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«Шетел тілдері» кафедрасы

АҒЫЛШЫН ТІЛІ
Сөйлеу әрекеттерін дамытуға арналған әдістемелік нұсқау
(барлық мамандықтарға арналған)

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Text 1.

Solar power

The sun’s energy manifests itself as thermal, photo-electric and photo-chemical effects. Men have tried to use solar energy since the earliest times, but no means existed to generate useful power from the sun’s heat until steam and hot-air engines were invented.

Crude devices for heating water by solar energy date back many years, and production of salt by solar evaporation of sea water is probably the most ancient of man’s sun-activated processes. Photo-electricity has been known for almost a century, and millions of selenium photo-cells have been used as light-meters and in similar application.

Most fundamental of all thermal solar processes is the simple fact that, when sunlight falls upon a surface of any kind, the surface becomes warmer than the surrounding air. The extent to which the surface temperature rises depends upon many factors, most important of which are the angle between the surface and the sun’s rays, the absorptivity of the surface and the precautions taken to prevent the surface from losing the absorbed heat.

The angle effect is caused by the fact that the sun's rays travel in straight lines. When a surface is perpendicular to the rays, their intensity is at its maximum, when the surface is horizontal, the radiation intensity drops off and reaches its minimum.

The most effective way to minimize the loss of energy from the sun heated surface is to cover it with one or more sheets of a glass-like material which is transparent to the sun's rays but opaque to the longer wave lengths emitted by the warmed surface. The air space between the surface and the glass is an effective prevention of heat loss by convection.

A flat plate of blackened metal covered with one or more transparent sheets of glass or plastic as the simplest collector of solar energy. Once collected, heat can be used in a variety of ways. Here are some of the potential and actual applications.

Space heating is probably the most important, since nearly one- third of our energy supply is used for this purpose. Water heating can be achieved by portable solar heaters which are able to give as much as 400 liters of boiling water on a sunny day.

The distillation of the sea water is another process to be accomplished by variations of the simple flat plate collector. The production of temperatures low enough for air conditioning and domestic refrigeration is a very important potential use of solar energy which is only now beginning to receive the attention it deserves.

Typical arrangements of concentrator-type solar plants with high- pressure boilers must be able to track the sun, so that its rays can be focused upon a collection-element.

When physicists discover a new way to generate electricity directly from radiation, without going through the thermal cycles, both nuclear and solar power will move forward rapidly. Until that time solar units will probably continue to be relatively small and applicable only to special purposes such as irrigation and power production in isolated locations.

Solar radiation is an immense and inexhaustible source of energy our world possesses. Up to the present time, mankind has been able to produce energy from the earth's fuel, but the time will come when this energy will be scarce and hence expensive. Research is needed now to learn how to use solar energy cheaply and effectively to heat and cool our homes, produce fresh water from sea water, and to generate large blocks of electric power.

1.1 Answer the following questions:

1) In what effects does the sun's energy manifest itself? 2) Men have tried to use solar energy since earliest times, haven t they? 3) When does the surface become warmer than the surrounding air? 4) What does the surface temperature depend upon? 5) What is the angle effect caused by? 6) What is the most effective way to minimize the loss of energy from the sun heated surface? 7) What is the simplest collector of solar energy? 8) What can water 'heating be achieved by? 9) When will both nuclear and solar power move forward rapidly? 10) Is solar radiation an immense and inexhaustible source of energy our world possesses? 11) How does mankind produce energy at present? 12) What is needed to learn how to use

solar energy cheaply and effectively? 13) What can solar energy be used for? 14) Is the earth's fuel an inexhaustible source of energy?

1.2 Translate the following words paying attention to the suffixes:

thermal, useful, evaporation, probably, absorptivity, intensity, horizontal, distillation, collector, arrangement, concentrator, boiler, physicists, relatively, inexhaustible, cheaply, effectively.

1.3 Translate the following sentences paying special attention to the translation of the suffix - *able*.

The sun's energy is valuable because of its thermal, photo-electric and photo-chemical effects. 2. The air space between the surface and the glass is a reliable prevention of heat loss by convection. 3. Until that time solar units will probably continue to be relatively small and applicable only to special purposes such as irrigation and power production in isolated locations.

1.4 Translate these words paying attention to negative prefixes:

Ineffective, ineffectively, inexhaustible, unprocessed, unproductive, unimportant, incapable, illogical, irrational, non-conducting, discharge, underestimate.

1.5 Translate the sentences paying attention to different meanings of the words in bold type:

1. Men have tried *to use* solar energy since earliest times, but no means existed to generate *useful* power from the sun's *heat* until steam and hot-air engines were invented. 2. Photo electricity has been known for almost a century, and millions of selenium photo- cells have been *used* as light-meters and in similar application. 3. They *used* the most effective way to minimize the loss of energy from the sun *heated* surface. 4. Crude devices for *heating* water by solar energy date back many years. 5. Our houses can be *heated* by solar energy cheaply and effectively. 6. They *heated* a flat plate of blackened metal.

1.6 Make up your own sentences with the following international words:

photo-electric, energy, selenium, fundamental, temperature, factor, absorptivity, effect, perpendicular, maximum, horizontal, radiation, minimum, effective, material, potential, special, irrigation

1.7 Make up pairs of the following words and translate them into Kazakh:

1) photo-electric	a) water
2) solar	b) source
3) straight	c) lines
4) heated	d) energy
5) effective	e) heating
6) space	f) cycles

7) boiling	g) purposes
8) domestic	h) locations
9) typical	i) power
10) thermal	j) prevention
11) special	k) refrigeration
12) isolated	1) surface
13) inexhaustible	m) effects
14) fresh	n) arrangements

1.8 Choose the right word combinations to finish the following sentences:

Straight lines, in a variety of ways, the potential and actual applications at its maximum, heat loss by convection, an immense and inexhaustible source.

1. When a surface is perpendicular to the rays, their intensity is.... 2. Once collected, heat can be used.... 3. The angle effect is caused by the fact that the sun's rays travel in.... 4. The air space between the surface and the glass is an effective prevention of.... 5. Here are some of.... 6. Solar radiation is...

1.9 Make up questions to the following answers:

1. The sun's energy manifests itself as thermal, photo-electric and photo-chemical effects. 2. Production of salt by solar-evaporation of sea water is probably the most ancient of man's sun-activated processes. 3. The angle effect is caused by the fact that the sun's rays travel in straight lines. 4. The air space between the surface and the glass is an effective prevention of heat loss by convection. 5. Water heating can be achieved by portable solar heaters. 6. Solar radiation is an immense and inexhaustible source of energy our world possesses.

Text 2.

Rodar

The word «radar» means Radio Direction Finding and Range. Radar equipment is capable of determining by radio echoes the presence of objects, their direction, range and recognizing their character.

There are several types of radar sets, all of them consist of six essential components, namely: a transmitter, a receiver, an antenna system, an indicator, a timer, and, of course, a power supply.

A radar set detects objects by sending out short powerful pulses of ultra-high frequency radio wave energy from a high-power transmitter. The directional antenna takes this energy from the transmitter and radiates it in a beam (similar to that of a searchlight).

