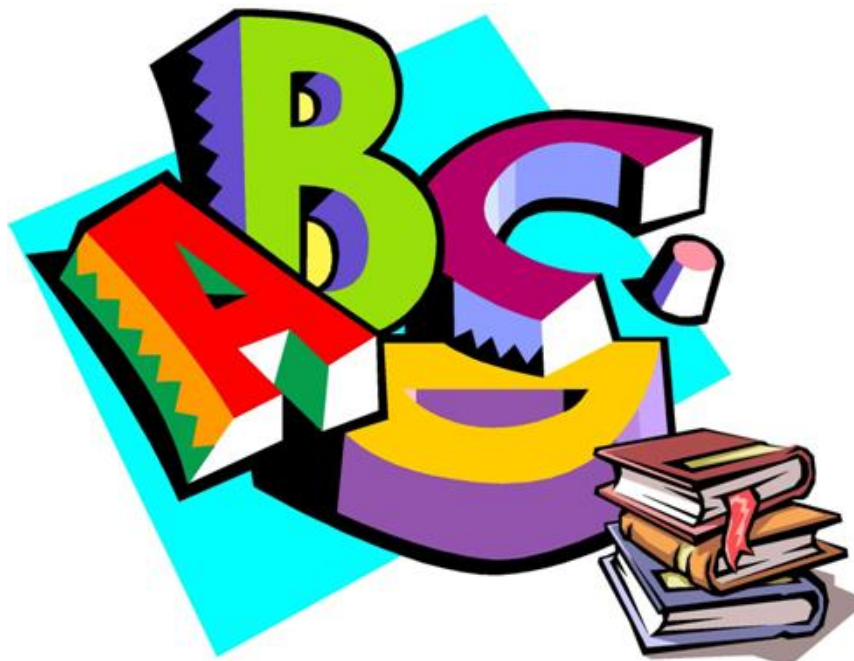


Федеральное государственное бюджетное образовательное  
учреждение высшего образования  
«Брянский государственный аграрный университет»

КАФЕДРА ИНОСТРАННЫХ ЯЗЫКОВ



**МЕДВЕДЕВА С.А., ГОЛУБ Л.Н.**

**ТЕХНИЧЕСКИЙ АНГЛИЙСКИЙ ЯЗЫК  
ДЛЯ АУДИТОРНЫХ ЗАНЯТИЙ  
И САМОСТОЯТЕЛЬНОЙ РАБОТЫ  
СТУДЕНТОВ  
НАПРАВЛЕНИЯ ПОДГОТОВКИ**

**13.04.02 ЭЛЕКТРОЭНЕРГЕТИКА И ЭЛЕКТРОТЕХНИКА  
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Рецензенты: кандидат педагогических наук, доцент, заведующий кафедрой иностранных языков Брянского ГАУ **М.В. Семышев;**

кандидат технических наук, доцент, заведующий кафедрой электроэнергетики и автоматики Брянского ГАУ **В.А. Безик.**

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## ВВЕДЕНИЕ

Основной целью обучения в магистратуре является приобретение обучающимися коммуникативной компетенции, необходимой для квалифицированной информационной и творческой деятельности в различных сферах и ситуациях делового партнерства, совместной производственной и научной работы. Обязательным условием достижения поставленной цели является решение следующих задач:

- достижение зрелого владения всеми видами чтения и перевода литературы разных функциональных стилей;
- овладение всеми видами монологического высказывания (информирование, пояснение, уточнение, инструктирование и иллюстрирование высказывания, а также умение сделать доклад на иностранном языке);
- осуществление и понимание высказываний профессионального и научного характера в ситуациях приема зарубежных специалистов, обмена профессионально-значимой информацией в процессе повседневных бесед, деловых переговоров.

Предлагаемое учебное пособие построено с учетом преемственности обучения и состоит из самостоятельных блоков (Units). Цель каждого блока - развитие умения чтения и адекватного перевода текстов по направлению подготовки и написания тезисов, докладов, рефератов и аннотаций. Работа с данным пособием способствует формированию у обучающихся компетенции ОПК-3.

Учебные тексты служат для первичного введения языковых явлений и иллюстрацией их употребления в иноязычной речи. При подборе текстов учитывалась их актуальность, информативность, частотность представленной в них лексики и уровень языковой подготовки обучающихся.

Перед каждым текстом даётся подробный список лексики, предназначенный для активного изучения и закрепления в ходе выполнения послетекстовых упражнений. Упражнения направлены на активизацию лексического материала и развитие навыков устной речи.

Грамматический материал охватывает основные явления грамматики английского языка и направлен на закрепление знаний, полученных на бакалаврском уровне подготовки.

**PART 1. Unit 1**  
**EDUCATION IN MODERN SOCIETY. HIGHER EDUCATION**

**1. Read and translate the text:**

**Text 1. HIGHER EDUCATION IN RUSSIA**

learning materials – учебные материалы  
to bring up to date – довести до современных требований  
information explosion – информационный взрыв  
training and instruction – подготовка и обучение  
over years – за многие годы  
curricula are enriched and broadened – программы (курсы обучения) обогащаются и расширяются

Higher education plays an important part in the life of any country as it provides the country with highly-qualified specialists for future development and progress. It trains people to become teachers, engineers, doctors and other professional workers.

In all the industrial countries standards of living are steadily changing; this means that the kind of education, which was good enough thirty years ago, is not necessarily good for them today. The serious need to find ways and means of ensuring continuous and thorough adoption of the universities to contemporary needs in our rapidly changing world is widely recognized. And this means that styles of teaching, quality of learning materials and organization of the university itself have to be continuously brought up to date and improved.

Besides, knowledge and information which comes through the mass media must also be taken into consideration. This information explosion has affected every field of study, especially, of course, in the natural and applied sciences and in all other sciences as well. The increase of information requires new methods and new approaches to students' training and instruction.

At present a new system of education is introduced in this country — a distance education system. This computer system of learning helps working professionals to continue their education while remaining at their jobs. This system enables people to get knowledge and a good foundation in the sciences basic to his or her field of study. Distance learning has developed over years from satellite video courses to modern videoconferencing through personal computers.

