

## UNIT 1.

### ***Grammar study: Tenses, Modal Verbs and their Equivalents***

#### ***Theme: Science Today and Tomorrow.***

#### ***Read and translate text A.***

Text A. Science and Technological Progress in Modern Society.

Natural science is the main characteristic feature distinguishing the present civilization from other civilizations of the past. The developments of science have influenced the course of civilization so much that today it plays a most dominant role. One can say that today we live in a world that, materially and intellectually, has been created by science. There is hardly an article around us that has not been modified by technology based on science; the means of communication that link the continents into a single community depend on scientific know-how.

There is, however, another part of the story which is still far more important. It is a story of expanding intellectual horizons. Fundamentally, science is an intellectual enterprise, an attempt to understand the world in a particular way. All the developments in the world are the results, the outcomes of the intellectual activity.

Over the past 150 years the range of human knowledge has been doubled every twelve to fifteen years. In 1930 man knew four times as much as he did in 1900; by 1960 his knowledge had grown sixteenfold, and by the year 2000 it can be expected to be a hundred times more in comparison with the end of the last century.

The second part of the twentieth century has brought a number of technical innovations. In the fiftieth of this century hardly anyone would probably have believed that we should be able to sit at home and watch astronauts walking in space or that people could be kept alive by the heart of a dead man. The technological innovations are revolutionizing our lives more than anything else. The laser, the computer, the atomic energy have found their ways into our lives and are already being used for the taste of today. These same and many new tools will be applied to new tasks of the 21-st century, tasks we cannot even conceive of today.

The technological innovations we are to experience during the next years to come may well surpass our wildest fantasies. Science occupies the central position in modern society. It dominates man's whole existence. Research and innovations in technology should improve society's living and working conditions and cure the negative effects of technical and social changes.

#### ***Work on the text.***

Task 1. Write out the international words.

Task 2. Write out the scientific terms.

Task 3. Choose the statements that are false for the text and correct them. See the pattern:

No, that statement is absolutely wrong. Science plays a great role in our life today.

or

I'm afraid the statement is false. I believe all the developments in the world are the results of the intellectual activity.

1. Natural science doesn't distinguish the present civilization from other civilizations of the past.
2. Science has not helped to create the world we live in.
3. The means of communication that link the continents into a single community depend on scientific know-how.
4. Over the past 150 years the range of human knowledge didn't change.

5. In 1930 man knew four times as much as he did in 1900.
6. By 1960 his knowledge has grown sixfold.
7. The second Part of the twentieth century has brought no technical innovations.
8. Science dominates man's whole existence.

Task 4. Answer the following questions:

1. What is natural science?
2. What has the world we live in been created by?
3. What do the means of communication depend on today?
4. How much will man know by 2000 in comparison with the end of the last century?
5. How much did man know in 1930 in comparison with 1900?
6. What main technological innovations of our century can you name
7. What is the role of science today?
8. What are the aims of research and innovations in technology?

Task 5. Find in the text the facts concerning:

1. The role of science in today's life;
2. The change in the range of human knowledge over the past 150 years.

Task 6. Retell the text using the plan given below:

1. The role of science in today's life.
2. Science as an intellectual enterprise.
3. The range of human knowledge during the past 150 years,
4. The main technical innovations of the 20th century.

**Task 7. Read text B.**

Text B.

In two years the Julian calendar will record the year 2001 - the beginning of the 21st century. Today we can mark the incredible speed of the developing technology during the last third of the 20th century.

The technological innovations are revolutionizing our lives more than anything else. Events, inventions - all slide and change so swiftly that it seems our future has already arrived.

The 21st century will probably be a new age of exploration when men will get the answer to the questions they have always asked but have never before had the means of getting those answers. The 21st century will surely provide these means and countless voyages in search of those answers will be undertaken.

The 21st century will demand extreme caution and scientific discipline. The targets of exploration and the tools that will extend our knowledge are close at hand. The remaining questions concern the uses to which the knowledge will be put and the price we must pay for it. In every area of human endeavour the future offers dazzling capabilities for exploring and understanding ourselves and the world around us.

Task 8. Ask your partner and let him answer the questions:

- Whether the technological innovations are revolutionizing our lives;
- Whether the 21st century will be a new age of exploration;
- If the 21st century will provide new means of getting answers to countless questions;
- Whether the future offers dazzling capabilities for exploring and understanding the world around us.

Task 9. Translate into English using indirect questions. Follow the pattern:

I wonder if...  
 I want to know whether...  
 I would like to know if...  
 It would be interesting to learn whether...  
 I'm not sure if...

1. Интересно было бы узнать, проводит ли эта группа исследования в области ядерной физики.
2. Мне хотелось бы знать, занимаются ли они исследованием той же проблемы, что и мы.
3. Интересно узнать, есть ли значительные достижения в этой области науки.
4. Я не уверен, есть ли в этой отрасли науки какие-нибудь нерешенные вопросы.

**GRAMMAR STUDY:**

Task 1. Translate into Russian paying attention to the use of tenses, active and passive.

1. Science and technology have modified our homes, places of work, means of communication. 2. Man's intellectual horizons are being expanded due to science. 4. For many centuries scientists of the world have been successfully working to uncover still unsolved secrets of nature. 4. Engineering has reached a high stage of development and now does great wonders. 5. A great deal of information had already been obtained about meteors from visual and photographic observation. 6. As far back as the early thirties atomic research was being successfully conducted in our country. 7. The operation of semiconductor devices is greatly affected by temperature. 8. One may be sure that by the end of our century some new discoveries in the field of X- ray and atomic energy application will have been made by scientists. 9. Difficulties are often met with in solving scientific problems. 10. The entire structure of our life is determined by our scientific knowledge.

Task 2. Translate the following sentences paying attention to modal verbs and their equivalents.

1. The image on the screen of a space TV should be much better than that which we obtain from ordinary sets. 2. The fundamental law of matter is that it can neither be created nor destroyed. 3. We should not forget that the future is rooted in the present. 4. In connection with these facts many pressing problems are to be faced and solved. 5. It should be emphasized, however, that whichever type of method is employed, a high degree of accuracy is desirable. 6. One should have controlled the temperature at which solidification was to start. 7. A highly sensitive parabolic antenna was to be used for transmitting data at the time of the probe's closest approach to Venus. 8. One cannot develop a fruitful theory without reliable observations. 9. Further progress in computers and electronics may well make fully automatic factories possible. 10. Progress is not inevitable, it has to be earned. Its foundation should be widely understood.

**UNIT 2.**

**Grammar study: the Gerund; Functions of "one».**

**Theme: Electronics.**

**Read and translate text A.**

Text A. A Revolution in Physical Science - Electronics.

In the closing year of nineteenth century a professor of Physics in Cambridge, Joseph John Thomson, discovered the electron. He found that one of the bodies into which the molecules-split up, the one having a negative charge, is quite different from an atom and is smaller in mass than, one thousandth part of the smallest atom known.

The discovery of the electron and the investigations into its nature which followed led to a revolution in physical science. Large-scale application of electronic technique is a tread of technical progress capable of revolutionizing many branches of industry. At present it is difficult to enumerate all branches of science and technology based on electronic technique. It is no mistake to compare the birth of electronics to such great achievements of mankind as the discovery of fire, the use of the wheel and the penetration into the secrets of the atom.

After all, during the time which has elapsed since the discovery of the electron, there have been many other great scientific discoveries, brilliant achievements in science and technology have followed one another at breath-taking speed.

Thomson's discoveries gave birth to modern atomic theory which transformed the whole of science. The discovery of the atomic nucleus; and the proton by Rutherford, the invention of the particle accelerator, Plank's Quantum Theory, Einstein's Theory of Relativity, Bohr's model of atom were all concerned the behaviour of electrons, protons and other fundamental particles of the Universe.

The intensive efforts of electronics to increase the reliability and performance of its products while reducing their size and cost has led to the results that hardly anyone would have dared to predict. It all began with the development of the transistor in 1947; its function in an electronic circuit could be performed only by a vacuum tube. The first transistors had no striking advantage in size over the smallest tubes and they were more costly. The one great advantage the transistor had over the best vacuum tubes was exceedingly low power consumption. Besides they promised greater reliability and longer life. But it took years to demonstrate other transistor advantages. The goal of creating electronic circuits with entirely solid-state components had been realized only in some years.

***Work on the text.***

Task 1. Write out the international words.

Task 2. Write out the scientific terms.