As the transmitted energy strikes an object, a portion of it is reflected back. The receiver picks up the returning echo through its antenna and translates it into visual readable signals on a fluorescent screen. The appearance of these signals shows the presence of an object within the 1 field of view of radar.

The electron beam sweeps across the fluorescent screen in somewhat the same way as a hand sweeps across the face of a clock. Just as the hand of a clock completes its sweep in sixty seconds, the electron beam can be made to travel across any desired portion of the screen in some predetermined interval of time. It is the timer, which is the synchronizer of the whole system, that times the transmitter pulse and the indicator. The use of these timed pulses and the fact that the radio waves travel at the constant velocity of light gives a simple means of measuring range. The accuracy with which time is measured determines the accuracy of the range.

How then is the direction in which an object lies to be found? Both azimuth and elevation can be determined by means of the directional antenna. The antenna may be rotated as the pulses are sent out and the strongest signal appears on the screen when the antenna points directly at the object. The direction of the antenna enables the determination of azimuth and elevation. Thus, with the help of a radar set we can get a three-dimensional location of an object.

The wide use of radar sets in our everyday life will make air and sea entirely safe. Radars may be installed on every ship at sea as well as in every large harbor.

They will prevent collisions in fog and aid a ship to sail safely into any harbor, regardless of night or weather. Similarly airplanes will be able to fly over mountain ranges in storms and effect blind landing during poor visibility.

2.1 Answer the following questions:

1) What can be determined by the use of radar equipment? 2) What are the essential components of a radar set? 3) How does radar detect an object? 4) What gives a simple means of measuring range? 5) What location of an object can we get with the help of radar? 6) How is radar used?

2.2 State the parts of speech of the following words and translate them:

similarly, visibility, entirely, dimensional, appearance, presence, direction, transmitter, receiver, indication, timer, powerful, frequency, directional, readable, location, synchronizer, elevation, determination, equipment.

2.3 Translate the following international words:

radar, object, antenna, system, component, indicator, timer, detect, energy, echo, signal, second, portion, interval, pulse, fact, azimuth, location, safe, storm, effect.

2.4 Make up pairs of the following words and translate them into Kazakh:

1) radar	a) supply
2) essential	b) transmitter
3) power	c) components
4) directional	d) frequency
5) ultra-high	e) screen
6) powerful	f) location
7) high-power	g) beam

8) fluorescent
9) electron
10) radio
11) three-dimensional
12) predetermined

h) equipment
i) interval
j) waves
k) pulses
l) antenna

2.5 Translate the following groups of words of the same root:
to elevate — elevation — elevator;
to reflect — reflection — reflective — reflector;
direct — direction — directional — directive — directly — directness — director — directress;
to install — installation;
to locate — location — locality — local;
to desire — desire — desirable;
to measure — measure — measurement — measurable.

2.6 Fill in the blanks with the words given below:
detects, beam, determined, antenna, radar sets, collisions, safe, three-dimensional, pulses, high-power, the returning echo, frequency.

1. The wide use of... in our everyday life will make air and sea entirely... .2. Radars will prevent ... in fog. 3. The electron... sweeps across the fluorescent screen. 4. Both azimuth and elevation can be ...by means of the directional.... 5. With the help of a radio set we can get a... location of an object. 6. A radar set... objects by sending out short powerful... of ultrahigh ... radio wave energy from a... transmitter. 7. The receiver picks up through its antenna.

2.7 Finish the sentences:
1) As the transmitted energy strikes an object.... 2) The electron beam can be made to travel across any desired portion of the screen.... 3) The timer times.... 4) The use of timed pulses and the fact that the radio waves travel at the constant velocity of light gives.... 5) Both azimuth and elevation can be determined by .... 6) With the help of a radar set we can get... . 7) Radars may be installed on every ship as well as .... 8) Airplanes will be able to fly over mountain ranges and effect…. 9) All radar sets consist of six essential components....

2.8 Make up questions to the following answers:
1)They consist of six essential components: a transmitter, a receiver, an antenna system, an indicator, a timer and a power supply. 2) A radar set detects objects, their direction, range and recognizes their character. 3) A radar set sends out short powerful pulses of ultra-high frequency radio wave energy. 4) The electron beam on the fluorescent screen resembles a hand sweeping across the face of a clock. 5) It times the transmitter pulse and the indicator. 6) The radio waves travel at the constant velocity of light. 7) The accuracy, with which time is

measured, determines the accuracy of the range. 8) Both azimuth and elevation can be determined by means of the directional antenna. 9) With the help of a radar set we can get a three-dimensional location of an object.

2.9 Translate the sentences paying attention to different meanings of *«as»:*

1) As ordinary radars cannot detect very small objects microwave radars are used for the purpose. 2) The possibility of using microwave radars as an aid to meteorological forecasting was recognized long ago. 3) As the radar transmitter sends out ultra-high frequency radio wave energy in short powerful pulses, the directional antenna takes this energy and concentrates it into a beam. 4) As soon as the beam strikes an object, a portion of its energy is reflected back. 5) The electron beam sweeps across the fluorescent screen just as a hand of a clock sweeps across its face. 6) As to the weather, it is known that it greatly affects the direction ranges of radar sets.

Text 3.

Transistors

Ever since electrical engineering and, later on, radio engineering, came into being, and up to the end of the first half of the 20-th century, metals and dielectrics were mainly used. They were very good or very poor electricity conductors. Semiconductors, occupy an intermediate place between metals and insulators.

Transistors made it possible to design compact, small-dimensioned electronic devices, which consume very little power. The transistors are successfully used for direct transformation of heat energy into electrical energy by means of thermal elements. They are also used to transform radiant energy into electricity with the help of *photocells* or so-called solar batteries.

Transistors revolutionized radio engineering and electronics. Because of their small size, the absence of incandescence and other properties, transistors make it possible to produce devices which cannot be made with vacuum tubes.

Transistors are extremely sensitive to external influences. Even thousandths of one per cent of admixtures change their electrical conductive properties by hundreds of thousands of times. They are very sensitive to the action of light, nuclear particles, pressure, etc.

The turning of the tiny crystal, into a transistor device, sometimes of extreme complexity, is achieved by adding mixtures to it. The outer looks of the crystal may not change when this is done, but alien atoms appear inside it, imparting new properties to the crystal.

Transistors are very sensitive to light, some of them react even to starlight. Cadmium sulphide as well as a number of other transistors, act as insulators in darkness. But already under ordinary room lighting their resistances decrease millions of times. This property was used as the basis for making the so-called photo resistances. Some of them react not only to visible light, but also to ultra-violet, infra-red and X-rays, and radioactive radiation. At present such photo-

resistances, being very small in size, are successfully used as the main elements for various measuring instruments and automatic devices.

The energy of light is transformed directly into electricity in photocells. It is precisely this energy that is used to power sputniks and spaceships with electricity. The photoelectric properties of transistors are largely used in TV sets, and other devices.

Opto-electronics *holds out great promise*. It is a synthesis of optics and electronics done on the basis of transistors. In this case electricity is directly transformed into light energy with great efficiency. Research in this field has already led to the making of miniaturized, reliable sources of light of very simple design. In the future they will be used on a great scale in computers, automatic devices, aviation, communications, etc.