The academic year usually lasts 9 months and is divided into two terms (semesters). The first- and second-year students obtain thorough instructions in the fundamental sciences of mathematics, physics, chemistry and drawing as well as computer engi-

neering and a number of others. The curricula are enriched and broadened by instructions in such subjects as foreign languages, history and economics.

At the third year students get more advanced knowledge and begin to concentrate on their special interests, so to say, their «major» subject and take many courses in this subject. Specialized study and courses will help students to become specialists and prepare them for their future work.

After four years students will get a bachelor's degree. Then the students may go on with their studies and in a year or two of further study and research get a master's degree. After graduating from the university they may go on with their study and research and may get a still higher degree.

About 75 percent of students receive state grants and 15 percent are sponsored by enterprises. Universities have their own students' hostels and some of them have large and excellent sport centers.

Education is a process through which culture is preserved, knowledge and skills are developed, values are formed, and information is exchanged. Education is the way to success.

## **2. Practise the pronunciation of the following words:**

Highly-qualified, steadily, ensuring, thorough, adoption, contemporary, instructions, science, curricula, preserve.

## **3. Answer the questions:**

1. When does the academic year begin in this country? 2. How many exams did you pass to enter the University? 3. Do you pay for your education? 4. Do students get grants? 5. What subjects do students study in the first year? 6. Which subject is the most interesting for you? 7. Is there a sport center in your University? 8. What degree do students get after four years of study? 9. What degree can a student get after two years of further study and research? 10. What new education system is introduced in this country? 11. What specialities do people get after graduating from a university? 12. Why is higher education important in the life of every country?

## **4. Use Active and Passive Voice.**

1. Students asked the lecturer many questions. The lecturer was asked many questions.  
2. The monitor told the first-year students to come to the laboratory. The first-year students were told to come to the laboratory.  
3. Usually a lab assistant shows the equipment to the students. Usually the equipment is shown to the students by a lab assistant. Usually students are shown the equipment by a lab assistant.  
4. Students watched the process with great attention. The process was watched with great attention.  
5. Tomorrow our teacher will give us a new task. A new task will be given tomorrow. We shall

be given a new task tomorrow. 6. Practice accompanies theory. Theory is accompanied by practice. 7. He asked me to bring a dictionary. He was asked to bring a dictionary. 8. The teacher told the students to sign their drawings. The students were told to sign their drawings. 9. The dean will send the students to a big plant in summer. The students will be sent to a big plant in summer. 10. He taught us to use the lab equipment. We were taught to use the lab equipment.

5.

**A. Transform into Passive Voice.**

1. You open the door. 2. We asked questions. 3. He will finish his project next week. 4. He can do this exercise. 5. They invited me to their conference. 6. I saw a new film. 7. My sister writes letters regularly. 8. Universities develop new methods of students' training. 9. After graduating from the University the students may get a still higher degree. 10. The study of foreign languages, history and economics must improve the curricula of technological universities.

**B. Translate.**

1. Mathematics, strength of materials, mechanics, elements of machines as well as engineering physics are studied at technological institutes. 2. The development of science is closely connected with the development of higher education. 3. Students are provided with hostels, well-equipped laboratories and libraries. 4. Any country must be provided with good specialists in all branches of science and technology for its further development. 5. Large sums of money are spent by the state to train highly-qualified engineers. 6. Much attention must be paid to improve the standards of higher education. 7. Students of technological institutes are trained to analyse various facts and theories. 8. The scientific and technological progress of a country is determined by the qualification of specialists. 9. Some institutes of technology are reorganized into universities. 10. The country must be provided with specialists capable of working with the technology of tomorrow effectively.

**6. Find Participle I and Participle II, translate.**

1. The students studying at the institutes passed entrance exams in summer. 2. The subjects studied in the first two years are very important for future engineers. 3. The lecture delivered by our dean was on new methods of technology. 4. The man delivering this lecture is our professor on mathematics. 5. An article discussing the new system of school education appeared in all newspapers. 6. The results of the experiments discussed yesterday will be published. 7. The attention paid to the study of fundamental subjects is great. 8. Students interested in computer engineering enter technological institutes. 9. The number of specialists connected with new branches of science and engineering is increased every year.

## 7. Read and translate the text.

### Text 2. HIGHER EDUCATION IN THE UK AND THE USA

to consist of - состоять из

self-governing - самоуправляющийся

tuition - обучение

to proceed - продолжать делать (что-либо)

a gown - мантия

a major subject - профилирующий предмет

a graduate school - старшие курсы

a five point scale - пятибалльная шкала

#### Part 1

Cambridge is one of the two main universities of England which is located at the Cam River. It was founded at the beginning of the 12th century. The University consists of 24 different colleges including 4 colleges for women. Each college is self-governing.

The head of the University is the chancellor who is elected for life. The teachers are commonly called «dons» and «tutors». Part of the teaching is by means of lectures organized by the University. Besides lectures teaching is carried out by tutorial system for which Cambridge University is famous all over the world. This is a system of individual tuition organized by the colleges.

Each student has a tutor who practically guides him through the whole course of studies. The tutor plans the student's work and once a week the student goes to his tutor to discuss his work with him. The training course lasts 4 years. The academic year is divided into 3 terms. The students study natural and technical sciences, law, history, languages, geography and many other subjects.

After three years of study a student may proceed to a Bachelor's degree, and later to the degrees of Master and Doctor. Students are required to wear gowns at lectures, in the University library, in the street in the evening, for dinners in the colleges and for official visits. All the students must pay for their education, examinations, books, laboratories, university hostel, the use of libraries, etc. Very few students get grants. Not many children from the working class families are able to get higher education, as the cost is high. The cost of education depends on the college and speciality.

A number of great men, well-known scientists and writers studied at Cambridge. Among them are: Erasmus, the great Dutch scholar, Bacon, the philosopher, Milton and Byron, the poets, Cromwell, the soldier, Newton and Darwin, the scientists.