Task 3. Choose the statements that are false for the text and correct them. Follow the pattern:

No, that statement is absolutely wrong. I think...
--

or

I'm afraid the statement is false. I should say. (I believe, I suppose, etc.)
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1. The electron was discovered in the middle of the XX-th century.
2. The discovery of the electron didn't influence physical science.
3. Electronic technique is not so important for science development.
4. Modern atomic theory has transformed the whole of science.
5. Transistors appeared before vacuum tubes.
6. Low power consumption is characteristic of both vacuum tubes and transistors.
7. Vacuum tubes promised greater reliability and longer life than transistors.
8. Transistors had no advantages over vacuum tubes.

Task 4. Ask your partner and let him answer:

- Who discovered the electron;
- How the electron was discovered;
- What the discovery of the electron has led to;
- What is capable of revolutionizing many branches of industry;
- What the birth of electronics can be compared to;
- What Thomson's discoveries gave birth to;
- When the transistor was invented;

- What function could be performed only by a vacuum tube prior to the invention of the transistor;
- What great advantage the transistor had over the best vacuum tubes;
- What transistors promised science and technology.

Task 5. Find in the text the information about:

1. The discovery of the electron;
2. Large-scale application of electronic technique;
3. Great scientific discoveries and achievements which followed the discovery of the electron;
4. Transistor developments.

Task 6. Give a short summary (7-10 lines) of the text.

**Task 7. Read text B.**

Text B. Some Words about Microelectronics.

It was, in fact, the effort to reduce the size of transistors so that they could operate at higher speed that gave rise to the technology of microelectronics. A microelectronic technology made the size of transistors and other circuit elements so small that they became almost invisible to unaided eye.

The point of the extraordinary miniaturization is to make circuits small, long-lasting, low in cost and capable of performing electronic functions at extremely high speeds. It is known that the speed of response depends primarily on the size of transistor: the smaller the transistor, the faster it is.

The development of microelectronics depended on the invention of techniques for making various functional units on or in a crystal of semiconductor materials. In particular, a growing number of functions have been given over to circuit elements that perform best - transistors. Several kinds of microelectronic transistors have been developed.

Microelectronic technique will continue to displace other kinds of technique. Continued progress in microelectronics may depend to a significant extent on our ability to predict properties from a knowledge of the steps taken in the fabrication of different electronic devices.

Task 8. Answer the questions.

1. What gave rise to the technology of microelectronics?
2. What is the aim of microelectronics?
3. What does the speed of response depend upon?
4. Why did the development of microelectronics take place?
5. What may the progress in microelectronics depend upon?

Task 9. Translate into English. Use such phrases as in question, under consideration (discussion, study).

1. Открытие, о котором идет речь, пока широко не известно.
2. Исследуемая проблема может повлиять на развитие этой отрасли науки.
3. Обсуждаемые сейчас данные тесно связаны с этой проблемой.
4. Рассматриваемый подход кажется вполне удовлетворительным.
5. Исследовательская работа, проводимая в нашей лаборатории, дает хорошие результаты.
6. Решение рассматриваемой проблемы может создать новые возможности для технологии микроэлектроники.
7. Статья, о которой идет речь, была опубликована в прошлом году.
8. Изучаемый вопрос представляет большой интерес для физиков.
9. Доктор Н. - один из крупнейших специалистов по обсуждаемому вопросу.

**GRAMMAR STUDY:**Task 1. Translate the following sentences into Russian paying attention to forms and functions of the Gerund.

1. The main objective of cybernetics is to increase the efficiency of human labour by controlling and governing processes in nature, in technology and in human society.
2. The rapid growth of computer technology gave birth to numerous types of electronic devices and computers, capable of performing highly complex mathematical calculations *in* a fraction of a second.
3. Great difficulties arose in applying this method to practice.
4. It will be hardly possible to make precise measurements without changing the experimental conditions.
5. Scientists have succeeded in breaking the nuclei of atoms and in harnessing their energy.
6. We know of Newton's having developed the principles of mechanics.
7. The potential of integrated circuits is so wide that in addition to replacing similar discrete component circuits they are responsible for creating a completely new technology of circuit design.
8. The computer has made it possible to mechanize much of the information interchange and processing which constitute the nervous system of our society.
9. Mendeleev's having noticed the periodicity in the chemical properties of elements enabled him to lay down his famous Periodic Law.
10. Several factors should be considered in evaluating the experimental data.
11. We cannot make progress in our research without taking into account the results of other investigations.
12. It's no use providing the evidence in favour of this concept.
13. One cannot help recognizing the importance of this study.
14. It's no use undertaking this research without initiating preliminary studies of the observational data.
15. The problem is worth discussing in all its complexity.
16. His having presented the problem in every detail helped us to grasp his idea.
17. His having succeeded in solving the problem was quite unexpected.

Task 2. Translate the following sentences into Russian paying attention to functions of "one". Pay special attention to the fact that "one" as the subject of a sentence is not translated.

1. One should understand that the problem is extremely difficult.
2. One cannot help attempting to determine the amount of the energy needed.
3. One must think of another approach to solving the problem.
4. One more type of pollution proves to have appeared recently.
5. This problem seems to be much more complicated than all the previous ones.
6. This is one of the most confusing and puzzling problems we have ever dealt with.
7. No one seems to have dealt with this problem yet.
8. We could offer you a number of challenging problems but this one seems to be most attractive.
9. The newly developed technique has certain advantages over the old ones.

## UNIT 3.

**Grammar study: Participle: Its Forms and Functions.**

**Theme: Radioactivity.**

**Revision: Functions of "after", "for", "since", "as" and "whether".**

**Read and translate text A.**

Text A. Radioactivity.

The discovery of radioactivity was another major step in the development of the science of the atom structure. At the end of the 19th century the French scientist Becquerel found that the compounds of uranium when placed on a photographic plate covered with black paper emitted radiations. It was soon discovered that the property of emitting penetrating radiations is not confined to uranium and its compounds. Some other minerals had the same property.

Marie Curie, an outstanding Polish physicist and chemist, together with her husband Pierre Curie discovered the radioactive elements - radium and polonium. From several tons of uranium pitchblende they managed to obtain 1 g of an unknown intensely radioactive mineral, the radioactivity of which being several million times higher than that of uranium. As a result the metal was called radium.

After the phenomenon of radioactivity was discovered the question of the nature of radiation in radioactive substances arose. Ernest Rutherford, the great British physicist, was the first to solve the problem, having discovered alpha- and beta- radiation of radium. Rutherford suggested that radioactivity was the result of atomic decay. But there still were some problems that seemed difficult to be answered for a part of atoms of a radioactive substance disintegrates due to an unknown reason. They seemed to explode with alpha- and beta-particles constituting the products of the decay - fragments of disintegrated atoms - the gamma-rays, an irradiation which is produced by the explosion.

Some radioactive substances disintegrate very slowly, while others very quickly. Thus, half of the present atoms of uranium disintegrates during several hundred million years and of a radioactive gas radon after 3-8 days.

While disintegrating certain radioactive substances emit electrons (beta-particles). Having yielded an electron, some of the neutrons of the nucleus turn into a proton. The nuclei of uranium, radium and other radioactive substances being very unstable, some of them disintegrate from time to time emitting an electron or an alpha-particle. Having emitted an alpha-particle, a radium nucleus, for example, turns into a nucleus of a radioactive gas radon.

***Work on the text.***

Task 1. Write out the international words.

Task 2. Write out the scientific terms.

Task 3. Choose the statements that are false for the text and correct them. Follow the pattern:

No, that statement is absolutely false. It was not Pierre Curie. The first experiment in fissioning an atomic nucleus was made by Rutherford in 1899.

or

I'm afraid the statement is false. I believe the experiments in fissioning were made by the great British investigator and scientist Ernest Rutherford.

1. Becquerel was the first to discover radiation.
2. Becquerel called the unknown element emitting radiation radium.
3. The nature of radiation was known to the scientists of the 19th century.
4. Pierre Curie was the first to make an experiment in fissioning an atomic nucleus.

5. All the radioactive substances disintegrate very quickly.
6. While disintegrating radioactive substances emit electrons.
7. The nuclei of uranium and radium are stable.

Task 4. Ask your partner and let him answer:

- When Becquerel found that compounds of uranium emitted radiations:
- What country Becquerel worked and lived in:
- Who radium and polonium were discovered by;
- How much of an unknown radioactive mineral they could obtain;
- If the nature of radiation was known at that time;
- Who alpha- and beta- radiation of radium was discovered by;
- What suggestions were made by Ernest Rutherford;
- How long some radioactive substances may disintegrate;
- What radioactive substances emit while disintegrating.

Task 5. Choose the right word to fill in the blank:

Compounds, fissioning, decay, are produced, property, substances, emitted, discovery, disintegration.