The supply of transistors is inexhaustible. But up to now only a limited number of them are being used for engineering purposes. Semiconductors are — germanium, silicon, selenium ‘and some of the simple compounds, like lead sulphide and arsenic and phosphor uses with indium and gallium. The electrical properties of germanium may be changed provided the latter is exposed to light. A very fine technology has been developed for obtaining transistors with *pre-set* physical properties by introducing into them admixtures of gold, copper, nickel, zinc, etc.

Notes

Photocells — фотоэлементтер

Holds out great promise — кең қолданысын тапты

Pre-set — берілген

3.1 Answer the following questions:

1) What is a semiconductor? 2) What is a transistor? 3) What place do semiconductors occupy? 4) What are transistors successfully used for? 5) What kind of electronic devices is it possible to design with the help of a transistor? 6) With the help of what batteries are transistors used to transform radiant energy into electricity? 7) What is the size of transistors? 8) How do some transistors act in the dark 9) Are photo resistances small or big in size; 10) Where are the photoelectric properties of transistors widely used? 11) In what case is electricity directly transformed into light energy with great efficiency? 12) Is it possible to make miniaturized reliable sources of light of very simple design or not? 13) Where will transistors be used on a large scale in the future? 14) Do you know any transistor devices?

3.2 Translate the sentences paying attention to the conjunction *both* ... and:

1) In later years both light sources and lasers were built on the basis of transistors. 2) Both silicon and germanium are semiconductors. 3) Transistors are very sensitive both to the action of light and to that of nuclear particles. 4) Both cadmium sulphide and a number of other transistors act as insulators in darkness. 5) Some of the photo resistances react both to visible light and to radioactive radiation.

6) Such photo resistances are successfully used as the main elements both for various measuring instruments and automatic devices.

3.3 Find nouns of the same root in the text. Translate them into Kazakh:

equip, accurate, directional, to determine, useful, to set up, to translate, to receive, to indicate, frequent, visible, to transmit.

3.4 Translate the following words and word-combinations:

heat energy, radio engineering, transistor crystals, vacuum tubes, light sources, future technology, room lighting, radioactive radiation, light-energy, engineering purposes, semiconductor devices, high voltage transmission lines, coal deposits, to power machines, to power spaceships with electricity, to occupy an intermediate place, to impart new properties, to impart, knowledge, one per cent of admixtures, different admixtures, admixtures of some metals, to expand the use of crystals, to expand the application of new measuring instruments, in this case, in that case, in case, some of simple compounds, the same simple compounds, some tiny crystals, the same tiny crystals, the so-called solar batteries, the so-called photo resistances, because, because of, by means of, by no means, by all means.

3.5 Group- the synonyms and translate them:

demand	aim
precisely	receive
small-sized	decrease
obtain	ordinarily
exactly	require
reduce	small-dimensioned
purpose	usually

3.6 Group the antonyms and translate them:

successful	outside
visible	inner
like	impossible
directly	inexhaustible
inside	unreliable
possible	complex
increase	unlike
exhaustible	indirectly
reliable	invisible
simple	decrease
outer	unsuccessful

3.7 Translate the words paying attention to the prefixes *pre-*, *super-*, *in-*, *dis*, prerevolutionary, prehistoric, pre-establish, prefabricated, predetermined, pre-set, precast, preheat, pre-sonic, super precise, superconductor, superconductivity, super-high, inexhaustible, impossible, irregular, disadvantage, disconnect.

3.8 Translate the sentences paying attention to the meanings of «*provided*»:

1) These experiments provided data necessary for the completion of our research. 2) All the members of the expedition are provided with all the necessary things. 3) Provided our plant is equipped with up-to-date machinery, we'll be able to raise the quality of the manufactured goods.

3.9 Make up questions to the words in bold type:

1) Small dimensioned electronic devices consume *very little* power. 2) *Under ordinary room lighting* the resistance of transistors decreases millions of times. 3) Transistors revolutionized *radio electronics and electronics.*

Text 4.

Electronic computer evolution

One of the most progressive and dynamic branches of science and technology is, computer technology. The word computer is of Latin origin and means «counting». A Computer is a special kind of a counting machine. It can do arithmetic problems at a tremendous speed. By means of electrical circuits it can find the answer to a very difficult and complicated problem *with lightning speed. A* computer can «remember» information you give it and store it in its «memory» until it is needed.

The first electronic computer appeared in 1946 on the basis of electronic vacuum tube with *response number* of five thousand operations per second. *As early as 1960s* the second generation appeared in which transistors were used to increase the number of operations to 200 thousand per second.

The appearance of *integrated circuits* and microprocessors *gave birth* to the third generation of computers (1964) capable of performing two million operations per second. It found wide application in all fields of economy solving the most complex economic problems.

The computers of the fourth generation (1979) are based on very high-capacity integrated circuits and microprocessors able to perform 100 million operations per second.

Now the fifth generation of computers is widely used in production. The PS-200 (PS stands for «parallel system») supercomputer is able to perform 200 million operations per second and is based on super high-capacity integrated circuits. Here for the first time in the world engineering practice a new parallel system concept is used.

Any computer performs many functions: in addition to dealing with numbers the computer supervises the whole computing process, and determines the sequence in which information is to arrive at its processors. In fact, the computer takes only one-tenth of its total *operating time* to do the computing, the function it is designed for.

What is needed, therefore, is a computer with computing elements free from all other functions. This becomes possible *if supervision is assigned to special*

processors acting as managers. Operating *in conjunction with* computing circuits these processors give instructions and *run the queue of information* to enter the processor from storage, etc.

The fastest computer in the USA works like an *assembly line*, with individual processors performing individual operations. Data have to pass through the entire length of the conveyer, *no matter how many* processors there are to process them. Our approach differs radically. We suggest a principle whereby all processors respond to a single control command which leaves them a certain *margin of freedom*, with the possibility to sort out their data independently. Receiving a common «command »they all start off doing similar operations, later switching over to *successive operations* until the whole problem is solved. The efficiency of this parallel system is obvious.

First, similar operations can be handled at any speed as it depends on *the number of processors involved*.

Second, a *single-control system* for all processors is simple and, consequently, low-cost.

4.1 Answer to the following questions:

1) Why is computer technology the most progressive and dynamic branch of science and technology? 2) When did the first electronic computers appear? 3) What was the response number of the first electronic computers? 4) When did the second generation of computers appear? 5) What was the number of operations they could perform? 6) What gave birth to the third generation of computers? 7) What are the computers of the fourth generation based on? 8) What is the number of operations they can perform? 9) What generation of computers is widely used in production now? 10) What types of computers do you know? 11) How does the computer work? 12) What principle of work of the computer was suggested by specialists?

4.2 Form new words by adding *micro-* or *super-* to the following words and translate them into Kazakh:

flow, normal, cosmos, corrosion, cool, natural, balance, fine, human, manipulator, processor, sonic, sensitive, fluid, large, quick.

4.3 Read the following international words and give their Kazakh equivalents:

dynamic, technology, computer, special, machine, operation, transistor, processor, application, national, engineering, concept, total, assembly, radically.

4.4 Speak on the topic using the following word-combinations.

Counting machine, electrical circuit, computing circuit, computer technology, computing element, integrated circuit, printed board, computer network, computing process, computer course, operating time, assembly line, control system, computer component, computer laboratory, successive operations.