## **Part 2**

There is no national system of higher education in the United States. Higher education is given in colleges and universities. There are over 2100 various higher educational institutions, including colleges, technological institutes and universities. The average college course of study is 4 years. The academic year is usually 9 months or 2 terms (semesters) of four and a half months each. Classes usually begin in September and end in June. The first-year students are called freshmen. Students choose a major subject and take many courses in this subject. After four years, they get a traditional Bachelor's degree. Then the students may go on to graduate school and with a year or two of further study get a Master's degree.

After another year or two of study and research, they may get a still higher degree as Doctor of Philosophy (Ph. D.). The student's progress is evaluated by means of tests, term works and final examinations in each course. The student's work is given a mark, usually on a five point scale. Letters indicate the level of achievement.

«A» is the highest mark. «F» denotes a failure.

Most American colleges and universities charge for tuition. The methods of instruction in the universities are lectures, discussions, laboratory and course works and seminars. Most cities have colleges or universities that hold classes at night as well as in daytime. In this way people may work for a degree or just take a course in the subject that interests them.

### **8. Practise the pronunciation of the following words:**

Tutor, tutorial system, guide, through, languages, chancellor, major, require, sciences, law, scholar, further, evaluated, Bachelor's degree, Master's degree, failure, method.

### **9. Read and translate the text.**

#### **Text 3. OXFORD UNIVERSITY**

Oxford is renowned the world over. It ranks in importance with Athens, Rome and Paris because of the stream scholars who, for hundreds of years, and particularly in the 20th century, have come to sit at the feet of learned men, and have returned to their own countries, their minds enriched with the distilled learning to be found here, and imbued with an abiding love for the place. They have absorbed the almost indefinable "spirit of Oxford", and many of them return again and again, so strong is the pull of the place.

This book is designed to help the visitor whose stay is short. So many visitors want to know where is the University. In their home country, the universities are easily identifiable because they are compact, purpose-built places, and probably isolated from the domestic and commercial buildings which form the heart of the city from which they take their name.



Oxford is different. It has a golden heart - an area of less than half a square mile in which is to be found the most varied assortment of historic buildings in the world. But they do not stand in isolation; they are intermingled, in the most delightful way, with houses, shops and offices.

Over the last decade millions of pounds have been spent in restoring and cleaning the stonework of college and university buildings, which had become blackened and decayed, and in many cases was in danger of disintegrating. Great care was taken in the restoration, and the result is that the university buildings present the honey-coloured facades which the great architects such as Wren and Hawksmoor created.

Interiors too, have been cleaned and restored - notably those of the Sheldonian Theatre and the Bodleian Library. Oxford is a place of great beauty, but it is not just a shrine to the past. It is a living entity and its historic buildings are the homes of masters and students whose learning, thinking and ideas have a profound influence on culture, education, science and politics, not only in England, but throughout the world.

The University did not come into being all at once. Oxford had existed as a city for at least 300 years before scholars began to resort to it. The end of the 12th century saw the real beginnings of the University. It is known that early in that century distinguished scholars were lecturing in Oxford, but it had no recognition as a place of learning. In about 1184 the University had become an accomplished fact as result of the migration to Oxford of students who brought their own traditions with them.

It is generally assumed that between 1164 and 1169, when Henry II forbade English clerks to go to the University of Paris, which at that time was the foremost in Europe, the scholars had to find somewhere else to continue their studies. Their choice fell on Oxford. The first group of scholars at Oxford may have been joined by others from Paris, and from other parts of Britain.

There is no "university" as such. Each college is practically autonomous, with its own set of rules for its good government. There is a central administration, providing services such as libraries and laboratories.

#### **10. Practise the pronunciation of the following words:**

Rank, scholars, particularly, imbued, indefinable, short, purpose, varied, delightful, autonomous, distinguished, profound, disintegrating, foremost, migration.

#### **11. Answer the questions:**

- 1) Why is Oxford ranking amongst the world's top universities?
- 2) How does Oxford differ from other educational institutions?
- 3) Why do the Oxford's buildings need to be restored?
- 4) What architects have worked on the University's facades?
- 5) Why didn't Oxford deserve any recognition until the 12th century?

- 6) When was the heyday of Oxford?  
 7) Why does the author claim that there's no university such as Oxford?  
 8) Why did English clerks give up going to the University of Paris, which was considered to be the foremost in Europe?

**12. Make up definitions:**

|                |  |
|----------------|--|
| Distinguished  | Ahead of all others, especially in position or rank.   |
| A scholar      | Something that exists as a particular and discrete unit.   |
| To intermingle | Standing above others in character or attainment or reputation.  |
| An entity      | An exposition of a given subject delivered before an audience or a class, as for the purpose of instruction. |
| Foremost       | To mix or become mixed together.   |
| A lecture      | One who attends school or studies with a teacher.  |

**Unit 2**

**THE QUALITY OF ENVIRONMENT. ENVIRONMENT PROTECTION**

**1. Read and translate the text.**

**Text 1.ENVIRONMENT PROTECTION MUST BE GLOBAL**

That the problem of pollution and ecology has become the most important one for mankind is evident to all. The more civilization is developing, the greater the ecological problems are becoming. Air and water pollution by industry is now reaching tremendous proportions. In our era it is changing from a national to an international problem, especially in territories where rivers cross several countries. The seas and oceans are also becoming seriously polluted. A similar situation is developing in the atmosphere. It is known that many cities throughout the world suffer from air pollution.

However, our scientific knowledge and technological advancement make it possible to eliminate it if people use good will and make considerable investments for that purpose. The development of natural resources on a global scale is already possible from a scientific and technical standpoint. Large-scale experimental work in this area is successfully being carried out.

At present scientists in industrially developed countries are working on the theory of interaction of all the atmospheric and oceanic global processes that determine the climate and weather of the world. Increasing growth of population, industrialization and the use of resources are slowly but surely changing the global climate and water balance. This can be described as a great experiment, one that may bring about changes in the environment more serious than ever before.