1. .... The ... of radioactivity was a major step in the science of the atom structure.
2. Becquerel found that ... of uranium ..... radiation.
3. Some other minerals had the same .. .
4. Radium and other radioactive ... continuously emit radiation.
5. .... Rutherford was the first to make experiments in ..... an atomic nucleus.
6. Gamma- rays are the products of the .....
7. Electrons .... in the process of atom .....

Task 6. Find in the text the facts concerning:

1. M.Curie's scientific activities;
2. Rutherford's experiments. Speak on them.

***Read and translate text B.***

Text B.

In February 1896, a few months after the discovery of X-rays, Becquerel was making an experiment using the double sulphate of uranium and potassium as a fluorescing substance. After preparing the experiment and while waiting several days for sunshine Becquerel discovered that even in the dark the specimen emitted a radiation. The radiation penetrated not only black paper but even thin sheets of metal. He found that this radiation was emitted by uranium. Soon it was discovered that some other substances possessed the property of radioactivity.

Task 7. Answer the following questions:

1. What did Becquerel choose for his experiments?
2. What did he find?
3. Did the radiation penetrate only black paper?
4. What substance was the radiation emitted by?
5. Was it discovered that some other substances possess the property of radioactivity?



Task 8. Retell text B using task 7 as a plan for retelling.

Task 9. Translate into English:

В 1898 году Эрнест Резерфорд работал в Университете в Монреале вместе с четырьмя молодыми учеными, помогающими ему в его исследованиях по радиоактивности. Он обнаружил (found out), что альфа-частицы являются положительно заряженными частицами и движутся (travel) со скоростью (at a rate) одной двенадцатой света. Резерфорд продолжил свои эксперименты в Университете Манчестера. Там он сделал еще одно интересное открытие: он нашел, что один грамм радия излучает (ejects) 34 миллиона альфа-частиц каждую секунду.

Task 10. Make up a story about a well-known scientist.

### **GRAMMAR STUDY:**

Task 1. Translate the following sentences into Russian paying attention to the participles:

1. The atom possessing the simplest structure is hydrogen. 2. Having made a series of experiments Ernest Rutherford solved the problem of the nature of radiation. 3. While studying nuclear reactions induced by bombardment of various elements with alpha-particles, the scientists found that in certain cases the new radioactive nuclei produced in such reactions emit positrons. 4. The combination of a proton and a closely bound electron is called a neutron, the name stemming from the fact that the electrical charge is zero. 5. The alpha-rays were really atomic fragments, flying out of exploding atoms, the beta-rays being a flow of electrons. 6. The quantum hypothesis having been introduced by Planck in the case of black body radiation, the idea soon found application in many other directions. 7. Three of the lighter elements – potassium, rubidium and samarium - have been found to possess extremely weak activities, the first two emitting beta-particles. 8. Neutrons being without charge lose energy only by direct contact with nuclei of matter. 9. Having arrived at a quantitative description of the speed of molecules composing gas, Maxwell was able to write a precise formula of gas pressure. 10. The electrons are also interacting with each other.

Task 2. Translate the sentences paying attention to the italicized words:

1. *After* the discovery of the neutron, the nucleus was regarded as being made up of protons and neutrons.
2. *After* the temperature of an object is raised, the velocity of electrons increases.
3. *As* Faraday was required to assist his mother in providing for the family, he had to leave school to begin working. 4. Faraday began original investigations with magnetism in 1812 and the same year he published his first article, *since* then more than 37 papers appeared.
4. *Since* alpha-rays are not true rays like light or X-rays, they are given special consideration.
5. Tsiolkovsky worked *as* a teacher of physics at a provincial school for more than twenty years.
6. *As soon as* the temperature is raised above absolute zero, the Fermi level must be found above the donor states.
7. It is the purpose of the article to present experiments which may decide whether or not this assumption is true.
8. *Since* the electric current must be essentially the same phenomenon whether it takes place through solids, liquids or gases, it follows that conduction through solids must consist in the passage of electrons through the conductor from the negative to the positive pole.

## UNIT 4.

***Grammar study: Functions of "V+ed"-forms. "One"-functions.***

***Theme: From the History of Inventions.***

***Read and translate text A.***

Text A. X - Rays.

In 1895 when Röntgen was experimenting on the discharge of electricity through gases, he found that if a discharge tube was evacuated to the stage at which the cathode-ray beam extended along its length, certain materials became fluorescent when placed in the neighbourhood of the tube and also that photographic plates were darkened. Moreover these effects persisted when the tube was covered with material such as black paper. They were evidently due to something which seemed to emanate from the places where the cathode rays hit the walls of the tube, and the agent received was called X-radiation or X-rays. In addition to the above mentioned properties X-rays were found to produce strong ionization in gases.

X-rays are produced when the fast moving electrons of the cathode stream are suddenly stopped. The X-rays are emitted in all directions from the spot on which the electrons are focused, and the surface of the target is cut obliquely so that some of the rays pass out of the side of the tube. Less than one per cent of the energy of the electrons is converted into X-rays, the remainder appearing as heat in the target. Sometimes the target was a comparatively small piece of metal embedded in the surface of a lump of copper, advantage being taken of the high thermal conductivity of the latter metal to dissipate the heat.

In very powerful X-ray installations, using anything up to a million volts, so much heat is generated that it has to be removed by the circulation of liquid.

In the early stages of the study of X-rays the terms "hard" and "soft" came to be used to indicate differences in penetrating power: hard rays can pass through greater thickness of matter, that is to say they are less strongly absorbed.

The greater the potential difference through which the electrons move before being stopped by the target, the harder are the X-rays.

The nature of X-rays was established several years after their discovery. The difficulty was in their behaviour. The apparent contrast between their behaviour and that of light and other radiations, namely, the seemingly impossibility of causing them to be reflected or to be diffracted by ruled gratings made it difficult to believe that they were a form of wave motion. At last X-rays were found to be waves of exactly the same nature as light but of smaller wavelength.

***Work on the text.***

**Task 1. Write out the international words.**

**Task 2. Write out the scientific terms.**

**Task 3. Find in the text:**

1. The facts about Röntgen's discovering the unknown rays  
(Say: when it happened; what Röntgen was experimenting with; what puzzled him; why he called the unknown rays X-rays)

2. What properties X-rays have  
(Say: how they are produced and emitted)

**Task 4. Ask your partner and let him answer:**

- What happened to photographic plate in the neighbourhood of the tube?
- How the agent was called;
- What the X-rays produced in gases;
- When the X-rays are produced;

- How the X-rays are emitted;
- How much energy of the electron is converted into the X-rays;
- What may be used as a target;
- Which metal has the highest thermal conductivity?
- What the terms "hard" and "soft" are used for;
- Which rays can pass through greater thickness of matter;
- If the X-rays are of the same nature as light.

Task 5. Choose the right word to fill in the blank:

emitted, called, installations, neighbourhood, indicate, converted, discharge.

1. In 1895 Röntgen was experimenting on the      of electricity through gases.
2. Some materials became fluorescent in the      of the tube.
3. X-rays are      in all directions.
4. The agent received was      X-radiation.
5. Less than one per cent of the energy of the electrons is      into X-rays.
6. In very powerful X-ray      tremendous heat is generated.
7. The terms "hard" and "soft" are used to ..... differences

In penetrating power.

**Task 6. Read text B.**

Text B. Particle Accelerators.

The history of acceleration of charged particles has been short, but spectacular. Since its beginning in 1928 particle energies attained have increased by a factor of about ten every six years.

In all particle accelerators the mechanism of acceleration involves application of an electric field. The earliest accelerators applied a potential difference between accelerating electrodes by use of transformer - rectifier systems, by cascade transformers or voltage multipliers, or by electrostatic charging of a high-voltage electrode.

Later it was found possible to use radio-frequency fields. Appropriate choice of electrode geometry made it possible for particles to arrive at accelerating gaps at the right phase of the rf-wave for continual acceleration.

In the cyclotron particles are returned by bending in a magnetic field to receive repeated acceleration from a rf-field at a single gap. Thus repeated application of a relatively small field can raise the energy of a charged particle to a level many times that achievable at a single gap.

The discovery of a phase stability in 1944-1945 made it possible to extend this procedure and in 1966 there was no theoretical limit to the energy that could be reached.

Electrons, positive and negative ions, all have been used to provide energy in high-energy accelerators. But a greater number of accelerators has been used to provide beams of protons or electrons.

Task 7. Choose the statements that are false for the text and correct them according to the text:

1. The history of acceleration of charged particles has been long.
2. The mechanism of acceleration has not been well studied yet.
3. The earliest accelerators applied a potential difference between accelerating electrodes.
4. It was also found possible to use radio-frequency fields.
5. Only one application of a small field can raise the energy of a charged particle.
6. There is still theoretical limit to the energy that could be reached.

