has gained a growing importance.

6.1.11 Change the complex sentences given below according to the examples and translate them into Ukrainian:

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.

6.1.12 Choose the sentences with Participle I from the ones given below, translate them:

1. The falling water has kinetic energy. 2. While testing the motor we take 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.

6.1.13 Match up the words which have an opposite meaning:

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

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

6.1.14 Listen to the following tape-recorded lexical programme. Try to memorize the words and word-groups:

■ alternating current – змінний струм ■ thermionic valve – електронна лампа ■ to rectify – виправити, детектувати ■ fine wire – тонкий дріт ■ rectifier – випрямляч; детектор ■ radar receiver – радіо-локаційний приймач ■ point-contact transistor – точково-контактний транзистор ■ junction – 1. з'єднання; 2. перехід; 3. площинний ■ junction transistor – площинний транзистор ■ in many respects – в багатьох відношеннях, density packing – щільна упаковка ■ an intricate circuit – складна схема ■ measuring instruments – вимірювальні прилади ■ recording equipment – реєструюча апаратура; прилади запису ■ instrumentation – контрольно-вимірювальні прилади; контрольно-вимірювальна апаратура ■ reliability – надійність; міцність.

6.2 Transistors and Semiconductor Devices

6.2.1 Study text A. Try to understand all details. Use a dictionary if necessary:

Text A

Transistors and Semiconductor Devices

1. 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. These semiconductor devices were used as rectifiers although by 1924 a scientific worker at the laboratory headed by Bonch-Bruyevich in Nizhni Novgorod Oleg Losev for the first time in the history of electronics had achieved amplification using a semiconductor crystal. Unfortunately, Losev's discovery did not receive due attention.

2. 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.

3. 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.

4. Since no heating is required there is no delay in transistor equipment waiting for things to warm up, as there is with thermionic valves. This is a great advantage with 'entertainment' equipment, such as radio and television receivers, and it may be vital with some kinds of measuring or recording equipment.

5. Their very small size and weight, combined with low heat dissipation[3], permits very high density packing of components and, in combination with their reliability, this has made possible the design of the very compact circuits which are essential for such applications as computers, portable measuring instruments, satellite instrumentation, etc.

NOTES

1.crystal set – детекторний приймач
2.crystal valve – кристалічний прилад
3.heat dissipation – розсіювання тепла

6.2.2 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.

6.2.3 Answer the following questions on paragraph 2:

1. What is a transistor? 2. When was the first transistor invented? 3. Where are transistors used?

6.2.4 In paragraph 3 find the English equivalents of the following words:

транзистор, твердотільний прилад, прискорення, рост, прилад, замінювати, неухильно, стислий, перевага, порівнювати, давати відповіді.

6.2.5 Translate paragraph 4.

6.2.6 Read paragraph 5 and say where the small size and weight of transistors is essential.

6.2.7 Write out of the text the words and phrases describing the transistor.

6.2.8 Divide text A into logical parts and find the topical sentence of each part.

6.2.9 Tell the story of transistors and semiconductor devices using the topical sentences.

6.3 Integrated Circuits

6.3.1 Look through the list of English words and their Ukrainian equivalents facilitating reading text B:

integrated circuit – інтегральна схема; resistor – резистор; capacitor – конденсатор, ємність; package, case – корпус; lead – вхід, вихід; infinitesimally small terms – безкінечно малі члени виразу; chip (die) – чіп, кристалик; to tend – мати тенденцію; cost – ціна, вартість; common – широко розповсюдженний; загальноприйнятий; thin– and thick-film ICs – тонкоплівкові и товстоплівкові інтегральні схеми (IC); simultaneously – 1. одночасно; 2. сумісно; complete – повний, завершений; performance – 1. продуктивність; ефективність; 2. якість функціонування; digital computer – цифрова ЕВМ; design – 1. проект; 2. конструкція; to design – проектувати, конструювати, розробляти; evaluate – оцінювати; to bring about – визивати, бути причиною.