The essential feature in the environment protection is that many problems can be solved only on the level of world community. Therefore, the planning of protection against pollution by human society as a whole is imperative today and in the near future. It is necessary to develop an international program to study data on land, forest, atmospheric and oceanic resources, both renewable and non-renewable. It is the joint efforts of many scientists and special public organizations that can deal with the problem and take necessary measures to protect the environment.

It is still a big job and much remains to be done. However, scientists are confident that planned actions of all countries can eliminate pollution and achieve successes in purifying air, water and soil and in safeguarding natural resources. At the same time one must realize that social and political circumstances may stand in the way of further progress in this field.

## **2. Answer the questions:**

1. What is this text about? 2. What is ecology? 3. How does water (air) become polluted? 4. Why is the problem of water pollution becoming a global problem?

## **3. Read and translate the following international words:**

Global, resources, problem, ecology, proportion, era, territory, ocean, oceanic, situation, atmosphere, process, climate, balance, experiment, social.

## **4. Read and translate the following words:**

Environment, pollution, achieve, success, successful, successfully, purify, air, natural, however, job, remain, mankind, reach, special, especially, serious, throughout, world, knowledge, advance, eliminate, purpose, scale, weather, essential, therefore, data, joint, measure, realize, circumstance.

## **5. Answer the questions according to the example:**

*What is one of the most important problems for mankind now? (the problem of pollution and ecology).*

*The problem of pollution and ecology is one of the most important problems for mankind now.*

1. What problem is becoming a global problem? (the problem of air and water pollution). 2. What makes it possible to eliminate air and water pollution? (scientific knowledge and technological advance, good will and large investments). 3. What are scientists in industrially developed countries currently working on? (the theory of interaction of the atmospheric and oceanic global processes). 4. What factors are slowly changing the global climate and water balance? (the growth of population, industrialization and use of resources). 5. What actions are necessary to take to deal successfully

with the problem of protecting the environment throughout the world? (planning, developing international programs to study ecological data, joint efforts of scientists and special public organizations).

#### **6. Read and translate the following text without a dictionary:**

It is difficult for mankind to predict changes in the environment accurately. It is known that natural changes in weather and climate may have more catastrophic global effects than human activity. But scientists are developing a new concept that can help make such prediction more accurately. It is based on our understanding that the Earth is an integral system. Its parts — oceans, atmosphere, land or life — cannot be understood in isolation to predict changes in the most accurate way. Modern scientific and technological progress made it possible to use new technologies for that purpose. That satellites can control physical, chemical, biological and geological changes on a global scale is well-known now. One must also know that the study of environmental problems with the help of satellites is becoming international. Russia, the US, France, Japan, Canada, India, China and Italy are planning to send their satellites in both polar and geostationary orbits.

#### **7. Read and translate the text 2.**

##### **Text 2. LAST CHANCE FOR MOTHER EARTH?**

*(From Scientific American)*

man's intrusion upon nature - вторжение человека в природу

to intrude upon - вторгаться

to violate the laws of nature - нарушать законы природы

to destroy the balance - нарушать равновесие

to combat pollution - бороться с загрязнением атмосферы

to be faced with the problem of - стать перед проблемой

environment - окружающая среда

industrial waste - промышленные отходы

to govern the process - управлять процессом

to harm - наносить ущерб

to be aware of the consequences - осознавать последствия

radioactive fallout - радиоактивные осадки

to affect nature - влиять на природу

to threaten - угрожать

to contaminate the atmosphere - загрязнять атмосферу

The U.S. environment is seriously threatened by the garbage of the economy. The Apollo 10 astronauts could see Los Angeles as a smudge from 25000 miles in outer space. What most Americans now breathe is closer to filth than to air. Americans know pollution well. It is car-clogged streets and junk-filled landscape – their country's visible decay.

California's air pollution is already so bad that on many days Los Angeles school children are warned not to breathe too deeply because of heavy smog conditions.

The United States is far from alone in its pollution and waste. The smog is dense in Tokyo. Some of Norway's legendary fjords are awash with stinking industrial wastes.

Sections of the Rhine River which flows through the industrial Ruhr Valley to the North Sea are so toxic that even hardy eels have difficulty surviving. In Sweden, not long ago, black snow fell on the province of Smoland.

The earth has its own waste-disposal system, but it has limits. The winds that ventilate the earth are only six miles high; toxic garbage can kill the tiny organisms that normally clean rivers. Meanwhile, modern technology is pressuring nature with tens of thousands of synthetic substances, many of which almost totally resist decay. This includes aluminum cans that do not rust, inorganic plastics that may last for decades, floating oil that can change the thermal reflectivity of oceans and radioactive wastes whose toxicity lingers for centuries.

Where do most of the pollutants end up? Probably in the oceans, which cover 70 per cent of the globe and have vast powers of self-purification. Yet even the oceans can absorb only so much filth; many scientists are worried about the effects on plankton — passively floating plants and animals, which produce about one fifth of the earth's oxygen. Emerging now is the importance of the science of survival — ecology. Trying to awaken a sense of urgency about the situation, ecologists sometimes do not hesitate to predict the end of the world. Yet they hold out hope too.

Ecology is the study of how living organism and the nonliving environment function together as a whole, or ecosystem, in the biosphere — that extraordinarily thin global envelope which sustains the only known life in the universe. Hundreds of millions years ago, plant life enriched the earth's atmosphere to a life supporting mixture of 20 per cent oxygen, plus nitrogen, argon, carbon dioxide and water vapour. The mixture has been maintained ever since by plants, animals and bacteria, which use and retain the gases at equal rates. The result is a closed system, a balanced cycle, in which nothing is wasted and everything counts.

The process is governed by distinct laws of life and balance. One is adaptation; each species finds a precise niche in the ecosystem. Another law is the necessity of diversity: the more different species in an area, the less chance that any single type will destroy the balance. Man has violated these laws — and endangered nature as well as himself.

A primitive community could harm only its own immediate environment. When it ran out of food, it had to move on or perish. But a modern community can destroy its land and still import food, thus possibly destroying ever more distant land without knowing or caring. Technological man forgets that his pressure upon nature may provoke revenge.