**GRAMMAR STUDY:**Task 1. Translate into Russian, paying attention to "V+ed" - forms.

1. In many experiments the scientists were able to watch drops falling under gravity and rising under the applied field. 2. The laws thus developed may be considered as a first order theory. 3. Used in this way the lens is a simple magnifier. 4. When used as an oscillator, the maser is capable of generating monochromatic radiation of extreme frequency stability. 5. While irradiated with light, many substances emit some of the energy of radiation they absorb. 6. Let us suppose that the molecules are spherically symmetric when isolated. 7. By means of a counter attached to the rotating disc, a record is kept of the number of revolutions it makes. 8. It was established that certain metals if cooled to sufficiently low temperatures completely lose their resistance to electric current. 9. The equations developed apply for either positively charged or negatively charged particles. 10. The substance obtained contained some impurities. 11. This apparatus called a cloud chamber and constructed in 1911 was later modified by Wilson. 12. The discovery of the phenomenon of radioactivity resulted from the study of X-rays discovered by Röntgen. 13. If the motor were examined in time, there would be no overheating. 14. Lowering the field resistance raised the generated voltage. 15. When added to brass aluminum greatly increased its resistance to corrosion. 16. The results obtained were summarized in the article.

Task 2. Translate into Russian paying attention to "one"- forms.

1. To determine the motion of a few particles, one can use the numerical method. 2. The third Law of Motion states that whenever one body exerts a force on another, the second body exerts an equal and opposite force on the first one. 3. One should not use this principle as the only one suitable for the discussion. 4. The atoms of different elements differ from one another. 5. The simplest example of the conservation of energy is a vertically falling object, one that moves only in a vertical direction. 6. According to the physical definition of work, if one holds a hundred-pound weight off the ground for a while, he is doing no work. 7. The researcher said it was the last but one experiment that could give satisfactory results. 8. One should do one's best if one wants to achieve some results in science.

Task 3. Translate the following sentences into Russian, paying attention to the underlined words: simple, single, some, same, because, because of, l6ðe

1. Kepler discovered some simple laws regarding planetary motion. 2. Two forces can be combined into a single force. 3. Under the influence of gravity all objects fall with the same acceleration. 4. For some years Newton studied light and its properties. He made some similar experiments and obtained the same results. 5. No matter what the position of the body, its centre of gravity will always remain at the same point. 6. Soon it became clear that the early telescopes were inaccurate not only because of spherical aberration, but also because of the colour. 7. Newton cared little for his studies at school because other things interested him much more. 8. Elastic energy is like chemical energy because chemical energy is the energy of the attraction of the atoms. 9. Like the Moon, other large heavenly bodies move in regular orbits month after month. 10. "I would like to be properly understood", -the supervisor said to his post-graduate student, pointing at the faults in his paper.

**PROFESSIONAL GAME**

Speak on the role of science in our life. Make up 5-6 sentences beginning with the following introductory phrases:

I think; it is considered; some scientists believe; the true scientist is governed by experimental evidence; scientific approach to the solution of the problem is...; the emphasis is put on...; we can list the following purposes...; the fundamental aim of science is...; the basis of science is...; the experiment proves that...

The main problems to be discussed are:

1. The necessity of combination of fundamental sciences with basic sciences. (Say what one can refer to fundamental sciences and basic sciences. Why both are necessary.)
2. The role of theory and practice. (Say if practice can exist without theory and theory without practice.)

3. Give some examples of science influence on our life,  
(Speak on X-rays importance, the theory of relativity, Mendeleev periodic Law, etc.)

Translate the following extract into English:

Уважаемые коллеги,

сегодня мы снова и снова возвращаемся к вопросу роли науки в развитии общества. Я полагаю, эта тема никогда не будет исчерпана (never seems to be exhausted).

Некоторые ученые полагают, что важны прежде всего базовые науки, и игнорируют значение фундаментальных. Это большая ошибка! Если цель фундаментальной науки - описать Факты природы и природных явлений, то базовые науки объясняют эти явления. Основой науки, таким образом, является поиск истины через наблюдение за фактами и организация этих фактов. Научный подход к решению той или иной проблемы - это эксперимент, который либо подтверждает теорию, либо опровергает ее. (either confirms the theory or rejects it). Эксперимент либо доказывает правоту научных исследований, либо заставляет искать новые подходы к решению проблемы.

## UNIT 5.

***Grammar study: Absolute Participle Construction. Functions of "for", "provided".***

***Theme: From the History of Electricity.***

***Read and translate text A.***

Text A. Alessandro Volta.

The history of electricity is tightly connected with the name of Alessandro Volta who was the first to produce electric current, his discovery developing out of Galvani's experiments with the frog. But Volta went further trying to get an electric source. Experimenting with metals he found out that the electric source was the result of the contact of both dissimilar metals used during his observations. He repeated his experiments many times to get sure that his observations were right. To carry out those experiments at that time was not an easy thing to do, two years being spent by him for the invention of the source of a steady continuous current. To increase the effect obtained with one pair of metals Volta increased the number of these pairs, the voltaic pile consisting of a layer of copper and a layer of zinc placed one above another with a layer of flannel moistened in salt water between them, in this way the voltaic pile looked like a thick sandwich containing copper, zinc, flannel, water and so on. A wire was connected to the first disc of copper and to the last disc of zinc.

The year 1800 is a good date to be remembered: for the first time in the world's history a steady, continuous current was generated. Volta's being one of the most famous scientists in the field of electricity is a well-known fact, but of course he is not the only one to be mentioned in 370 year history of electricity science.

It is interesting to know that the name of "electricity" was introduced by Gilbert, the English physicist who began the first systematic scientific research on electrical phenomena. He discovered that various other substances possessed the property similar to that of amber or, in other words, they generated electricity when they were rubbed, the phenomena he was studying being given the name "electricity".

**Task 1. Choose the statements that are false for the text and correct them. While correcting use the following phrases:**

"No, it's absolutely false; the text says that..."

"I'm sure it is wrong and I can prove it with the help of the text which says... "

"I hope it'll be correct to say that..."

"The statement doesn't correspond the text"

1. The history of electricity is tightly connected with the name of Alessandro Volta.
2. Galvani could produce electric current.
3. According to Volta the electric source was the result of the contact of similar metals.
4. 4. Experimenting was a usual thing at that time.
5. The terms "negative" and "positive" charges were introduced by Volta.
6. The term "electricity" was also introduced by him.
7. In 1800 the source of electric current was found.
8. In his experiments Volta used one pair of metals.

Task 2. Ask your partner and let him answer:

- who introduced the terms "negative and positive charges";
- what Volta found experimenting with metals;
- how many times Volta repeated his experiments;
- if it was easy to make experiments at that time;
- how many years were spent by him for the invention of a source of a steady continuous current;
- what a voltaic pile looked like;
- what the wire was connected to;
- how long the history of electricity science is;
- who the term of electricity was introduced by;
- if various other substances generate electricity at rubbing.

Task 3. Find in the text the facts concerning:

1. Volta's role in the development of electricity science;
2. Volta's experiments aimed at getting steady continuous current. Speak on them.

Task 4. Read text B.

Text B. M.Lomonosov

M.Lomonosov was complete master of natural sciences as well as history, philosophy and engineering.

It is quite impossible to name a scientific problem he did not turn his attention to. However theory alone left him unsatisfied. He knew by experience that it was useless and unreliable if it didn't find practical application and he did try to find it for the phenomena studied. Lomonosov possessed an unusual capacity for work. His scientific activity lasted for 25 years. During these years he carried on scientific research in natural sciences and made numerous reports on the results of his achievements. As a materialist, Lomonosov studied physical properties of bodies on the basis of the molecular and atomic theory. He developed the kinetic theory of gases, the molecular kinetic theory of heat and was the first to discover the law of the conservation of matter and motion. He also found that light, heat and electricity are different forms of motion.

Task 5. Using the text prove:

1. that Lomonosov did not rely only on theory in his research. Say why.
2. that Lomonosov really possessed an unusual capacity for work.

Give examples from the text.

Task 6. Fill in the blanks with the words from text B:

capacity, activity, reports, turned, research, conservation, unreliable, scientific, properties.

1. Lomonosov . his attention to many ..... problems.
2. Lomonosov knew that theory alone was . .
3. He possessed unusual .. for work.

4. A. His scientific . lasted for 25 years.
5. .... He carried on scientific .... in natural sciences and made on the results of his experiments.
6. .... Lomonosov studied physical of bodies on the basis of atomic theory.
7. .... The law of the of matter was discovered by Lomonosov.