4.5 Arrange the following words in pairs according to; *similar meaning*:

to start, to perform, to call for, to propose, to raise, to carry out, to suggest, to begin, to increase, to supervise, to require, to control; complex quick, radically, total, fast, considerably, whole, complicated;

opposite meaning:

to increase, dynamic, dependency, different, static, to decrease, simple, similar, possible, low-cost, complex, total, impossible, above, high-cost, independently, below, partial.

4.6 Translate the following sentences into Kazakh paying attention to the meanings of the words *«matter»* and *«involve»:*

1) The first industrial revolution involved the replacement of human and animal muscle power by the power of machines. 2) A technical project often starts as a simple practical activity involving only a few scientists or engineers. 3) This institute is involved in a research project on computer technique. 4) The activities involved in various space programmers have brought a revolution in science and technology. 5) Chemistry deals with changes in the composition of matter. 6) The subject matter of the lecture was computers.

4.7 Translate the following words paying attention to the meaning of the prefix *pre*.

predetermined, presupposed, prefabricated, pre-established, pre-war, prehistorical, prerevolutionary.

4.8 State the functions 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. 6) Being cooled water turns into ice. 7) The electric current passing through a wire will heat it. 8) Transistors contain no moving parts. 9) The scientist is carrying on an important research. 10) Developing the new method they achieved good results.

4.9 Speak on the topic; Computers in Modern life.

Text 5.

The Modern theory of light

In the history of the theory of light we see that two very different models have vied from the out-set as to which is the true model to be used. On the one hand, light was pictured as a wave motion of some sort, and on the other as a flight of fast-moving particles.

During the 19th century the former model gained universal acceptance thanks to a remarkable series of developments on both the experimental and theoretical basis.

The wave theory of light seemed to have defeated the particle theory when it explained the approximately rectilinear propagation. The theory was found by the physicists to be adequate enough to explain all the experimental results of the nineteenth century in terms of the wave theory.

However, early in the twentieth century a series of observations on photo-electricity gave rise to a really serious difficulty for the wave theory. It was found that light could cause atoms to emit electrons and that, when light released an electron from an atom, the energy possessed by the electron very greatly exceeded that which the atom could, according to electromagnetic-wave theory, have received. It was at this point that the wave theory failed to suggest an explanation. It was this fact and others associated with it that showed the wave hypothesis to be incomplete.

A return, at least to some extent, to the particle theory of light appeared to be necessary. In 1905 Einstein suggested that in order to adequately describe these observations, it was necessary to assume that the energy of a light beam is not evenly spread over the whole beam, but is concentrated in the form of small particles proportional to the frequency of light. These localized concentrations of energy he called «photons» or «light quanta».

For the observation to be described in detail it is necessary to assume that the photons corresponding to light of the wavelength all have the same energy, those of blue light having nearly twice the energy of the red. Photons are propagated like particles. It is assumed that there are usually a very large number of them, the energy in any one photon being very small. Thus in most ordinary experiments, the energy of a light beam is evenly distributed, just as a gas exerts a very nearly uniform pressure on the surface of an ordinary vessel, because each molecule is very small and the number of molecules is very large. When the movements of an ultra-microscopic particles are observed the irregularities of the Brownian movements show the discontinuous «structure» of the gas. In a similar way, the atom presents to the light beam an area so small that it indicates the presence of «molecules of light» or photons.

Thus, on the one hand, stand all the phenomena of interference, diffraction and polarization which are so well described by the wave theory. On the other hand, modern experiments have greatly increased the number and range of the experiments which are readily described in terms of photons. The electromagnetic picture has no place for the photons, and the particle theory has no place for the wave. Yet, both are required to give a complete description of the phenomena.

According to the present concept light has a dual character such that it may be represented equally well by waves or by particles. The wave and particle properties of light are found by modern scientists to be two different aspects of the same thing. These two, aspects are to be regarded as complementary rather than antagonistic, each being correct when dealing with the phenomena in its own domain. In

macroscopic effects light can be treated as a continuous wave and in microscopic ones the photon aspect begins to become important. Though there seems to be no doubt as to the essential correctness of this theory we still find it difficult to understand how these two theories can both be true. Yet, we are forced to do so by the mass of good evidence which can be brought forward in support of each of them. The acceptance of this concept required a fundamental change in our ideas.

5.1 Answer the following questions:

1) What two different theories of light do you know? 2) Which theory gained universal acceptance in the 19th century? 3) Why did serious difficulty arise for the wave theory in the 20th century? 4) What did Einstein suggest in 1905? 5) What was the conclusion of the scientists?

5.2 Translate the sentences paying attention to the meanings of the verbs in bold type.

gain

1) An atom may gain one or more electrons. 2) Using this type of engine one can gain much in terms of effectiveness. 3) A rocket with a constant thrust continually gains in speed. 4) This book is for anyone who wants to gain, with the least difficulty, a complete understanding of the fundamentals of radio and electronics.

fail

5) All the attempts to explain the processes of emission and absorption through the electromagnetic theory of light have failed. 6) The classical laws of both mechanics and electricity fail to predict the behavior of atoms.7) Helicopters were used to transport men and supplies to the forward line when ground transport failed. 8) Some scientists failed to realize the role of mathematics in science. 9) The author did not fail to make reference to all the previous works concerning the subject of his article.

suggest

10) The step-rocket for space travel was suggested by Tsiolkovsky. 11) The scientist suggested a new method of measuring cosmic ray intensities. 12) Rutherford suggested that the positive charge of electricity was concentrated in the nucleus of the atom. 13) Ampere suggested that the origin of all magnetism lay in small circulating currents associated with each atom. 14) The book «Analytical Mechanics for Engineers», as its name suggests, presents those principles of mechanics that are essential for the study of engineering.

assume

15) It is ordinary assumed that uncharged objects contain equal amounts of positive and negative electricity. 16) The air in the «standard» atmosphere is assumed to be perfectly dry. 17) A liquid is unable to maintain a particular shape and it immediately assumes the shape of the container. 18) Rockets may assume a great variety of forms and sizes.

5.3 Translate the sentences paying attention to the verb *«to exceed»* and its derivatives.

1) A number of vehicles have been launched whose velocities are in excess of the escape velocity of 11 km/sec. 2) In long-range ballistic missiles the temperatures of aerodynamic heating may be in excess of several thousand degrees. 3) The flight velocities required for astronautics far exceed those obtainable with a single rocket engine. 4) The noise in the Rostock's cabin did not exceed the noise in the cockpit of a conventional jet plane. 5) The excess reactivity of the reactors can be used for the production of a large number of different kinds of radioactive isotopes. 6) The excessive heat during the operation of the device was one of the problems to be solved. 7) Uranium-235 has similar chemical properties with Uranium-238, but is in other ways exceedingly unlike.

5.4 Translate the sentences paying attention to close meanings of the words in bold type.

1) The plane was provided with a *conventional* piston engine. 2) The measurement of the pressure distribution over the surface of a model is a *common* type of experiment in wind- tunnel work. 3) *Ordinary* liquids are bad conductors compared to metals.