What most appalls ecologists is that technological man remains so ignorant of his impact. Neither the politicians nor the physicists who developed the first atomic bomb were fully aware of the consequences of radioactive fallout. The men who de-signed the automobile did not foresee that its very success would turn cities into parking lots and destroy greenery in favour of highways, all over the world.

Man's inadvertence has even upset the interior conditions of the earth. Wherever huge dams are built the earth starts shuddering. The enormous weight of the wa-ter in the reservoirs behind the dams puts a new stress on the subsurface strata. In conse-quence the earth quivers.

If technology got man into this environment crisis ant pollution mess, surely tech-nology can get him out of it again.

There is no lack of hopeful ideas for balancing the environment and the most en-couraging today is the swell of public opinion. We are at least starting to combat gross pollution. Even so, real solutions will be extremely difficult and expensive. Ideally, en-tire environment should be subjected to computer analysis. Whole cities and industries could measure their inputs and outputs via air, land and water. But this is a far-off dream. Far more knowledge is needed.

Even the simplest ecosystem is so complex that the largest computer cannot fully unravel it.

Technological man is bewitched by dangerous illusion that he can build bigger and bigger industrial society with scant regard for the iron laws of nature. Pessimists argue that only a catastrophe can change that attitude – too late. By contrast, the hopeful ecol-ogist put their faith in man`s ability.

## **8. Read and translate the following words and word-combinations**

Garbage, smudge, breathe, decay, synthetic substances, radioactive wastes, linger, self-purification, filth, carbon dioxide, vapour, govern, species, violate, immediate envi-ronment, subjected to computer analysis, bewitched.

## **9. Agree or disagree with the statements given below. Use the following phrases:**

1. What most Americans now breathe is very clean air and they have no idea about pol-lution.
2. Some other countries are faced with the same problem of pollution and waste as the U.S.

3. Modern technology does not affect nature in any way.
4. We needn't worry about the resources of our environment for they are inexhaustible.
5. The oceans can absorb as much filth as necessary.
6. It is plants that help maintain the mixture of oxygen, nitrogen, carbon dioxide and water vapour.
7. Ecology is a linguistic science.
8. Man has violated laws of nature and is going to pay for it.
9. When the primitive community ran out of food it perished.
10. The men who designed automobiles knew only too well that some day the automobiles would turn cities into parking lots and destroy all the greenery in them.
11. More attention ought to be paid to ecology.
12. We are actually ruining our own habitat.
13. It will be very difficult to balance the environment now.
14. Technical progress has greatly affected nature.
15. The big cities of today are not faced with any important problems such as traffic and so on.
16. A catastrophe is inevitable and there's no solution to the problem.

**10. Sum up discussion. Use the following phrases:**

*Summing it up... On the whole...*

*Summarizing the discussion I'd like to say that...*

**Model:** The garbage of economy is a serious threat to our environment.

*Summing it up* I'd like to say that the garbage of economy is a serious threat to our environment.

1. Pollution has grown into an urgent problem.
2. Nature is being seriously damaged by civilization.
3. Immediate measures must be taken to change the grave situation.
4. Politicians and scientists must realize full well dangers we are faced with.
5. The consequences of this violation of nature are hard to foretell.
6. Measures must be taken to save the plankton of oceans.
7. The problem of man and biosphere is very acute.
8. Radioactive fallout must be strictly controlled.
9. Computers must be of much help in solving the problem.
10. Technology will help man to get out of this critical situation.

**11. Comment upon the following problems.**

1. Modern technology and its impact upon nature.

2. The resources man has been using for centuries are not inexhaustible and there is an urgent need for an efficient research into our environment.
3. How do you picture the development of science in ten years' time

**12. Dispute the problems given below. The group can be divided into two opposing parties, each advocating their viewpoint.**

**Use the following phrases:**

*It must be admitted that...*

*My point is that...*

*It seems reasonable to assume...*

1. There can hardly be any solution to the problem raised in the text. A catastrophe is inevitable.
2. Big cities are now becoming self-defeating for their growth entails numerous insoluble problems. They ought not to be developed, renewed or replanned.
3. Nature is being destroyed by growing civilization. We can hardly stop or prevent it.

**13. Read and translate the text 3.**

**Text 3. THE QUALITY OF ENVIRONMENT**

emissions – выбросы в атмосферу

pollutants – загрязняющие примеси

automobile exhausts – автомобильные выхлопные газы

to expose to air pollution – подвергаться воздействию воздушного загрязнения

portable water – питьевая вода

water pipe network – городской водопровод

ferrous metallurgy – черная металлургия

mechanical engineering industry – машиностроение

non-ferrous metallurgy – цветная металлургия

eroded soil – эродированная почва

degrading land – приходящая в упадок почва

coniferous forest – хвойный лес

Poisonous atmospheric emissions by Russia's industry were close to 32 m tons in 1991. Russia's European part accounts for nearly 65% of the country's industrial air pollution. Automobile exhausts in Russian cities contaminated the air with another 21 m tons of pollutants in 1990. Some 50 m people in Russia were breathing air with harmful



content amounting to 10 MAC; over 60 m were exposed to air pollution of between 5 and 10 MAC. (Maximum admissible concentration).

In 1991 the water run-off of some southern rivers was decreasing at a progressive rate, as a result of human economic activity. A lot of Russia's small rivers, most badly affected by human activity throughout the last 10 or 15 years, were deteriorating rapidly. The quality of portable water in Russia is far from satisfactory. About a quarter of municipal water pipe networks and one-third of industrial ones carry water which was not properly purified. The most common water surface pollutants include petroleum products, phenols, organic matter, copper and zinc compounds, etc. Surface water is heavily polluted by ferrous and non-ferrous metallurgy, the coal, oil, gas, chemical and petrochemical industries, farms, municipal drainage, etc. chemicals are washed in large quantities into rivers and lakes from adjacent areas. Livestock farms, pastures and sown land are responsible for high content of biological and organic matters in water.

The ozone content in the atmosphere has been decreasing lately in high and medium latitudes of the Northern Hemisphere. The ozone layer depletion is especially fast (10% in ten years) in the lower stratosphere, that is, at altitudes between 15 and 20 kilometers.