Task 7. Retell text B, using the following words and phrases:

to turn attention to; scientific problems; to be satisfied (or unsatisfied); unreliable; practical application; capacity for work; to last; to make reports; on the basis of; to discover; property; forms of motion.

Task 8. Speak on your scientific work using the same words and expressions.

Task 9. Translate into English:

1. История науки тесно связана с именем М.В.Ломоносова. 2. Ломоносов впервые в истории русской науки стал проводить эксперименты, пытаясь доказать надежность теории. 3. Необычайная трудоспособность характерна для многих русских ученых. 4. Атомная теория была положена в основу изучения физических свойств тел. 5. Закон сохранения материи явился чрезвычайно важным для развития науки. 6. Немногое известно о научной деятельности Кавендиша в период его обучения в Кембридже. 7. Многочисленные статьи по результатам научных изысканий этого конструкторского бюро печатаются в сборнике института электроники и радиотехники.

### **GRAMMAR STUDY:**

Task 1. Translate the following sentences into Russian, paying attention to Absolute Participle Construction

1. The filament being heated, the electrons leave its surface. 2. The problem having excited a great deal of discussion, a series of tests had to be carried out. 3. The oil having been exhausted, the engine stopped. 4. Working at his new device, the inventor made numerous improvements, the latter resulting from his own experiments. 5. An object losing its potential energy, that energy is turned into kinetic energy. 6. Electrical devices find a wide application in every house, a refrigerator being one of them. 7. The energy sources of the world decreasing, the scientists are looking for new ones. 8. There are different sources of energy, the Sun being an unlimited source of all its forms. 9. Industrial applications of energy increasing, more and more energy is needed every year. 10. The pressure range being beyond the limits of the existing diagram, data have been calculated by other means. 11. The flow of the current being reduced, the speed of the motor is correspondingly decreased. 12. In cold weather the engine exhaust is not efficient to supply the heating system, the radiators condensing the steam more rapidly than it can be supplied.

Task 2. Translate into Russian, paying attention to the underlined words:

1. Planck's formula provided a means of expressing; energy in terms of frequency. 2. Electrons provided only a negligible portion of the atomic weight. 3. For a long time people didn't know that lightning and atmospheric electricity are one and the same thing. 4. Static electricity cannot be used for practical purposes for it is very high in voltage and difficult to be controlled. 5. The year 1800 is a good date to be remembered for the first time in the world's history a steady, continuous current was generated.

Task 3. Translate the following sentences into English using the absolute Participle construction:

1. Так как Вольта был не удовлетворен результатами, эксперимент пришлось повторить.
2. Так как изменения температуры влияли на конечные результаты, был применен новый метод, причем он оказался удачным.
3. После того, как Вольта применил металлы при трении, он понял, что электрический источник был результатом взаимодействия этих двух разнородных металлов.
4. Когда вода падает с высоты, потенциальная энергия переходит в кинетическую.

5. Когда лазер направился в сторону Луны, ее площадь была освещена только на несколько миль в диаметре.
6. После того, как электрические двигатели заменили паровые, высокая скорость на транспорте стала возможной.
7. Имя Гильберта известно всему миру, причем термин "электричество" был введен им.

## **UNIT 6.**

### ***Grammar study: ING-forms; Their Translation. Modal Verbs.***

#### ***Theme: Lasers and Masers.***

#### ***Read and translate text A.***

Text A. Lasers and Masers.

The devices known as masers and lasers serve as amplifiers and generators of radiation, their common characteristic being their making use of the conversion of atomic energy to electromagnetic radiation. This process is known as stimulated emission of radiation. When the wavelength, of the emitted radiation is in the vicinity of 1 cm we speak of microwave amplifiers or masers. Instruments which generate or amplify visible radiation are called optical masers or lasers.

The history of the invention or the evolution of these devices may be divided into the following periods. The phase of the premaser period started with the discovery of the existence of the stimulated emission process and ended with the recognition by many physicists of the possibility that this process might lead to a radiation amplifier. This period is known to extend from 1916 to 1953. The maser period begins with the publication of an article by Basov and Prokhorov and the construction of the first operating maser by Townes. It was Basov who gave a detailed theoretical explanation of the use of molecular beams in optical spectroscopy. It was shown that molecules of certain kinds present in a beam containing molecules in different energy state might be separated from each other by passing the beam through the nonuniform electric field. The molecules in the selected energy state may then be fed into a microwave resonator where absorption or amplification takes place. The article of Basov and Prokhorov contained detailed calculations pertaining to the role of relevant physical parameters, the effects of linewidth, cavity dimensions, and the like. Thus the quantitative conditions for operating microwave amplifier and generator were found.

In 1954 Townes announced the construction and operation of a device that might be used as a high-resolution microwave spectrometer or a very stable oscillator. This was the maser.

Task 1. Write out the international words.

Task 2. Write out the scientific terms.

Task 3. Choose the statements that are false for the text and correct them according to the text. Use the expressions:

It can't be true; on the contrary; I think (suppose, believe); I'm sure it's wrong.

1. Both lasers and masers have some common characteristics.
2. They both convert atomic energy to electromagnetic radiation.
3. When the wavelength of the emitted radiation is large enough we speak of a maser.
4. Lasers can amplify visible radiation, while masers can't do that.
5. The premaser period started with the appearance of a radiation amplifier.
6. It was Townes who gave a theoretical explanation of molecular beams use.
7. The quantitative conditions for operating microwave generator were found in early forties.
8. The first maser was constructed in 1953 by Russian scientists Prokhorov and Basov.



Task 4. Answer the following questions:

1. What is a maser?
2. What is a laser?
3. What is their common characteristic?
4. What instruments are called optical lasers and masers?
5. When did the premaser period begin?
6. What did Basov and Prokhorov work out?
7. Who constructed the first maser?
8. When did the laser period begin?

Task 5. Find in the text the facts concerning:

1. Townes' activities in the field of maser constructing;
2. Basov's and Prokhorov's theoretical investigations

(Mind mentioning the time period, the country, they worked in, the results achieved by them).

Task 6. Retell the text using the plan given below:

1. The relevant phase of the premaser period.
2. The publication of an article by Basov and Prokhorov.
3. Their theoretical explanations.
4. The construction of the first operating maser.
5. The properties of the maser.

**Task 7. Read text B.**

Text B.

Laser applications have increased in variety. These days most optical experiments can be done as well with lasers as with conventional light sources. Experiments requiring high intensities in narrow spectral regions can be made only with lasers. Outside the experimental field many applications were found in medicine, communications, geophysical and space exploration and metals technology. The potential importance of these applications continues to stimulate new developments in the laser field. The awarding of the 1964 Nobel Prize in physics to Basov, Prokhorov and Townes was a recognition of the importance of the achievements in quantum electronics which these men founded.

Task 8. Find out:

1. if laser applications have increased nowadays;
2. what scientific experiments need laser application;
3. where else lasers are widely used;
4. how the achievements in quantum electronics were appreciated by world scientific community.

Task 9. Retell text B, using task 8 as a plan for retelling.Task 10. Translate the following sentences into English.

See the expressions below:

a great number of - большое количество various - различные

to result in - давать в результате, приводить к (результатам) to be evident - быть очевидным

to carry out the developments in - вести разработки

1. Большое количество разнообразных лазеров появилось в результате развития квантовой электроники. 2. Диэлектрические кристаллы, газы, полупроводники и плазма используются для создания лазеров. 3. Широко обсуждается проблема применения лазеров для связи. 4. Ведутся разработки по применению лазера в вычислительной технике. 5. Большой интерес представляют газовые лазеры и полупроводниковые лазеры, причем их преимущества очевидны. 6. Лазер - это

новый и очень сложный прибор, возможности которого еще полностью не изучены. 7. Твердые тела обычно используются для лазеров, так как их молекулы более сконцентрированы, чем молекулы газов.

Task 11. Translate the following sentences, paying attention to the underlined words:

1. Matter can exist as a plasma. 2. It is a different matter if charged bodies are placed inside a space surrounded by conducting vails. 3. The latter method is more convenient. 4. Later on we shall use the results achieved in further investigations. 5. All substances show reaction to a magnetic field if the latter is sufficiently intense. 6. The last definition was the best one. 7. The discussion could last very long if it were not interrupted by the announcement about the last results obtained an hour ago.