5.5 Translate the sentences paying attention to the adverbs.

1) *Nearly* all the models which were tested proved successful. 2) Liquids are perfectly elastic, but they are so *nearly* incompressible that this property is not of much practical use. 3) The voltage will *hardly* remain the same during the experiment. 4) In *1918* aeroballistics as a science *hardly* existed. 5) Cold neutrons *are* useful as they penetrate most solid materials *readily.* 6) Radiation in the infrared region can be *readily* detected by heat it produces. 7) For the application of the computer to the solution of engineering problems a working knowledge of differential equations is *necessarily* assumed. 8) Plasmas need not *necessarily* be associated with high temperatures.

5.6 Translate the sentences paying attention to the meaning of the noun *«evidence».*

1) During the eighteenth and nineteenth centuries chemists slowly had been accumulating *evidence* that all matter was composed of atoms. 2) The photographic *evidence* clearly indicates that approximately 90 per cent of all visually observable meteors are of cometary origin. 3) The 1956 close approach of Mars brought very little new *evidence* concerning the origin of geometrical patterns on its surface.

5.7 Translate the words paying attention to the prefixes.

continuous	Discontinuous
charge	Discharge
close	Disclose
connect	Disconnect

advantage	Disadvantage
regular	Irregular
complete	Incomplete
correct	Incorrect
divisible	Indivisible
accurate	Inaccurate
movable	Immovable
logical	Illogical
important	Unimportant

5.8 Translate the following words and state their parts of speech:

reasonable, achievement, employer, important, unimportant, resistance, resistant, darkness, weakness, departure, pressure, changeable, comparable, dangerous, restrictive, helpless, accessible, incorrect, unnatural.

Text 6.

Modern light wave communications technology

Read the text. Try to understand all details. Use a dictionary if necessary:

A few decades ago, the concept of using light pulses instead of electrical signals to transmit information was only that — a concept. Today, light wave communications systems are among the most sophisticated transmission systems in the telecommunications network. They are at once efficient, versatile and relatively inexpensive to install and maintain.

The efficiency of light wave systems is perhaps their most renowned quality. They carry enormous amounts of information over long distances at very high speeds. Consider, for example, the speed and capacity of the Bell System's long distance light wave system. Light pulsing through a single, hair-thin glass fiber in this system can transmit the entire contents of Webster's unabridged dictionary — more than 2700 pages — over thousands of miles in only six seconds.

No less impressive than this tremendous speed and capacity is the versatility of light-wave systems. Because they are digital systems they can transmit easily any of these types of information: voice signs, high-speed data signals, and television signals. Without undermining quality or efficiency, a single system can accommodate thousands of telephone conversations, and alternately handle data or video signals.

Finally, light wave systems are inexpensive to install and operate compared to their wire- and-cable counterparts. Moreover, they allow considerable savings.

The reasons for such savings system from the technology of light wave communications.

Conventional telecommunications transmission is based on the conduction of electrons through metal (usually copper wires). Light wave systems, however, substitute protons for electrons and glass fibers for copper. These technological differences translate into big savings, the most significant of which is in

construction costs. Because light guide cables are only a fraction of the diameter and weight of copper cables, they are easy to handle and take up far less space. They can be installed in existing underground ducts and rights-of-way sometimes right next to copper cables.

In addition, light wave systems eliminate certain equipment and operating costs. They are immune to electromagnetic interference and therefore require no protection from it. Also, light can travel much farther through light wave cables without regeneration than can electrons through copper carrier systems. This is because the light encounters little resistance from the very pure glass fibers through which it travels. Light wave systems require significantly fewer signal regenerators than do electrical digital carrier systems: typically one every ten miles instead of one every mile.

6.1 Say whether the following statements are true or false.

1. The concept of using light pulses instead of electrical signals to transmit information is not new. 2. The efficiency of light wave systems is their most renowned quality. 3. Light wave systems can transmit various types of information: voice signals, high-speed data signals, and television signals. 4. Conventional telecommunications transmission is not based on the conduction of electrons through metal.

6.2 Answer the following questions.

1. Is the idea of using light pulses instead of electrical signals to transmit information new?

2. Do light wave communications systems belong to the most sophisticated transmission systems? 3. What are the qualities of light wave communications systems?

3. Describe the technological differences between the conventional telecommunications transmission and light wave systems.

4. Divide the text into logical parts and find topical sentences in each part.

6.3 Form words after the models and translate them:

For example;

-ment: to measure — measurement

to move; to require; to achieve; to develop; to improve; to equip.

-tion: to invent — invention

to produce; to compress; to evaporate; to prevent; to distillate; to concentrate

-ly: bad — badly

usual, steady, probable, cheap, effective, relative, simple, experimental, general, common, rapid.

6.4 Say the following sentences in the Simple Passive.

Example: Scientists use crystals in electronic devices.

Crystals are used by scientists in electronic devices.

1) Scientists developed several types of lasers. 2) I will 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 radio electronics. 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. 17) Radio devices perform various communication tasks. 18) We use such devices for amplification of radio signals.

6.5 Translate the following word-combinations:

useful power; hot-air engine, crude devices, thermal solar processes, surrounding air, the sun's rays, angle effect, to minimize the loss of energy, glass-like material, flat plate collector, typical arrangements, high-pressure boiler, special purposes, isolated locations, solar radiations, inexhaustible source of energy, large blocks of electric power.

6.6 Give the definitions to the following words:

Light, network, signal, pulse, conventional, transmit, cable, conductor, interference, speed, communication, wave, voice, versatile, fiber, copper, wire.

6.7 Speak on the topic; Communication technologies.

Text 7.

An efficiency of nearly 100 per sent

Perhaps the most interesting thing about semiconductor lasers is that they can transform electrical energy directly into light wave energy. They do this with an efficiency approaching one hundred per cent as compared with a maximum of about one per cent of other lasers.

Semiconductor lasers are sure to open up great prospects for solving various scientific and technical problems. Calculations and experiments show that already super-hard substances (diamonds, rubies and so on) and hard alloys can be worked profitably by ruby lasers, for example. The development of powerful-efficient semiconductor lasers is certain to considerably raise the power efficiency of a number of technological processes.

The high frequency radiation of optical generators makes it possible to transmit an enormous flow of information. This is of great significance for the advancement of communication techniques. The small dimensions of the semiconductor laser make it especially suitable for use in super-speed computers.

Ruby crystals about ten centimeters long can intensify light ten times. The same results can be obtained from semiconductor crystals only a few microns long. Thus it is possible to develop quantum light intensifiers with maximum sensitivity.

Theoretical calculations have shown that devices similar to semiconductor lasers can also transform the energy of light waves into electrical energy with an efficiency of close to 100 per cent. This means that electric power may be transmitted over considerable distances with negligible losses without the use of transmission lines.

The high efficiency of semiconductor lasers opens up possibilities of developing extremely economical sources of light. Luminescent lamps were instrumental in increasing the efficiency of light sources from two to ten per cent. Semiconductor lasers will increase this efficiency several times over. In addition, semiconductor devices will greatly increase the efficiency of luminescent crystal lasers. Semiconductor lasers are sure to have a great future.

The diversity of available lasers is now determined by the fact that all possible states of matter are used as their active media — gases, liquids, solids and plasma. The use of each new form of matter as an active medium is associated with definite stage in the development of quantum electronics. The research for various active media may be regarded as the method of quantum electronics at an early stage of its development. Over the past decades high-power lasers have found a place in manufacturing processes: welding, heat-treating of parts to improve their surface properties, cutting, drilling of small holes and in electronic devices and medical instruments. In all these operations laser systems have made productive lines more efficient and have reduced costs.