6.3.1 Skim through the text and say what it is about (you are given 10 minutes):

Text B

Integrated Circuits

An integrated circuit (IC) is a collection of interconnected transistors, diodes, resistors, and capacitors mounted in one package or case with as many as fourteen leads.

The word "integrated" does not refer to the mathematical process of adding together an infinite number of infinitesimally small terms, but rather to the fact that all transistors, diodes, and resistors are formed from a single piece of semiconductor material called a "chip" or a "die". If only one chip is present in the case, the IC is called "monolithic"; if several chips are mounted inside the case the IC is called "hybrid". Some integrated circuits contain several thousand transistors and resistors, and so extreme miniaturization is possible.

Because of their extremely small size, integrated circuits tend to be restricted to low power applications. Their small size, however, does enable them to operate at high frequencies. The cost of an IC is considerably less than the total cost of the separate components.

Monolithic ICs are by far the most common, but there are other kinds. Thin-film and thick-film ICs are larger than monolithic ICs but smaller than discrete circuits. With a thin– or thick-film IC, the passive components like resistors and capacitors are integrated simultaneously on a substrate. Then, discrete active components like transistors and diodes are connected to form a complete circuit. Therefore, commercially available thin– and thick-film circuits are combinations of integrated

and discrete components[1].

If only a few components have been integrated to form the complete circuit it is an example of small-scale integration (SSI)[2]. As a guide, SSI refers to ICs with less than 12 integrated components.

Medium-scale integration (MSI)[3] refers to ICs that have from 12 to 100 integrated components per chip. Large-scale integration (LSI)[4] refers to more than a hundred components.

The IC is becoming more important as a component to be used in the design of electronic equipment, not only in equipment that must be small and light in weight, but where reliability and performance are demanded. In many areas of application particularly in digital computers, the IC provides more economical designs.

A number of important new developments are being evaluated both in the laboratory and in limited product usage. Some of these promise to bring about significant changes in the way microcircuits are designed and used.

NOTES

1.discrete component – дискретний компонент
2.SSI (small-scale integration) – мала інтегральна схема
3.MSI (medium-scale integration) – середня інтегральна схема
4.LSI (large-scale integration) – велика інтегральна схема

6.3.3 Answer the following questions:

1. What is an integrated circuit? 2. What does the word 'integrated' mean? 3. What types of integrated circuits are known to you? 4. What is large scale integration?

6.3.4 Give the main points of text B in 3-5 sentences.

6.3.5 Speak about integrated circuits.

6.4 From Radio Valves to Cosmic Communications

6.4.1 Look through the list of English words and their Ukrainian equivalents. You will need them for better understanding text C:

reduction – зменшення, скорочення; bulky electronic equipment – громіздке електронне приладдя; printed circuit – печатна схема; trend – загальний напрямок, тенденція; to reduce – зменшувати, скорочувати; to consume – споживати, витрачати; durable – довговічний, вічний; coating – покриття; lattice – (кристалічна) решітка; to assemble – збирати, монтувати; to look ahead – дивитися вперед, дивитися в майбутнє; packing density – щільність монтажу; щільність упаковки; unit – прилад; вузол; блок; tremendous – величезний; diverse – різний; molecular electronics – молекулярна електроніка.

6.4.2 Scan text C and find the answers to the following questions:

1.What is a major trend in modern radio electronics?
2.What possibilities does molecular electronics open up?

Text C

From Radio Valves to Cosmic Communications

1. The reduction of radio instruments to miniature proportions and even smaller – is a major trend in modern radio electronics. The significance of this research has grown especially in connection with space research. It is impossible to equip a rocket for flights to other worlds without light, small and economical electronic apparatuses. The space rockets will carry a large amount of miniature equipment, systems for contact with the Earth, radars, computers for calculating flight trajectories, life-support systems, etc.

2. Bulky electronic equipment will have no place in the future. It will be unsuitable for automation of production, transport or domestic use.