### **GRAMMAR STUDY:**

Task 1. Translate the following sentences, paying attention to the modal verbs:

1. Newton could explain small changes in the motion of the planets. He was able to show how it is possible to describe a planet's position at any time in its orbit. 2. An extremely simple example may be of help in illustrating mechanical motion. 3. A comparison of the results achieved can be made with similar results predicted. 4. You ought to look through all these articles before you begin to work at your report. 5. Heat can be converted into electricity. 6. If there is a force between any pair of objects, we ought to be able to measure the force between them. 7. In order to overcome this limitation, a plasma generated by a radio – frequency oscillator could have been used as a source of helium ions. 8. Several methods exist whereby sufficient energy may be supplied to the electrons in a metal in order that some of them may leave the metal.

## **UNIT 7.**

***Grammar study: The Infinitives: Adjectives and Adverbs.***

***Theme: Computers.***

***Read and translate text A.***

Text A. The Computer Revolution.

When Charles Babbage, a professor of mathematics at Cambridge University, invented the first calculating machine in 1812, he could hardly have imagined the situation we find ourselves in today. Nearly everything we do in the modern world is helped, or even controlled, by computers, the complicated descendants of this simple machine. Computers are being used more and more extensively in the world today for the simple reason that they are far more sufficient than human beings. They have such better memories and can store huge amounts of information. They can pay wages, reserve seats on planes, control machines in factories, work out tomorrow's weather, and even play chess, write poetry, or compose music.

Many people associate computers with the world of science and maths, but they are also a great help to scholars in other subjects, in history, literature and so on. It's now possible for a scholar to find a book or article he needs very quickly, which, when a million or more new books are published every year, is quite an advantage. There is a system controlled by computer of giving books a code number, reducing them in size by putting them on microfiche\* and then storing 3.000 or more in a container not bigger than a washing machine. You tell the computer which subject you are interested in and it produces any microfiche you need in seconds.

There are also systems being developed to translate articles from foreign journals by a computer and to make up many lists of information that are needed in a modern library. Co computers can help us to deal with the knowledge explosion in many ways.

But the computer cannot actually think. To make the computer work one must tell it what to do with the information fed into it - to add, subtract, multiply or divide the coded pulses stored in its

memory. The memory of the computer contains the instructions prepared by a human brain that provide the computer with the road to follow in order to solve a problem. These instructions are called the program.

\*microfiche /'maikroufi / - микрофиша (карточка с несколькими кадрами микрофильма).

The computer performs all the functions by route. Once an answer is achieved, another program within the memory tells the computer how to display the solution - to type it out on paper, display it as pictures or words on a television screen, or perhaps even to say the answer in words a man can hear.

Task 1. Write out the international words.

Task 2. Write out the scientific terms.

Task 3. Choose the statements that are false for the text and correct them according to the text. Follow the pattern.

Yes, that's right.

No, that statement is absolutely wrong.

I'm afraid, the statement is false. I believe...

1. Charles Babbage, a professor of physics at Moscow University, invented the first computer.
2. Computers are complicated descendants of simple radio sets.
3. Computers are not more efficient than human beings.
4. Computers have much better memories than human beings and can store huge amounts of information.
5. Computers can be used only in the spheres of science and maths.
6. Computers will be never used as translators of texts from one language into another.
7. Computers make instructions called programs.
8. Computers perform all their functions by route.

Task 4. Ask your partner and let him answer:

- who invented the first calculating machine ;
- when this machine was invented ;
- why computers are being used more and more extensively today ;
- what one can say about computer's memory ;
- what computers can do ;
- what spheres computers can be associated with ;
- how computers can help us to deal with the knowledge explosion ;
- how one can make a computer work ;
- who prepares instructions for a computer and how these instructions are called ;
- how the computer performs all its functions.

Task 5. Give a short summary (10 - 12 lines) of the text.

**Task 6. Read and retell text 1.**

Text B. Computers - translators.

The 21st century would be impossible without a computer. Today computers are already running our factories, planning our cities, teaching our children, forecasting the possible futures, translating foreign texts. A machine translator will be a great help to the development of science and technology.

In the 80-s a machine was developed that could optically scan the written characters and print out the translation. It has a program that translates Chinese into English and English into Chinese. At a press demonstration the programmer asked for a phrase to translate and a reporter said: "Out of sight, out of mind". The phrase was fed into the computer, which replied by printing out a string of Chinese

characters. "There", said the programmer, that means "out of sight, out of mind".

The reporter was sceptical. "I don't know Chinese and I don't know that "that" means "Out of sight, out of mind".

"Well", replied the engineer, "it's really quite simple. We'll ask the other program to translate the Chinese into English."

And so once again a string of characters, this time Chinese, was fed into the computer.

The translation was typed out almost immediately and was read: "invisible idiot".

Task 7. Answer the questions:

1. What is your idea of computers - translators?
2. Is the problem really feasible today?
3. Is the author of the text above optimistic or sceptical about it? Prove your idea.
4. Why couldn't the computer translate the phrase properly?

Task 8. Translate into English:

разработать новый тип компьютера; оптически сканировать; переводить с китайского на английский; управлять заводами; развитие науки и техники; демонстрация для прессы; с глаз долой - из сердца вон; ввести фразу в компьютер; китайские иероглифы; напечатать перевод.

Task 9. Translate into English. Use either the word "experiment" or "experience".

1. Я полагаюсь на собственный опыт. 2. Опыт обычно длится несколько часов. 3. Я это знаю по своему опыту. 4. В результате наших исследований мы приобрели большой опыт. 5. У нас большой опыт научной работы. 6. Результаты опыта будут опубликованы в ближайшем будущем. 7. Чем больше мы работаем, тем больше опыта мы приобретаем. 8. Нам не удалось провести дополнительные опыты.

### **GRAMMAR STUDY:**

Task 1. Translate into Russian, paying attention to the Infinitives.

1. To solve the problem as fast as possible by means of a computer is a matter of some minutes.
2. To know the displacement of a moving body one should know both the length of the route and the direction of motion.
3. One of the objects of the computer-controlled traffic experiment carried out in London was to make the use of road space more efficient.
4. A program of a computer is a set of instructions to be followed.
5. To explain the behaviour of the electrons in the atom, the new concepts of the quantum theory had to be substituted for the principles of classical mechanics and electrodynamics.
6. The theory to account for these changes has not been developed yet.
7. The problem, as can be seen, is how to obtain further information of the process.
8. The phenomena to be considered are very complicated.
9. A problem that takes the human brain 2 years to solve can be solved by a computer in a few seconds.
10. For the decision to be correct all the facts should be taken into consideration.
11. It is most important for the computer to work under suitable conditions.
12. For the results to be valued our technique should be used in combination with statistical analysis.
13. A mean solar day is the mean time for the Earth to make one rotation on its axis relative to the Sun.
14. Sufficient time was needed for temperature equilibrium to be established.
15. These stars are much too remote for the astronomer to answer questions with the tools now available.

Task 2. Translate into Russian, paying attention to adjectives and adverbs.

1. Still faster means of getting computer-stored Information must be developed.
2. Such a situation can no longer be accepted, for computers already calculate at a blinding pace and their speeds are steadily increasing.
3. The transistor is made of a semiconductor, a crystal that conducts electricity better than glass, though not as well as metal.
4. More than that, they insist on applying this theory to a much wider range of phenomena.
5. Electronic brains work a thousand times more rapidly than nerve cells in the human brain.
6. The smallest and simplest is the hydrogen atom, while at the other end of the elements scale is the uranium atom, known as the heaviest and most complex.
7. The abstract should be as short as possible and should contain only the most important thoughts of the author.
8. The more we go into the thing, the more complex the matter becomes.

## **UNIT 8.**

### **Grammar study: *Infinitive Constructions; Complex Sentences: to be due to — due to.***

#### **Theme: *Economy.***

#### ***Read and translate text A.***

Text A. People and Their Work.

All over the world people go out to work. The variety of jobs they do seems to be endless: some work with their hands using various skills they have learned; others work in offices using their knowledge rather than manual ability. One person may work in a laboratory as a nuclear physicist, another serves customers in a shop, while yet another plays guitar in a pop group. Whatever they do, most people who go out to work do so for a combination of reasons.

There are three basic reasons why people go out to work. Firstly, they have to earn money to buy the things they need and want in order to live. These things include necessities such as food, clothing and housing, and more luxury items such as home computers, cars and personal stereos (although some of these are considered to be necessities these days).

Secondly, if people did not work, most of the things needed would not be available. We live in a complex society where people no longer produce the things they need for themselves. If nobody worked to build houses, grow and produce food or make personal stereos, there would be none of these things produced for people to buy.