7.1 Answer the following questions:

1) What is the most interesting thing about semiconductor lasers? 2) What prospects do semiconductor lasers open up? 3) What are the advantages of the semiconductor laser? 4) What results can be obtained from the semiconductor crystal in the field of intensifying light? 5) What have theoretical calculations shown? 6) By what fact is the diversity of available lasers determined? 7) In what operations have laser systems made productive lines more efficient?

7.2 Translate the following words paying attention to the suffixes:

useful — useless
powerful — powerless
fruitful — fruitless
lawful — lawless
careful — careless
doubtful — doubtless

7.3 Translate these words paying attention to negative prefixes:

uneconomic, unimportant, unknown, unlimited, unofficial, unequal, unexpected, disappear, disarm, improbable, irresponsible, incapable, unlock, unload, unpack.

7.4 Form adjectives adding the suffixes *-able, -al, -ant, -ful, -ish, -(ive), -less, -ous, -y* electric, power, consider, technology, suit, economic, compare, change, profit.

7.5 Form nouns adding the suffixes *-er(or), -ance(ence), -ion(tion), -ment, -ness* to the following verbs:

calculate, communicate, transmit, develop, connect, improve, advance, generate, produce, restrict.

7.6 Form adverbs adding the suffix *-ly* to the following adjectives:

extreme, direct, wide, economical, certain, considerable, efficient, great, successful.

7.7 Translate the following sentences, paying attention to the underlined word combinations:

1) The electron has an electron charge as great as that of a proton. 2) The sun is much nearer to the Earth than other stars. 3) The moon is much smaller than the Earth. 4) The weight of a proton or a neutron is about two thousand times that of an electron. 5) Ruby crystals about ten centimeters long can intensify light ten times. 6) Semiconductor crystals a few microns long can also intensify light ten times. 7) The size of a gas generator is about 1 meter long. 8) The new radio set is half the size of the old one. 9) The most modern instrument is half the weight of the outdated one. 10) The density of a semiconductor laser radiation is hundreds of times as great as that of the best ruby lasers. 11) The weight of this heavenly body is half as much as that of another meteor. 12) Carbon fiber, a mixture of carbon and plastics, is twice as strong and twice as light as steel.

7.8 Arrange the following words in pairs of synonyms and translate them:

for example	surprising
enable	production
manufacture	size
operate	work
apply	near to
close to	for instance
change	vary
dimension	make possible
enormous	great
major	accuracy
precision	main
amazing	employ

7.9 Arrange the following words in pairs of antonyms and translate them:

major	heat
rapidly	failure
cool	more

less	(the) best
(the) worst	inaccurate
success	external
conventional	minor
accurate	unusual
internal	slowly
increase	reduce
efficient	inefficient

Text 8.

The colour spectrum

Translate the text paying attention to the uses of Modal verbs+Perfect Infinitive.

Light brings us the news of the Universe. Coming to us from the Sun and the stars it tells us of their existence, their position, their movements, their constitutions and other matters of interest.

The first step in the acquirement of this knowledge is made when we use a prism to analyze the light. In every case we observe a continuous spectrum of colors running from red to violet in the order of the colors of the rainbow.

By a closer observation of the spectrum, however, we find that the spectrum is crossed by an immense number of fine dark lines, amounting to many thousands. To each of these lines there corresponds a definite wavelength and a definite intensity. The explanation of the phenomenon can be based on absorption of radiation. When in the laboratory, a substance is vaporized and made luminous, the light it emits appears as a collection of isolated lines and is characteristic of the substance. No two substances yield the same line spectrum and consequently the chemical nature of substances can be determined spectroscopically. Thus glowing atomic hydrogen is characterized by a bright line in the red and since it is exhibited by nothing but hydrogen, it serves to disclose the presence of atomic hydrogen wherever it occurs.

When a beam of light which, *if analyzed, would form* a continuous spectrum, passes through a less brightly glowing vapour, which, acting alone, *would give* a line spectrum, the spectrum formed consists of a continuous background on which dark lines appear exactly in the positions of the bright lines which the interposed vapour *would give by itself*. The glowing vapour absorbs, from the light passing through it, precisely those colors which it can itself emit.

When we investigate the dark lines in the spectrum of the Sun, we find that these correspond line by line to the spectra emitted in the laboratory by various elements, iron, calcium, hydrogen etc., brought to the conditions of luminous gases.

From this it follows that the light from the Sun must have gone through clouds of these atoms somewhere and in respect to such substances as iron or calcium, or most other elements, this *must have happened* on the Sun because there is no other

part of the path of the light where substances can be brought to the state of a luminous gas.

The radiation emitted by the Sun *would have given* a complete spectrum *were it not* that on its way to us it has passed through an atmosphere surrounding the Sun and containing the various elements in the form of gases. These gases themselves must be luminous and be emitting light of the very frequencies which we suppose them to have been absorbing and therefore causing black lines to appear in the spectrum.

The hot interior of the *Sun would have given* a complete spectrum but the cooler outer layers absorb the radiations of various wavelengths, thus producing the dark lines. These prove conclusively that the elements that are found on the Earth are found also in the Sun and stars.

We can use the relative intensities of the lines due to different elements to obtain some fairly reliable conclusions about the abundance of each element. If, for instance, *we were to* double the amount of one element in the Sun, leaving the amounts of the other elements unaltered, *we should find* that the intensities of the lines of the particular element *would be relatively strengthened*. It is by means of such considerations that we can determine the relative abundance of this or of that element in the Sun or in a remote star.

We can, moreover, not only identify the chemical elements in the atmosphere of the Sun and the stars but draw conclusions concerning the temperature in their atmospheres. Astronomical spectra represent conditions which range in temperature from a few degrees above absolute zero to 100,000 or even more in the atmospheres of the hottest stars. For the Sun the central temperature is estimated to be of the order of 20,000,000 °C.

Of all the results of stellar spectroscopy, however, the most interesting is the uniformity of distribution of the chemical elements throughout the Universe. *It must have been* a revelation to the earlier astronomers when they discovered in the Sun the same familiar substances — hydrogen, iron, calcium and the rest — which they knew on the Earth. Their belief in the uniformity of the chemical elements *must have been strengthened* when several mysterious spectral lines turned out to be produced by the newly discovered gas, helium. The principle of uniformity of chemical elements means that the atomic building blocks of the Universe are the same throughout space.

8.1 Answer the following questions:

1) What news of the Universe does light bring us? 2) What do we observe when we use a prism to analyze the light? 3) What phenomenon can be based on absorption of radiation? 4) What do we find when we investigate the dark lines in the spectrum of the Sun? 5) What conclusion can be drawn from this observation? 6) When would the radiation emitted by the Sun have given a complete spectrum? 7) What fact proves conclusively the existence of the same elements on the Earth and in the Sun and stars? 8) How can we obtain reliable conclusions about the abundance of each element? 9) Can we draw conclusions concerning the

temperature in the atmosphere of the Sun and the stars? 10) What does the principle of uniformity 'of chemical elements mean?