3. Semiconductors and printed circuits have helped to reduce the size of apparatus considerably. The semiconducting instruments which have replaced electronic valves are much smaller and lighter, consume less power, are reliable and more durable.

The development of micromodules – tiny ceramic plates with a metallized coating – has opened up big possibilities for making miniature electronic instruments. Semiconductors compressed into this plate are hundreds of times smaller than electronic valves. A radio receiver assembled of micromodules does not weigh more than 50 grammes.

4. Molecular electronics opens up new possibilities. The crystalline lattice can be changed by tantalum or titanium being added to semiconductors to obtain crystals with the required electrical properties.

At present, a radio-receiving set is assembled of separate, ordinary-size parts. The radio sets based on semiconductors or micromodules are also assembled of separate parts but tens and hundreds of times as small. The germanium or silicon plates will not operate like separate resistors or condensers, but as complete circuits – as generators or amplifiers.

5. All this might sound fantastic, but a scientist is looking still further ahead. Present research programmes are taking the development of even more miniature parts. We can say that when superminiature elements are developed, it will become possible to place approximately 200 million of these "parts" within one cubic centimetre. The density is approximately that of the human brain.

6. Cybernetics machines assembled of these units will memorize tremendous volumes of information and will give man invaluable assistance in diverse fields of life.

6.4.3 Say where the reduction of radio instruments is especially significant.

6.4.4 Find the information about semiconductor instruments.

6.4.5 Think of the most suitable title for paragraph 3 out of the given ones:

1. Miniaturization.
2. Semiconductor Devices – a Big Step in the Direction of Miniaturization.
3. Steps of Miniaturization.

6.4.6 Give reasons for the development of micromodules.

6.4.7 Say what new possibilities molecular electronics opens up.

6.4.8 Which paragraph contains the information directly connected with the title of the text. Render this information.

6.4.9 Imagine that you are to make a report on the topic "Evolution of Electronics". Use the information of texts A, B and C. The following plan is available:

1. The demands for reduction in size and weight of electronic equipment and components.
2. Transistors and semiconductor devices.
3. Printed circuits.
4. Micromodules.
5. Integrated circuits.

7 LASERS

7.1 Introduction

7.1.1 Practise the reading of the following words:

laser ['leizə(r)], maser ['meizə(r)], machine [mə'ʃi:n], amplification ['æmplifi'keiʃn], concentrate ['kɔnsntreit], radiation [reidi'eiʃn], emission [i'miʃn], intense [in'tens], neutron ['nju:trɔn], electron [i'lektrɔn], proton ['prəutɔn], circle [sə:kl], liquid ['likwid].

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

Laser, maser, distance, radiation, stimulate, intensity, neutron, electron, proton, energy, material, type, spectroscopy, steel, diamond, operation, holography, photograph, hologram, real, engineer, engineering, molecule, atomic, generate, revolutionary, telescope, control, isotope.

7.1.3 Give the initial forms of the following words:

making, concentrating, stimulated, made, waves, lasers, increases, excited, given, seen, including, liquids, solids, purposes, developed, gives, changes, generated, known, allowing, smaller, longer.

7.1.4 State to what parts of speech the following words belong:

Visible, length, ordinary, different, amplifier, amplification, emission, radiation, semiconductor, scientific, industrial, gives, needed, atomic, microwave, unbelievable.

7.1.5 Find the roots of the following words:

amplifier, different, development, industrial, intensity, achievement, atomic, revolutionary, building, shorten, achievable, realize.

7.1.6 Form nouns adding the suffixes a)-age, b)-ment and c)-ity to the given verbs and adjectives and translate them:

Example: a) to leak – текти b) to equip – обладнати
Leakage – витік equipment – обладнання

c) stable – стійкий

stability – стійкість

a) to use, to cover, to store, to break, to pass, to carry, to link, to stop, to assemble, to short(en);

b) to develop, to arrange, to achieve, to move, to measure, to improve, to manage, to establish, to excite, to require-,

c) real, active, able, complex, dense, electric, intense, conductive, capable, special, flexible.