Thirdly, people go out to work because they want to. Work, if it is done well and enthusiastically, can give a sense of satisfaction and achievement, no matter what a person's job is. A nurse, for example, knows that as well as earning a living she is providing an essential and worthwhile service by caring for others. A computer operator in a company that makes washing machines knows that he or she is helping the company to provide goods that are wanted by other people in society. The computer operator is contributing to society and the economy of the country in helping to supply the goods society wants and provide employment at the same time earning money for him or herself and his or her family.

So we can say that people go out to work to produce the goods and services needed, to earn money and to gain a sense of achievement by doing something that contributes to the well-being of themselves, their families and society as a whole. People work together in business organizations to provide the goods and services they and others want to buy. The types of goods and services business organizations are willing to provide are determined by what is called the principle of supply and demand.

Task 1. Write out the international words.

Task 2. Write out the scientific terms.

Task 3. Answer the following questions:

1. Why do people go to work?
2. What are necessities?
3. What luxury items can you name?
4. When can work give a sense of satisfaction?  
Give some examples of such work.
5. What are the types of goods and services determined by?

Task 4. Retell the text using the questions given above as a plan for retelling.

Task 5. Choose the right word to fill in the blank:

goods, necessities, available, items, to earn, reasons, satisfaction, service

1. There are different ..... why people go out to work.
2. To buy things they need people have ..... money.
3. Among the things people need are ..... and luxury .....
4. In order to live people should have a lot of things.....to them.
5. Besides giving money work can give a sense of..... .
6. A nurse is providing an essential..... by caring for other people.
7. People working in business organizations should provide ..... and services for other people to buy.

**Task 4. Read text B.**

Text B. Income, Expenses and Profit.

The purpose of many business organizations is to make a profit. The factors which affect the level of profit a business organization makes are known to be the income and expenses, or expenditure, of the organization,

Income comes from sales: the more of its products an organization sells, the higher will be its income. Selling is therefore a vital activity for a business organization. Unless it sells enough of its products, a business will not receive sufficient income to cover its costs. Income is generated by sales and without a high level of sales a business organization will make a loss and eventually go out of business.

It costs an organization money to produce the goods and services it sells. Things like machinery and the raw materials out of which the goods produced are made have to be bought, rent has to be paid for factories or offices, and of course the wages and salaries of employees also have to be paid. These are just some -of the expenses of business organizations.

The profit of an organization is the amount by which its income exceeds its expenses. Since the purpose of many business organizations is to make as large a profit as possible, they will want to have as high a level of income and as low a level of expenses as possible. It is often said in business that a sale is not a sale until it is paid for. A business organization needs the money it receives for goods and services it has sold (its income) in order to pay for its expenses.

Task 7. Choose the statements that are false for the text B and correct them according to the text. Use the following expressions:

It can't be true; On the contrary; I think (suppose, believe); I'm sure it's wrong; etc.

1. The purpose of business organizations is not to make a profit.
2. The income and expenses do not affect the level of profit.
3. Selling *is* a vital activity for a business organization.

4. Income is not generated by sales.
5. A business organization can do well without a high level of sales.
6. The profit of an organization is the amount by which its income exceeds its expenses.
7. Business organizations don't need high level of income, they want to have a high level of expenses.

### **GRAMMAR STUDY**

#### Task 1. Translate into Russian, paying attention to infinitive constructions.

1. Money is considered to be the central nervous system of our economy. 2. One knows profits to be a residual of what is left, if any, after expenses. 3. The long-run relationship of consumption to income appears to be fairly stable. 4. Inflation is sure to have undesirable affects on production efficiency. 5. Mew inventions and new products are not likely to be introduced in a smooth and continuous process. 6. Unsound and unwise economic policies are known to be able to ruin entire nations. 7. Taxes are supposed to have a determining influence on the decision whether to undertake or not to undertake a particular investment. 8. We know inflation to be a rise in price level. 8. Statistics on national income and product is likely to be the most important analytical tool in the field of economy.

#### Task 2. Analyse and translate the following complex sentences. State the type of subordinate c<sup>-</sup>Ynses and the way they are introduced.

1. Nearly everything we produce and consume is bought and paid for by money. 2. Prices show the amount of money the citizen has to give up in order to obtain the desired goods or services. 3. The process of capital formation means more must be produced than is consumed. 4. The shoemaker doesn't need to exchange shoes he makes directly for pork chops, but he can sell the shoes for money. 5. Some people think they are always right in what they are doing. 6. Managers have specific responsibilities relating to the department they manage. 7. You should try to be sure that the job you do and the career you choose is one that you are interested in and from which you will get satisfaction and enjoyment. 8. The higher the level of profits, the higher the level of benefit each employee receives. 9. The sales person should try to find out the price a customer is expecting and prepared to pay for the product he is going to buy. 10. Most manufacturing business organizations keep stocks of the raw materials they use so that they always have enough on hand to cover the needs of immediate production.

#### Task 3. Translate into Russian, paying attention to the expressions: "to be due to"; "due to".

1. There are local problems due to the production of smoke and offensive gases by factories.
2. The discovery of radioactivity was due more or less to pure accident.
3. Due to spectroscopic analysis a number of new elements were discovered.
4. The discovery of new facts was due to the modern theory of atomic structure.
5. The problem still remains unsolved due to the difference of opinion.
6. The errors are due to careless analysis of the data received.
7. Due to their help we could complete the work in time.
8. The numerical value of the conductivity changes due to the concentration of impurities.
9. The problem could be solved only due to very careful investigations.

#### Task 4. Translate into English, using either "to be due to" or "due to".

1. Квантовая теория бала создана Максом Планком.
2. Медь широко используется из-за ее высокой проводимости.
3. Благодаря этому прибору все измерения были сделаны очень точно.
4. Проблема была успешно решена благодаря тщательным исследованиям.
5. Все ваши ошибки происходят за счет небрежных вычислений.
6. Физика сделала огромные успехи благодаря теории относительности.
7. Эти явления происходят из-за электромагнитных эффектов.

8. Неудачи эксперимента обусловлены отсутствием современного оборудования.
9. Из-за неточных измерений результаты оказались неправильными.

## ***APPENDIX 1.***

### ***REVIEW EXERCISES.***

#### Task 1. Translate into Russian paying attention to the tense and voice of the predicate.

1. Atmospheric pollution raises problems of several types.
2. Our life is more and more influenced by natural sciences.
3. Any of the countless devices giving us comfort have been invented by scientists.
4. It is supposed that the ozone layer is the thinnest over the Antarctic.
5. Electronics has extended man's intellectual power.
6. Initially the computer was designed as a tool to manipulate the numbers.
7. The chemical properties of chromium are greatly affected by the carbon content.
8. Difficulties are often met with in solving scientific problems.
9. The computer role is influenced not only by its speed but also by its memory size.
10. Extremely complicated methods of research are being developed and highly sensitive devices are being constructed by the scientists of our laboratory.
11. In the Periodic Table potassium is followed by calcium.
12. The latest discovery of our physicists is referred to and commented upon in scientific journals.

#### should - would - conditional

1. Should they put forward any working hypothesis, a sound approach could be developed.
2. Should the problem be discussed at the conference, I would make a report.
3. Should the new technique be worked out, we could make use of its advantages.
4. But for this method the measurements would be inaccurate.
5. But for the results obtained we would not write the article.
6. Were it not for these studies the data would be unreliable.
7. Were it not for the new techniques the estimation of this value would be unreliable.
8. Had the science of radio not been developed so rapidly, we should not have got such remarkable changes in the technique today.
9. Modern life would be impossible without electronics.
10. The data are very important. Put them down lest you should forget them.
11. It is necessary that a force should be applied to the moving body to maintain motion.
12. We were quite sure that the method now in use would give the results desired.
13. One should pay more attention to this phenomenon while conducting the research.
14. One should avoid using such instruments in the research for they have a high power consumption.

#### Task 2. Translate the following sentences into Russian paying attention to non-finite forms of the verb.

1. The reactors being built at present consist essentially of uranium bars lying in a number of channels drilled through blocks of graphite.
2. Having been used for a long time, the instrument partly lost its former efficiency.
3. The pressure range being beyond the limits of the existing diagram, data have been calculated by other means.
4. Drawing curves gives us a means of showing the relation existing between the two constants.
5. Wishing to find out the cause of the fault they examine the device in all the details.