8.2 Translate the following verbs paying attention to the prefixes:
overestimate, overcharge, overvalue, underestimate, undercharge, undervalue.

8.3 Translate the sentences paying attention to the *«to be + adjective + preposition»* structures:

1) It *is characteristic of* the kinetic theory of heat that all its statements are of this statistical kind. 2) The transformation occurs rapidly, *as is characteristic for a* radioactive decay with a large energy release. 3) These are errors which *are characteristic of* precise measuring system. 4) Such energy *is typical of* a cyclotrons. 5) The author's figures *are* not *indicative of* the role played by the receiving aerial as a link in the whole chain. 6) The equation 24 takes the following form, which *is typical of* many electrical integrating circuits.

8.4 Translate the sentences paying attention to the meaning of the word *«matter»:*

1) Early experimenters worked without satisfactory theory to explain the structure of matter. 2) Cathode rays can penetrate matter very easily. 3) The subject matter of statics is to study bodies at rest. 4) The purpose of this chapter is to exemplify the subject matter of this book. 5) To repeat the experiment was a matter of several hours. 6) The penetrating nature of the X-rays was a matter of great interest for early workers in this field. 7) Building a transistor receiver is a relatively easy matter. 8) As a matter of fact, the variation in wavelengths is the principal distinction between the different types of electromagnetic radiations. 9) No matter how accurate the measuring device may be, repeated readings will not be the same. 10**)** Solids maintain their sizes and shapes no matter where they are placed. 11) No matter what improvements are made, it will not be possible for the vehicle to considerably exceed the speed of its own exhaust.

8.5 Translate the sentences paying attention to the verbs in bold type:

yield

1) It is evident that thermonuclear fusion reactions can *yield* propellant temperatures and performance far beyond that available at present by any other means. 2) To be efficient**,** a propellant should have a large heat of combustion to *yield* high temperatures. 3) Research on nuclear rockets *may yield* information useful to the construction of such a device. 4) The discovery of X-rays *has yielded* certain branches of medicine, radiology, radiotherapy and crystallography.

identify

1) Some special device was used to *identify* the position of the emitted beam. 2) We saw earlier how the energy contained in an assembly of molecules *can be identified* with the kinetic and potential energies of rotation, vibration and molecular interaction.

8.6 Translate the sentences paying attention to the meanings of the word «*but*»:

1) At that time aerodynamics was a new *but* very important science. 2) Since heat is not a substance *but* a form of energy, we cannot measure it directly in pounds or liters, *but* must measure it by the effect it can produce. 3) We study every day in the week *but* Sunday. 4) Several years ago the centigrade scale was in common use in all *but* English-speaking countries. 5) Our Sun is *but* a star of our Milky Way, which is *but* one of many galaxies. 6) The tailless missile generally involves *but* one set of control surfaces. 7) Heat energy is nothing but the energy of motion of the molecules of which matter is composed. 8) Life is nothing *but* an endless series of chemical reactions. 9) The accuracy and reliability of his method were so obvious that we could not *but* accept it.

8.7 Translate the sentences paying attention to the meanings of the verbs in bold type:

occur

1) Acceleration *occurs* when thrust is greater than drag. 2) Vibration of aircraft due to landing tends to *occur* mainly at the lower frequencies. 3) The heaviest of all the naturally *occurring* atoms is uranium. It *occurs* in three isotopic forms.

estimate

4) It is the purpose of this chapter to *estimate* the danger arising from uranium radiation. 5) Measurements of the changes of the Sputnik's orbit allowed the scientists to *estimate* the air density at a height of 200 kilometers. 6) The inside temperature of the Sun is *estimated* to be about 30,000,000 °C.

reveal

7) Maxwell's equation *reveals* that all the waves of the spectrum have the same velocity in vacuum. 8) Radar is most successful m *revealing* isolated objects. 9) The length of the new turbojet is about 150 ft. Precise dimensions have not yet been *revealed*.

8.8 Translate the sentences paying attention to the meanings of the noun «*background*».

1) The best time for the observation of Sputniks is when the Sun is below the horizon and illuminates the Sputnik against a dark background. 2) The book describes the background of current work on rockets and guided missiles. 3) The last four chapters of the book give the student background and related information which will broaden his understanding of the gas-turbine engine field. 4) One needs a background in astronomy and astrophysics in order to fully understand this text. 5) Every mechanic must have a background of special technical knowledge in order to operate and inspect his apparatus.

8.9 Translate the sentences paying attention to the adjectives in bold type:

1) An inner wing is that part of a long airplane wing that lies inside the outer wing. 2) The upper part of the earth's atmosphere is called the ionosphere. 3) In a good conductor like copper, some of the outermost orbital electrons are only slightly bound to the atomic nucleus. 4) The uppermost part of the atmosphere, called the ionosphere, is located above the stratosphere. 5) The innermost planet of the solar system is Mercury.

Text 9.

Integrated circuits

Translate the text using a dictionary:

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.

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

Medium-scale integration (MSI) refers to ICs that have from 12 to 100 integrated components per chip. Large-scale integration (LSI) 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
Small-scale integration (SSI) — кіші интегралдық сұлба
Medium-scale integration (MSI) — орташа интегралдық сұлба
Large-scale integration (LSI) — үлкен интегралдық сұлба

9.1 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?

9.2 Form words after the models and translate them:
For example;
V + -ment: to move — movement
V + -ion(-tion, -ation): to collect — collection
to agree, to develop, to govern, to improve, to pay, to settle, to advance;
to combine, to connect, to introduce, to produce, to restrict, to transmit, to include, to transport, to communicate, to calculate, to inform, to limit.

9.3 Form words with opposite meaning by adding the prefixes *un-, dis-, im, ir-, in-:*
comfortable, equal, limited, approve, appear, connect, probable, possible, mobile, ability, capable, complete, direct, experienced, responsible, regular, reliable.

9.4 Fill in the blanks with the words given below:
Inexhaustible, radiation, loss, heaters, scarce.

1. The time will come when this energy will be ... and hence expensive. 2. Solar radiation is an immense and ... source of energy our world possesses. 3. Water heating can be achieved by portable solar…..4. The air space between the surface and the glass is an effective prevention of heat ... by convection.5. ...intensity drops off and reaches its minimum.

9.5 Make up sentences using the worlds given below:
Applications, of, here, some, are, potential, the, actual, and. 2. Can, once, ways, of, variety, a, be, used, in, collected, heat. 3. The, another, distillation, process, of, to be, sea, accomplished, water, by, of, variations, plate, flat, collector, the, simple, is. 4. Lines, in straight, travel, rays, the, sun’s, that, fact, the, caused, by is, effect, angle, the.

9.6 Analyze the functions of the verb **to be.** Translate the sentences:

1) 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) Technical progress is now impossible without high-quality materials. 7) Electronics is being used more and more throughout the industry. 8) The electron is a particle. 9) The machine is pf five parts. 10) Our task is to finish the test by 7 o'clock. 11) Words in a dictionary are in alphabetical order. 12) Smoking is dangerous. 13) The temperature is three degrees above zero. 14) My friends are mostly students. 15) It is the only positive solution. 16) The British are very proud of their sense of humor. 17) The scientific discovery was the result of six years research. 18) Our aim is to accomplish this task as soon as possible, 19) He will be an engineer in two years. 20) Their house is in the middle of the village.