7.1.7 Make sure if you remember the meaning of the following verbs. Consult a dictionary:

to increase, to excite, to give, to include, to fall, to use, to test, to check, to join, to mount, to achieve, to exceed, to oscillate, to reach, to jump.

7.1.8 Define the functions of the Gerund in the following sentences and translate them:

1. A laser is a machine for **making** and **concentrating** light waves into a very intense beam. 2. Go on **making** the experiment. 3. The idea of **using** lasers came from A.Prokhorov and N.Basov. 4. The laser beam is made by **exciting** the atoms of a suitable material. 5. **Measuring** temperature is necessary in many experiments. 6. There can be no progress in science without **experimenting. 7. Solving** such problems helps us greatly. 8. Their wish is **mastering** the fundamentals of radio-engineering. 9. The **melting** point of aluminium is 657°C. 10. I remember **visiting** this laboratory. 11. They succeeded in **obtaining** these data.

7.1.9 Choose the sentences with the Gerund from the ones given below and translate them:

1. Special instruments measuring cosmic radio signals are being installed in the observatory. 2. Penetrating into space was very important for mankind. 3. Applying the method we get better results. 4. Upon adding heat we can change the state of a substance. 5. When measuring the voltage we use a voltmeter. 6. A number of materials, including some gases and semiconductors, possess this property. 7. For many centuries men were interested in obtaining new sources of energy. 8. The engineer insisted on experimenting as the best method to solve this problem. 9. The importance of scientific researches and discoveries is growing with every year.

7.1.10 Translate the following sentences. Note the words which help you to define whether the word with the suffix -ing is verbal noun, a gerund or a participle:

1. Our aim is solving this complex problem. 2. They succeeded in obtaining good results working with this metal. 3. The building of the house will be finished next month. 4. In testing the devices they found some serious faults. 5. The growing importance of automatic equipment in industry attracts world-wide attention. 6. Russian scientists played a great role in the spreading of the metric system in Russia. 7. After graduating from Petersburg University A.S.Popov remained there as a post-graduate at the Physics Department. 8. After Hertz had published his experiments proving the existence of electromagnetic waves, A.S.Popov thought of a possibility of using Hertz waves for transmitting signals over a distance. 9. On March 24, 1896 he demonstrated the transmission and reception of a radiogram consisting of two

words: Heinrich Hertz. 10. Using the new method it is possible to increase accuracy and speed of spectral analysis. 11. Thousands of scientists, using the most modern equipment, are studying the atmosphere.

7.1.11 Translate the following sentences paying attention to the functions of the Gerund:

1. Large-scale application of electronic technique is a trend of technical progress capable of revolutionizing many branches of industry. 2. Leningrad physicists have developed a method for using optical quantum generators for spectral analysis. 3. When atoms or molecules are excited they emit electromagnetic waves. By counting the number of waves in a certain period, a very accurate measure of time can be defined. 4. The operating speeds of these systems will be measured in nano-seconds.5.Telemetry is the science of seeing some place without being there. 6. Electronics is not so much a new subject as a new way of looking at electricity. 7. We know of Kondakov's having made the first synthetic rubber in the world. 8. Soviet physicists saw in semiconductors the way of solving complicated engineering problems. 9. These scientists continue working in this promising field of knowledge. 10. We know of Yoffe's having contributed much to the research of transistors.

7.1.12 Match up the words which are opposite in meaning:

a) high, thin, hot, small, long, visible, possible, increase, known, important, include, different;

b) unimportant, unknown, decrease, impossible, invisible, short, big, cold, thick, low, exclude, the same.