6. By raising the filament temperature we increase the number of emitted electrons.
7. The next point to be studied is the geometry of the parts to be welded.
8. As for the mechanism referred to above, it should be made as small as possible.
9. Further tests have shown the receiver to be very sensitive.
10. The instrument to be used for testing purposes is similar to that widely applied in the research laboratories.
11. We know of copper having been used as a conductor since its suitable characteristics were discovered.
12. These series of tests were followed by others, no satisfactory results being obtained.
13. To observe is the primary rule of any experiment.
14. Maxwell's equation led to Hertz discovering radio waves which, in turn, resulted in Popov's inventing wireless telegraphy.
15. A three-inch tube has been found to be satisfactory, but it is practicable to use greater tubes if needed.
16. Radium is said to be one and a half million times more radioactive than uranium.
17. We expect more bodies to expand when heated.
18. To find out the state of a mass of gas one should know its volume, pressure and temperature.
19. To find out the state of a mass of gas is quite possible.
20. To analyse the effect is to take into consideration all the elements of the circuit.
21. To analyse this effect let us consider all the elements of the circuit.

Task 3. Translate the following sentences into Russian paying attention to prepositional phrases.

1. In spite of or, perhaps, because of its apparent simplicity, the problem seemed to have been misunderstood.
2. In case of gases, it was found that the higher the temperature, the less gas will dissolve.
3. Owing to two opposing effects, the pressure in the gas tube can be either high or low.
4. In effect what is said with regard to one device will apply to the other, as well.
5. According to the data obtained, the test was successful in spite of unfavourable conditions.
6. Galvanized iron is often used instead of aluminium because of its cheapness.
7. Great progress has been made in science due to the discovery of the Law of Gravity.
8. In order to classify the elements, they are arranged in the table in the order of increasing atomic weights and each one is assigned a member by means of which we find its position in the table.
9. Silver stands out among the tested materials thanks to its low resistance and stability.

Task 4. Modality. Translate into Russian, paying attention to the expressions of modality.

1. The frequency could be varied to meet different conditions.
2. No matter in what position the cell may be put it will serve its purpose.
3. One must keep in mind all the above mentioned figures. Solutions of all the difficulties of FL Parithmetic will have to be discussed in subsequent sections.
4. Numbers whose fractions are allowed to have leading zeroes are called unnormalized.
5. The machine-tools have to be directed exactly where to move and may not be physically able to accept data that will cause cutting movements of more than one inch at a time.
6. The inventors of computing machines realized that cards could be prepared to use a language of punched holes, that ought to be readable by a machine.
7. The data received by the machine must have been incorrect. A computer must have processed a large variety of non-numerical information.
8. One of the requirements of an ideal optical system is that the magnification is to be constant.
9. One should be careful with acids.

10. Let us find out directly from Newton's Second Law how the kinetic energy should change.

You should have made one further experiment to be determined that your calculations were correct.

Task 5. This exercise is aimed at coping with the lexical difficulties in translation. Pay special attention to the underlined words such as:

either, either...or, neither, neither...nor, whether, likely, unlikely, rather.

1. Whether the unit is simple or complex in structure, its natural length is quite variable.
2. The programmer's language is neither binary nor decimal: it is a set of alpha-numeric symbols.
3. Neither of these machines were completely constructed.
4. Intensity is not a force: rather it is an electrical property of the field.
5. The electron must rather be considered as a ring of electricity about the nucleus.
6. It is the purpose of this paper to present experiments which may decide whether or not this assumption is true.
7. Any digital calculation whether it be performed by "pencil and paper" methods or with the aid of an automatic computer must first be broken down into a sequence of arithmetical operations.
8. Like charges repel and unlike charges attract each other.
9. Computers like the G-15 are better adapted to problems like those in the sciences where a smaller amount of data leads to a larger volume of calculations.
10. Atomic power is unlikely to be used for heating houses.
11. A paper on the information theory is likely to appear in the journal very soon.
12. Rather than perform some operations the operator began to examine the machine.
13. Results indicate that the device is rather insensitive to changes in operating conditions.
14. The organization of an automatic computer like that of any other machinery, is dictated by the purpose to be served.
15. Unlike other inventions television began to develop its resources not only as a means of entertainment, but as a powerful research instrument as well.

Task 6. Complex sentences.

Translate the following sentences into Russian:

1. The instrument we can measure small electric currents with is called a galvanometer.
2. Everybody knows energy is the ability to do work.
3. In America there are rather many short rail-ways. Americans are mostly proud of because of their history.
4. At present it is impossible to imagine trans-continental passenger spaceships people could travel by in space.
5. Were there ecological and ergonomical transport nowadays, the towns would not be so dangerously polluted as they are now.
6. The figures the historical magazine refers to give many facts about the development of Moscow transport during our century.
7. Had the motor been examined, no overheating would have taken place.
8. Had the designers come in time, the reactor would have been brought into operation last week.
9. Were the cross-sectional area of the conductor greater the resistance to current flow would be less.
10. The intelligence the operator had transmitted helped to find out the location of the ship.

Task 7. Translate the following sentences into Russian, paying attention to "it" and "that" functions.

1. It is essential that the rotors should be spaced properly.
2. It was decided that the current would be increased gradually during the whole experiment.

3. A thermocouple connected to an ammeter measured the amount of heat energy falling upon it.
4. It should be noted that the remelting is usually done in a "cupola" which is like a small blast furnace.
5. Foot is a measure of length, it is equal to 30,45 cm.
6. It is known that the metric system of weights and measures is used in most European countries. It is also used in many countries on other continents. Americans use it during international trade operations and during international conferences.
7. It was Mendeleev who created the Periodic Table of Elements.
8. Solar energy is of great value for mankind, people use it in many ways. It is the Sun that can give us the most powerful and the cheapest source of energy.
9. It was Faraday's discovery that the "flux rule" is still correct no matter why the flux changes.
10. That is the fundamental property of a crystal.
11. In previous chapters we have seen that the laws of mechanics can be summarized by a set of three equations for each particle.
12. Power networks of the future may have little resemblance to those of today.
13. All the formulas that we wrote for plane rotation can be generalized to three dimensions.
14. The variation of the kinetic energy is just the opposite of that of the potential.
15. Making the experiment the scientist was surprised to see how many changes the substance he used underwent, that is why he decided to repeat the experiment.
16. A few scientists could understand Einstein's theory of relativity at that time, but he published some new works for all that.
17. The conference took place in late June so that more postgraduate students could participate in it.

## ***APPENDIX 2.***

### ***PROFESSIONAL GAMES.***

#### Task 1. Speak on:

I. The aim of your thesis (its structure, the methods used, the results obtained). While speaking use the following expressions:

1. the present thesis discusses some aspects of...
2. it is designed to demonstrate (to describe, to show)...
3. it is to consist of ... chapters
4. the present chapter is devoted to...
5. the first (second, third) chapter presents some results which illustrate...
6. the purpose of this chapter is to compare the results of... (to sum up the results)

II. The results of your first year at the post-graduate courses; Use the following expressions:

1. I have been studying at...for...months (years, weeks)
2. I have passed some candidate exams (I'm going to take exam in...)
3. I have attended seminars on...
4. I work at the department of... making experiments
5. I have written some papers which deal with the problem...
6. I expect them to be published
7. My last paper presents some results which illustrate...
8. My work is an attempt to show (to prove) that...
9. Of course, some economic aspects of the work done are considered (are taken into consideration; are given attention to)
10. I do appreciate the supervision of professor... and my senior colleagues

11. The first portion (part) of my thesis is going to be discussed at... (the chair sitting, scientific council, by a group of scientists) on...
12. It is going to be completed in...
13. It will be submitted to... on...

Task 2. Fill in the blanks in the following dialogues by one of the given phrases ( see task 1 )

1. The Talk about the Thesis.

A: How are you getting on with your thesis?

B: Oh, I've written two chapters, the first one..., while the second...

A: How many chapters will it consist of?

B: Four, I believe. The main will be chapter 3. Its purpose...

A: Will it consider some economic aspects?

B: Of course,.... They are supposed to ... in chapter 4.

A: By the way, what about the papers?

B: I've written...

A: Is anyone helping you with your papers?

B: Sure. I do appreciate...

A: That's fine. Professor... is said to be a real expert in...

When is your thesis to be completed?

B: I hope...

A: I wish you good luck.

2. The conversation between a supervisor (SV) and a post-graduate student (PGS).

SV: As far as I know you want me to be your supervisor.

PCS: I'd like you to be and I want to ask you to consult me from time to time.

SV: Fine. But I'd like to know your plan of work.

PCS: Well, the present thesis...

SV: Is there going to be any experimental material?

PGS: Of course; now...

SV: What have you done during this period of time? PGS: I...

Remember some expressions with "that" word:

1. that is = i.e.            - то есть
2. that is why            - вот почему, поэтому
3. that is to say        - таким образом
4. that is the point    - в этом суть дела, именно так
5. for all that            - несмотря на все это, все же
6. so that                - так чтобы, таким образом

Translate two dialogues into English using the expressions mentioned above.