Many small and detached fields were overgrown with woods and shrubs. Soils on large areas were eroded, flooded or turned into marsh. Arid lands are degrading everywhere in Russia, giving way to deserts. Soils contaminated with heavy metallic isotopes, oil products and other toxic substances lay in rings dozen of kilometers wide around big cities and centers of metallurgical, chemical petrochemical and mechanical engineering production.

The national timber wealth in standing trees totals 81.6 bn cubic meters. Over the past 20 years, timber cutting and forest fires reduced the country's reserve of ripe wood in coniferous forests by 8 bn cu meter, including by 3 bn cu m. over the past 5 years.

#### **14. Read and translate the following international words:**

Atmospheric, industry, automobile, progressive, economic, human, activity, satisfactory, industrial, portable, products, phenols, zinc, metallurgy, chemical, ozone, biological, organic, stratosphere, eroded, isotope, toxic, petrochemical, production, reserve, substance.

#### **15. Practise the pronunciation of the following words:**

Exhausts, content, admissible, throughout, deteriorating, purify, water surface, quantify, adjacent, decrease, latitude, altitude, flooded, dessert, wealth, timber, reduce, ripe, coniferous, include.

**16. Sum up a discussion. Use the following phrases:**

Summing it up... On the whole...

Summarizing the discussion. I'll like to say that...

**Model:** The garbage of the economy is a serious threat to our environment. Summing it up I'd like to say that the garbage of economy is a serious threat to our environment.

1. The atmosphere, rivers, lakes and underground stores hold less than 1% of all fresh water and this tiny amount has to provide the fresh water needed to support the Earth population.
2. Fresh water is a precious resource and the increasing pollution of our rivers and lakes is a cause for alarm.
3. Industry often uses water for cooling processes sometimes discharging large quantities of warm water back into river.
4. Raising the temperature of the water lowers the level of dissolved oxygen and upsets the balance of life in the water.
5. Contaminants in the soil can adversely impact the health of animals and humans.
6. Everywhere in the world where people change a natural ecosystem into agriculture, the land degrades.
7. Soil can degrade without actually eroding. It can lose its nutrients and soil biota.
8. Probably one of the most dangerous disasters that can be averted to a great extent is a forest fire.
9. When out of control, forest can cause extensive damage not only the forest cover, but also to human life and the environment.

**17. Agree or disagree with the following statements given below.**

1. Nature means simply what is around us.
2. We never know the world of water till the well is dry.
3. There are no passengers on Spaceship Earth. We are all crew.
4. We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong we may begin to use it with love and respect.
5. There is enough oxygen in the water and in the atmosphere.
6. Rivers are not polluted, because factories don't produce a lot of waste and don't pour it into rivers.
7. Economic advance is not the same thing as human progress.
8. Take care of the earth and she will take care of you.
9. The ozone layer in the atmosphere protects us from dangerous radiation.
10. Understanding of laws of nature does not mean that we are immune to their operations.

11. The universe is not required to be in perfect harmony with human ambition.
12. Man is a complex being: he makes deserts bloom and lakes die.
13. In its broadest ecological context, economic development is the development of more intensive ways of exploiting the natural environment. Give the examples.
14. The system of nature of which man is a part tends to be self-balancing, self-adjusting, self-cleaning. Not so with technology.

**18. Comment upon the following problems.**

1. In efficiency of timber use Russia lags far behind other countries.
2. Over 80% of timber in Russia is logged in clear cutting.
3. Fortunately there are many ways to reduce erosion.

**19. Fill in the blanks with the following words and word-combinations and translate the text 3.**

*Careful, to say nothing of, in addition, oil, urbanization, to result in, according to, growth of industry, contamination, crude oil, harmful, laundry, poisonous waterways, due to, catastrophe, substances, discharging, depredations, tons.*

*There are many causes of water pollution which may be classified into four main categories*

*1. pollution from chemicals, 2. pollution from solids, 3. pollution from radio-active wastes, 4. pollution from living matter.*

**Text 3. WATER POLLUTION**

immense urbanization – колоссальный рост городов.

contamination of water from fertilizers – загрязнение воды удобрениями.

tons of detergents – моющие средства.

crude oil – неочищенная сырая нефть.

refuse – отходы.

to make worse – ухудшать.

to bring about degradation – приводить к деградации.

heavy expenditures - значительные расходы.

mass campaign – массовая компания.

sad statistics – неутешительные данные статистики

The first two causes are perhaps more dangerous than the others due to the tremendous \_\_\_\_\_ and the immense \_\_\_\_\_ in large cities. Pollution from chemicals and solids includes \_\_\_\_\_ of water from fertilizers and pesticides, acids, alkalis, mercury and cadmium (i.e. from heavy metals) which are widely used in industry \_\_\_\_\_ detergents from

washing \_\_\_\_\_ are also dumped into the water. The above-mentioned \_\_\_\_\_ are extremely \_\_\_\_\_ for the living matter and once found in water in large quantities they kill everything and turn our rivers into \_\_\_\_\_. A remarkable illustration of such pollution is the Thames in England and the Rhine in Europe - up until recently there was no fish in these two rivers.

The banks of these rivers and many others represent a sad picture of cans, plastic containers, paper and refuse. Furthermore man not only pollutes water in the rivers and lakes, but he also pollutes seas and oceans as well. Let us take for example oil from \_\_\_\_\_ tankers and supertankers. As we know each supertanker is capable of carrying hundreds upon thousands of \_\_\_\_\_. Sea water is used to clean the tankers after \_\_\_\_\_ and to make things still worse almost every year \_\_\_\_\_ sad statistics there occurs at least one shipwreck in the sea \_\_\_\_\_ bad weather conditions, faulty navigation aids, grounding, etc. This \_\_\_\_\_ tremendous contamination of sea and the sea shore too. One of the vivid examples of such a disaster was the wreckage of the supertanker TORREY CANYON in the English Channel. Not only the sea but the beautiful beaches in England and in France were covered with oil.