7.1.13 Listen to the following tape-recorded lexical program. Try to memorize all the words and word-groups:

■ laser – лазер, оптичний квантовий генератор ■ maser – мазер, мікрохвильовий квантовий генератор ■ light waves – світові хвилі ■ amplifier – підсилювач ■ to make up – складати ■energy level – рівень енергії (енергетичний рівень) ■ to give off energy (light) – віддавати енергію; випромінювати, ■to generate – генерувати; виробляти ■ solid – тверде тіло; твердий ■ property – властивість ■ three-dimensional image – об’ємне зображення ■ emission – емісія, випромінювання ■ range – дальність, радіус, сфера (дії); діапазон, границі ■ wavelength – довжина хвилі ■ by a factor of 10 – в 10 раз ■ to oscillate – коливатися ■ master control – головний орган керування ■ holography – голографія

7.2 Lasers and Masers

7.2.1 Study text A. Try to understand all details. Use a dictionary if necessary:

Text A

Lasers and Masers

1. A laser is a machine for making and concentrating light waves into a very intense beam. The letters LASER stand for Light Amplification by Stimulated Emission of Radiation. The light made by a laser is much more intense than ordinary light. With ordinary light, all the light waves are different lengths. With lasers, all the light waves have the same length, and this increases the intensity.

2. Atoms are made up of neutrons, electrons and protons. The electrons circle round the protons and neutrons. In a laser, the electrons are "excited" to a high energy level. As the electrons fall back from their "excited" state to their normal state, they give off energy. This energy is given off as light which can be seen. A number of materials have this property including some gases, liquids, solids and semiconductors. Thus a number of different types of lasers have been developed.

3. Lasers are now used for many scientific, medical and industrial purposes. The thin beam of light gives a lot of heat and it is used to join metal when a very small joint is needed. The beam can also be used as a drill, to make holes in steel, or even in diamonds. Because the beam is so small, it's very important in delicate surgery and is used in eye operations.

4. Lasers are also used in holography. A hologram is a three-dimensional image, a bit like[1] a photograph. It's different from a photograph because it looks solid. As you walk round a hologram, it changes, as if it were real. Now holography is used for testing engineering ideas. An engineer can use a hologram to build up and check a new building such as a bridge. He can find out all about it before he builds it.

5. The word MASER is also an acronym – for Microwave Amplification by Stimulated Emission of Radiation. The maser is operated on the same principle[2] as the laser except that the wavelengths generated are much longer and therefore the energy jumps involved are smaller. The excited bodies in a maser are molecules rather than atomic electrons and the beam generated is a coherent beam of microwaves which is not visible to the eye.

6. Masers have made revolutionary advance possible in a number of different fields. They are up to 1.000 times more sensitive[3] than any other type of amplifiers. Maser amplifiers mounted on radio telescopes can increase even their great range by a factor of 10, allowing us to reach out to the bounds of the known universe. Because of the very constant frequency with which masers can be made to oscillate they can be used as master controls for atomic clocks of unbelievable accuracy: an error not exceeding 1 second in 10.000 years has already been achieved.

7. The idea of using stimulated emission of radiation for amplification of very short waves came, from A.Prokhorov and N.Basov of the Lebedev Institute in Moscow.

NOTES

1. a bit like – трохи нагадує
2. is operated on the same principle – працює на тому ж принципі

3.1.000 times more sensitive – в 1000 раз більш чуттєвий

7.2.2 Say whether the following statements are true or false:

1. The light made by a laser is much more intense than ordinary light. 2. With ordinary light, all the light waves have the same length. 3. With lasers all the light waves have different length. 4. A laser concentrates light waves into a very intense beam.

7.2.3 Answer the following questions on paragraph 2:

1. What are atoms made up of? 2. To what level are the electrons excited in a laser? 3. When do they give off energy? 4. In what form is this energy given off?

7.2.4 Find the place in paragraph 3 containing the information of the uses of lasers. Render this information to your group-mate.

7.2.5 In paragraph 4 find the English equivalents of the following words:

голографія, голограма, об'ємне зображення, виглядати, випробувати, перевіряти, з'ясовувати.