9.7 Speak about integrated circuits.

Text 10.

The world is made of subatomic particles

Read the text carefully and explain the phenomenon of "phase change". Say why this phenomenon is of interest to physicists.

According to contemporary physicists, the world is made of several types of objects, collectively referred to as subatomic particles. (These particles can also be thought of as manifestations of something yet more fundamental, known as quantum fields.) There may be as many as 1089 identical copies of some of these particles in the present universe. The forms of matter familiar to us, both living and nonliving, on the earth and in the heavens, are all composed of various combinations of only three types of subatomic particles - protons, neutrons, and electrons. Dozens of other types of particles can be produced momentarily in the laboratory, however, and are thought to have existed in large numbers in the early universe.

All subatomic particles are defined by a few qualities that they may possess, such as mass, spin, and electric charge. Two particles are of the same type, if all of these qualities agree. Otherwise, they are considered to be different particles. Particles of the same type are, as far as we know, truly identical in these properties of mass, spin, and charge rather than just very similar. If all photons, the particles that make up light, were not identical, lasers would not operate.

The subatomic particles readily convert into one another when they collide. The kinetic energy of motion of light particles can be converted into the energy associated with mass (rest energy) of heavy particles. In many cases, even isolated particles can convert spontaneously into others, if the latter are less massive. In all such transformations, only a few properties, such as the total electric charge, remain unchanged. The subatomic particles do not act like the changeless building blocks

imagined by some Greek philosophers. In the last few years, physicists have realized that even which subatomic particles exist they have changed radically over the lifetime of the universe. It appears that evolution takes place on all levels of matter, not just on the more complex levels of living things. The driving force behind this evolution is the expansion of the universe, which by changing the environment in which particles are found, changes the particles themselves. Only twenty years ago, the idea that the properties of subatomic particles might depend on their environment would have been considered heresy. Nevertheless, there is now considerable theoretical support for this conclusion.

Under the conditions in which physicists usually observe subatomic particles, their defining properties are not perceived to vary giving these properties an illusion of stability. However, under the immense temperatures and densities that prevailed in the early stages of the universe, the properties, such as mass, of some particles would have been very different from what they are now. This situation is related by nature to the variability of a liquid such as water. Under a fairly wide range of temperatures water remains liquid and its properties do not change much whatever the temperature within this range. But if the water is subjected to much lower temperatures, or is heated to above 100° Celsius, its properties change abruptly. The liquid becomes a solid (ice) or a gas (water vapour). This type of change, in which the properties of a substance change drastically as a result of a small variation in its environmental conditions, is called a “phase change” by physicists.

The presumed change in the properties of subatomic particles at very high temperatures is also considered to be a phase change, one that involves the properties of space, as well as of the particles in it. In other words, the particles do not react directly to a temperature change but to some alteration in space, the medium, in which they find themselves.

It is easy to boil or freeze water, but very difficult to duplicate in the lab the extreme conditions present at the birth of the universe. Yet physicists have become convinced of the theory that atomic particles, and space itself, went through momentous phase changes during and after the Big Bang. The rapid cooling that followed that primordial explosion is thought to have generated several phase changes. After an incredibly short time (perhaps a microsecond), the subatomic stuff of the young universe became stabilized, combining into the particles that make up matter today.

10.1 Look through the passage carefully and find the English equivalents for the following Kazakh phrases:

Ортақ атымен белгілі, шындығында, жай ұқсас ғана емес, жалғыз немесе біреу ақ, өте жоғары температурада, өте жылдам уақытта, субатомдық материал, қазіргі жер шарында, көп жағдайларда, фазалық айналым.

10.2 For each word in A find in B its equivalent having roughly the same meaning.

A.1. abrupt; 2. immense; 3. rapid; 4. incredible; 5. drastic; 6. to prevail; 7. to presume; 8. to perceive.

B. a) quick; b) unlimited, immeasurable; c) very powerful; d) improbable, impossible to believe; e) sudden and surprising; f) to understand (see or notice); g) to be most common or general; h) to suppose, to be true without proof.

10.3 Fill in the blanks with information taken from the text.

1. The world is made up of 1089 ... . 2. These subatomic particles have characteristic properties of ..., ..., and ... . 3. These particles can be converted into one another while ... . 4. Dozens of other types of particles can be produced only ... 5. Scientists believe that other types of particles existed ... . 6. Under ordinary conditions subatomic particles are considered to be ... . 7. Under immense temperatures and densities of the Big Bang they might have undergone ... . 8. The Big Bang process might have lasted only ... .

10.4 Choose the facts from the list below, which you could consider as well established by science. Give reasons for your choice.

1. The number of distinct particle types in nature. 2. Photons and neutrinos cannot cluster. 3. Most matter of the universe is made up of quarks and electrons. 4. Electron is indivisible. 5. Quarks cannot be found in isolation. 6. Neutrons are unstable. 7. Protons are unstable. 8. Neutrons can bind with one another. 9. Quarks can bind with one another.

10.5 Do the following grammar tasks.

Make up all possible kinds of questions:

1) A direct current flows only in one direction. 2) The heating effect of current is independent of the direction of the current. 3) The magnetic field varied with the moving coil current. 4) Wattmeter's always contain 2 electrical circuits. 5) We shall briefly consider various kinds of electrical instruments.

10.6 Translate the sentences with the Complex Object paying attention to the meaning of the verbs *«cause»* and «*make*».

1. The ancients thought electricity to be invisible fluid. 2. We consider nuclear energy to be the prime source of heat energy. 3. The early discoveries in nuclear science showed the atomic nucleus to be a vasv source of energy. 4. Maxwell found the speed of propagation of electromagnetic waves to be equal to the ratio of electromagnetic to the electrostatic units of charge. 5. At some distance above the Earth, ultra-violet radiation from the Sun causes some of the molecules to dissociate from the molecular state to the atomic state. 6. What makes a satellite go around the Earth and stay n its orbit? 7. The tendency of a body to continue to move in a straight line is very evident when for some reason it is necessary to make the body move in a circle. 8. The more stages, the more difficult it is to make an amplifier run in a stable fashion.

10.7 Translate the following sentences paying attention to the functions of Participle II:

1) The discovery mentioned remained unknown to most scientists for a long time. 2) The equipment tested required further improvement. 3) When passed through a motor, electric current can do work. 4) The students have conducted all the experiments. 5) These instruments recorded the cosmic rays and the information obtained was sent back by the radar to the ground. 6) When heated, a magnet loses some of its magnetism. 7) The results received changed with the material used. 8) Unless repaired, this part cannot be used in the radio set. 9) The substances investigated showed quite interesting properties. 10) When developed, the device was used for amplification of radio signals. 11) The developed technology enables us to improve the quality of articles produced. 12) The first laser was developed in 1960. 13) The methods introduced received general recognition. 14) The device used in our work is up-to-date 15) The apparatus tested is looked upon as an experimental one. 16) When required, these data will be applied in our practical work. 17) The investigation analyzed resulted in an interesting discovery.

10.8 Think and say about:

1) Big Bang and subatomic world;
2) the matter make up;
3) phase changes in everyday life and in subatomic world;
4) laboratory experimentation with subatomic particles.

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