This \_\_\_\_\_ brought about huge losses of sea birds and animals \_\_\_\_\_ the heavy expenditures by the French and British governments in a mass clean-up campaign.

We should remember that we are all passengers aboard the ship "Earth". We must be more \_\_\_\_\_ and must do everything to protect our beautiful planet from the \_\_\_\_\_ of man, i.e. ourselves.

## **20. Read and translate the following international words:**

Urbanization, classify, chemicals, radioactive, pesticides, mercury, cadmium, ocean, heavy metals, contamination, illustration, result, substances, tons, supertanker, passengers, protect, campaign.

## **21. Practise the pronunciation of the following words:**

Cause, dangerous, tremendous, immense, fertilizer, detergent, above-mentioned, dump, quantity, turn into, discharging, remarkable, poisonous, occur, due to, ship-wreck, refuse, wreckage, faulty, furthermore, laundry, according to, loss, worse, beautiful.

## **22. Read the text and give English equivalents to the following Russian words and word-combinations:**

Бурный промышленный рост, в соответствии с, разделить на, бытовые отходы, широко применяться, в больших количествах, превратить в, до недавнего времени, загрязнить моря и океаны, происходить, приводить к, вызывать, колоссальный рост городов, тонны моющих средств, сырая нефть, отходы, загрязнение воды, значительные расходы правительств, ухудшать, гибель морских птиц и животных, неутешительные данные статистики, массовая компания.

**23. Agree or disagree with the statements given below. Use the following phrases:**

*That's right*

*I don't think so*

*Exactly*

*You're wrong there*

*I fully agree with you*

*Just the reverse*

1. The causes of water pollution may be classified into two main categories pollution from solids and pollution from living matter.
2. Pollution from chemicals is unknown to large cities inhabitants.
3. Chemicals and solids contaminate water.
4. Fertilizers and pesticides are seldom used in industry.
5. The above-mentioned substances including acids, mercury and cadmium kill everything.
6. The Thames in England and the Rhine in Europe bound in fish.
7. Sea water is never used to clean the tankers after discharging.
8. The shipwrecks occur due to bad weather conditions, faulty navigation aids.
9. Sea catastrophes do not cause tremendous contamination of sea and the sea shore
10. The supertanker Torrey Canyon catastrophe brought about losses of sea birds and animals.
11. Water pollution doesn't affect people's health.
12. We do everything to protect our planet.

**24. Sum up a discussion. Use the following phrases:**

*Summing it up...*

*On the whole ...*

*Summarizing the discussion...*

*I'd like to say that...*

1. Powerful purifying systems are urgently needed in Russia.
2. Water contamination has grown into a serious problem.
3. Oil transporters should meet the ecological safety requirements.
4. Water pollution is inevitable in big cities.
5. Contamination from chemicals could hardly be avoided today.
6. The problem of biosphere is very acute.
7. Ecological education of individuals and preventive measures can do more than penalties of the violators.
8. Cars make the human life dependable, thus aggravating the hard ecological situation in small and big cities.
9. Water transport is harmful for sea nature.

**25. Comment upon the following problems:**

1. Nature is threatened by technological progress.
2. Human mankind acidified lakes and streams and they can't support fish, wildlife, plants or insects.
3. Acid rain is killing forests.
4. Water contamination could lead to shortage of safe drinking water.
5. Civilization has upset nature's sensitive equilibrium polluting rivers and oceans with industrial wastes.
6. Computers project that between now and the year 2030 sea levels would rise by several metres, flooding coastal area and ruining vast tracts of farmland.

**26. Dispute the problems given below. The group can be divided into two opposing parties, each advocating their viewpoint. Use the following phrases:**

*It must be admitted that ...*

*My point is that...*

*It seems reasonable to assume...*

1. We are obliged to remove factories and plants from cities, redesign and modify purifying systems for cleaning and trapping harmful substances.
2. We must review our wasteful, careless ways of life, we must consume less, recycle more, conserve wildlife and nature.
3. We should act according to the dictum «think locally, think globally, act locally».
4. We are obliged to protect and increase the greenery.
5. 159 countries – members of the UNO hold conferences and set up environmental research centres.
6. The 5th of June is proclaimed the World Environmental Day by the UNO and is celebrated every year.

**Unit 3**

**ENERGY SOURCES AND PROBLEMS OF SURVIVAL IN POST-INDUSTRIAL SOCIETY**

**1. Read and translate the text.**

**Text 1. ENERGY SOURCES**

ancestor - предок

trend - тенденция

rate of consumption – темп потребления

finite - конечный

exploitable – ископаемый; добываемый  
sharp - резкий  
beneficial – благоприятный, полезный  
in the long run – в конечном счете  
discourage – зд. не поощрять  
waste – бесполезная трата (денег)  
to seek - искать  
initially - первоначально  
the former - the latter – первый (из упомянутых) – второй (из упомянутых)  
nuclear - ядерный  
ultimately – в конечном счете  
derive – зд. получать, извлекать  
availability - доступность  
unlikely - маловероятно  
to contribute – содействовать, способствовать  
in a sense – в каком то смысле  
prohibitively – недопустимо

In technologically advanced societies, the enormous consumption of energy per head is one aspect of the ever-increasing pressure man is placing on his environment. Early industrial man used three times as much energy as his agricultural ancestor; modern man is using three times as much as his industrial ancestor. If present trends continue, the rate of consumption will have tripled again by the end of the century. The problem lies in the fact that most of our current energy sources are finite. The hard truth is that a day will come when there is little or no exploitable coal, oil or natural gas anywhere. The sharp rise in the price of oil over the last decade has been unpleasant for many parts of the world but in the long run it is beneficial, partly because it discourages waste and partly because it has forced many nations to seek ways of developing better and more permanent sources of energy.

Energy sources may initially be divided into two kinds: non-renewable (i.e. finite) and renewable. The former group includes coal, oil, gas and, in the long run, nuclear; the latter hydropower, solar power and wind power. The energy from all these sources ultimately derives from the sun. There is a further source – geothermal – which depends on the earth's own heat. In practice this may be classed as nonrenewable as it is exploitable in only a few places and even there is limited.