7.2.6 Translate paragraph 5.

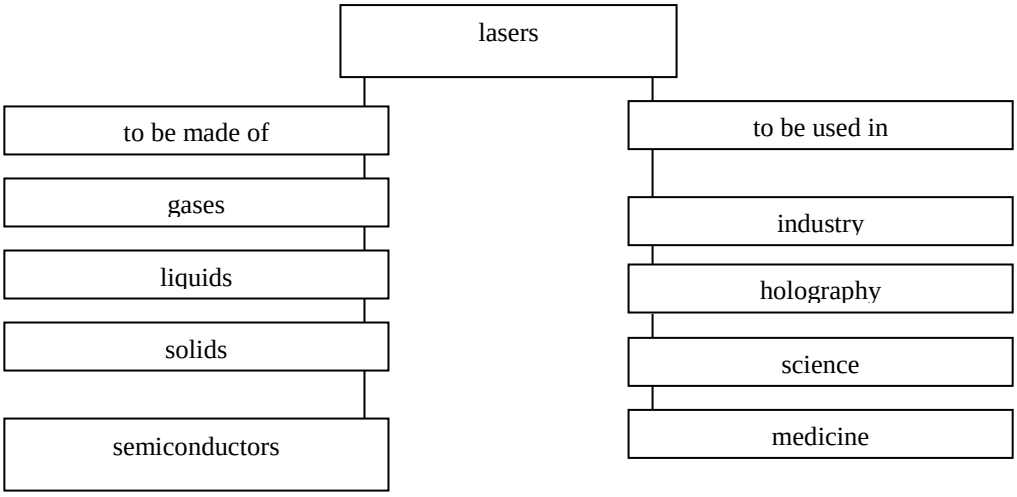
7.2.7 Read paragraph 6 and say where masers are used.

7.2.8 Write out of the text the words and phrases describing a laser.

7.2.9 Describe the uses of lasers.

7.2.10 Divide text A into logical parts and find the topical sentences of each part. Put them down.

7.2.11 Speak about lasers using the topical sentences and the logical diagram given below.



7.3 The use of laser

7.3.1 Look through the list of English words and their Ukrainian equivalents facilitating reading text B:

micro welding – мікрозварювання; resistor trimming – припасування резисторів; isolation – ізоляція; відокремлення; power engineering – энергетика; extrapure – надчистий; resolution – рішення, розв'язання; to store – запам'ятовувати, зберігати; to process – обробляти; archive – архів; to display – отображать *(дані);* показувати *(дані);* screen – екран; information carrier – носій інформації; to come in handy – стати в пригоді, знадобитися; indispensable – обов'язковий, необхідний; to put into effect – здійснювати, виконувати, реалізувати.

7.3.1 Read the following text and entitle it. Compare your title with the one given by the author.

Text B

Just some decades ago, neither laser installations nor the very word laser were in existence. Today, lasers are used in electronics, medicine, engineering, communications, the automobile and aircraft industry, agricultural machine building, and other fields of the economy and science. But the field of laser applications is expanding very rapidly. Let us point out only a few new uses of the laser.

Lasers have wide-ranging technological uses. In the production of electronic components lasers are used in such operations as micro welding, resistor trimming, etc., something that can be performed perfectly well today.

Laser radiation has the property of selective excitation of atoms and molecules, enabling laser isolation of isotopes. The first successful experiment in separating isotopes by laser was performed at the Institute of Spectroscopy of the USSR Academy of Sciences, in 1972. This work is regarded by specialists as highly promising for power engineering and production of extrapure materials.

The use of laser technology has considerably increased the resolution and sensitivity of the spectroscopic methods.

Without the laser beam, there could be no optical electronics which computer specialists see as a highly promising direction for making high-performance and small-size computers. Optical electronic instruments for recording, storing and processing information use a laser beam.

Lasers can quickly record and read out information, with recording density being 100 times higher than in the most advanced magnetic system. It is evident that in the near future centralized archives will be set up allowing us to display any required information on a home TV screen.

We have succeeded in designing a new information carrier which can be used for multiple recording of light signals, similar to the magnetic tape recording.

Great importance is attached today to the use of lasers in medicine. Lasers have been successfully used in eye treatment.

Thus the laser today comes in handy in solving process and quality control problems, in medicine, communications and computer technology. It can do hundreds of jobs; the number has been constantly increasing, and before long, the laser will become a customary and indispensable assistant in most professions.

Projects are now being discussed in scientific literature of using high-power lasers for long-distance space communications. These projects have not yet been put into effect, primarily because of the great technological difficulties and, therefore, of the great cost involved. But there is no doubt, that in time, these projects will be realized and the laser beam will begin operating in outer space as well.

7.3.3 Answer the following questions:

1. Where are lasers used today? 2. The field of laser applications is extending very rapidly, isn't it? 3. Where do lasers have wide-ranging technological uses? 4. In what fields is the use of lasers highly promising? 5. What projects are now being discussed in scientific literature?

7.3.4 Give the main points of text B in 3-5 sentences.

7.3.5 Speak about the new uses of the laser.

7.4 Laser at Work

7.4.1 Look through the list of English words and their Ukrainian equivalents. You will need them for better understanding text C:

thermonuclear fusion – термоядерна реакція, термоядерний синтез; to condense – конденсувати; згущати; evolvement – розвиток; створення; exploration – дослідження; target – мішень, ціль; angle reflector – кутовий відбивач; incident – що падає на; reverse – зворотній, протилежний; range – далекість; geodetic – геодезичний; precision – точність.

7.4.2 Read the following text carefully. While you are reading look for the answers to the questions:

1. What idea have specialists of the quantum radiophysics laboratory suggested?
2. How is the distance to the Moon measured?

Text C

Laser at Work

1. In a department of the Lebedev Physics Institute of the USSR Academy of Sciences (FIAN) scientists from the quantum radiophysics laboratory have suggested the idea of laser-controlled thermonuclear fusion and obtained priority results in this field. Experiments in heating and condensing plasma to receive thermonuclear fusion are being conducted at one of the world's biggest laser thermonuclear installations "Delfin" (Dolphin).

2. The Institute carries out research in developing new types of lasers, studying the interaction of coherent radiation with matter, in laser thermonuclear fusion and in optoelectronics.

3. The results of this fundamental research find wide application in the development of new instruments and technological processes, in the evolvement of substances with new properties in medicine, in metrology and in the latest methods of information processing.

4. What's more, lasers are being used for very important and interesting explorations, such as measuring the distance to the Moon. Power lasers send very short light pulses to-the Moon. There are targets, or angle light reflectors, installed in five different places there, able to reflect the incident light in a precisely reverse direction. As with radar, the distance to the Moon is being established by measuring the time the signal takes to reach the target and return.

5. FIAN's station in the Crimea has built laser range finding complexes. They measure the distance to the Moon with an error of not more than one or two centimeters. This precision has allowed the laser measurement of distances to the Moon to become a new method for exploring the Earth-Moon system. Compared with other methods, laser measurements of many basic geometric and dynamic characteristics of the Earth-Moon system offer precision several factors higher and enable more delicate geodynamic phenomena to be explored and geodetic constructions to be performed with a high degree of precision. It will give us a better understanding of the laws governing the movements of the Earth and the Moon.

7.4.3 Say where new types of lasers find wide applications.

7.4.4 Find the information about laser-controlled thermonuclear fusion.

7.4.5 Unite paragraphs 2 and 3 and choose the most suitable title for this part out of the following ones:

1. New Types of Lasers.
2. Lasers in Optoelectronics.
3. New Applications of Lasers.

7.4.6 Which paragraph contains the information directly connected with the title of the text? Render this information to your group-mate.

7.4.7 Imagine that you are to make a report on the theme "Lasers today and tomorrow". Use the information of texts A, B and C and the following plan:

1. The definition of a laser.
2. The principle of laser operation.
3. The application of lasers in industry, electronics, engineering, holography, computer technology, communications, medicine, science.

The key to text B: "New Applications of Lasers".

Рекомендована література

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