Energy sources may be compared from several points of view:

a) renewability.

b) availability. Some energy sources may be excellent from some points of view but unlikely to contribute much at any time because of their limited geographical availability.

c) cost and efficiency. Some sources may be cheap but highly inefficient, even to a point where they are not practicable. Coal, for instance, though certainly practicable and comparatively cheap, is not very efficient (the efficiency even of a modern power station is only 35%). Geothermal sources, though in a sense free, would, in order to be maintained, end up by using more energy than they produced. Others, like oil, may be comparatively efficient but are in danger of becoming prohibitively expensive.

## **2. Answer the following questions:**

a) What are these trends, mentioned in paragraph 1?

1. What has forced many nations to seek ways of developing better and more permanent sources of energy?

2. What are non-renewable sources of energy?

3. What source of energy is comparatively cheap, but not very efficient?

4. What source of energy is highly exploitable, but becoming prohibitively expensive?

b) 1. Is your home heated in winter and, if so, how? How is your food cooked?

2. Which kinds of fuel are used in your country to make electricity for industry and the home?

3. Are there any problems or difficulties in getting enough energy or paying for it?

4. Do you think the situation will have changed much in a hundred years' time and, if so, why?

## **3. Read and translate the following international words:**

Electricity, civilization, economic and social progress, transformer, universal, electrometallurgy, cable, specific, machine, photocopying machine, radar, Paris, generator, battery, lamp, dynamo, indicator, nation, energy, service, laser, compact.

## **4. Read and translate the following words:**

Imagine, turn, daily, completely, power, appearance, gear, pulley, whole, range, device, source, century, design, since, consumption, double, health, reduce, beam, advantages, clean, regulated, generate, human, latest.

## **5. Read and translate the text.**

### **Text 2. ELECTRICITY**

application – применение

longstanding - долгосрочный

power cables- силовые кабели

transmission shafts – трансмиссионные валы



gear wheels – зубчатые колеса  
belts and pulleys – ремни и блоки  
time and labour-saving appliances – электроприборы, экономящие время и труд  
dynamos and induction motors – динамо и индукционные моторы  
consumption – потребление  
per capita – на человека, на душу населения  
by-products – побочные продукты  
truly – поистине

It is impossible to imagine our civilization without electricity: economic and social progress will be turned to the past and our daily lives completely transformed.

Electrical power has become universal. Thousands of applications of electricity such as lighting, electrochemistry and electrometallurgy are longstanding and unquestionable.

With the appearance of the electrical motor, power cables replaced transmission shafts, gear wheels, belts and pulleys in the 19-th century workshops. And in the home a whole range of various time and labour-saving appliances have become a part of our everyday lives.

Other devices are based on specific properties of electricity: electrostatics in the case of photocopying machine and electro magnetism in the case of radar and television. These applications have made electricity most widely used.

The first industrial application was in the silver workshops in Paris. The generator – a new compact source of electricity – was also developed there. The generator replaced the batteries and other devices that had been used before.

Electric lighting came into wide use at the end of the last century with the development of the electric lamp by Thomas Edison. Then the transformer was invented, the first electric lines and networks were set up, dynamos and induction motors were designed.

Since the beginning of the 20th century the successful development of electricity has begun throughout the industrial world. The consumption of electricity has doubled every ten years.

Today consumption of electricity per capita is an indicator of the state of development and economic health of a nation. Electricity has replaced other sources of energy as it has been realized that it offers improved service and reduced cost.

One of the greatest advantages of electricity is that it is clean, easily-regulated and generates no by-products. Applications of electricity now cover all fields of human activity from house washing machines to the latest laser devices. Electricity is the efficient source of some of the most recent technological advances such as the laser and electron beams. Truly electricity provides mankind with the energy of the future.

## 5. Answer the questions:

1. What is this text about? 2. What is electricity? (a source of electric power used in every day life and industry) 3. What are the sources of electricity? (batteries, generators, electric motors and other devices). 4. What industrial applications of electricity do you know? (lasers and electronic devices) 5. What home applications of electricity do you know? (lighting, heating, radio, television, video, computers and many others) 6. Where was the generator developed? 7. Who invented the electric lamp? 8. What are the advantages of electricity (cleanness, easy regulation, no by products, low cost, improved service) 9. Can you imagine our life without electricity? Why?

## 6. Fill in the blanks with the words given above.

*Electricity, increase, consumers, power, use, generation, reduce, consumption, far users, application, provide, sources, energy, light*

We hear so much these days of local problems of electricity (1) ... Many (2) ... are taking steps to (3) ... their electricity (4) ... This is as a result of the recent (5) ... in electricity tariffs for (6) ... We should all try to (7) ... less (8) ..., by insulating our houses, turning off the (9) ... when leaving a room and using less hot water. We must try to develop alternative (10) ... of energy to (11) ... electricity for domestic and industrial (12) ... It is known that nuclear power comes to the consumer as electricity, which is clean and convenient form of (13) ... Although nuclear (14) ... stations are large, they can be built (15) ... from places where people live.

## 7. Find the subjects and predicates in the following sentences:

1. That electricity is clean and easily-regulated is its great advantage. 2. The important fact is that electricity offers improved service at reduced cost. 3. That the two scientists Lodygyn and Yablochkov were the first in Russia to work in the field of electrical engineering is well-known. 4. One of the main advantages of electricity is that it does not pollute the environment. 5. The indicator of nation development is how much electricity is consumed per capita. 6. What has been and is being done in environment protection cannot be measured by yesterday's standards.

## 8. Read the text and speak about the most promising sources of energy.

### Text 3. NON-TRADITIONAL RENEWABLE SOURCES OF ENERGY

renewable - возобновляемый

support - поддерживать

consumption - потребление

unlimited - неограниченный

that is why – поэтому  
solar power - солнечная энергия  
thermal power station - теплоэлектростанция  
water steam – водяной пар  
closed cycle – замкнутый цикл

It is known that much is being done in the world today for the development of non-traditional sources of energy. Without them the Earth cannot support its present population of 5 billion people and probably 8 billion people in the 21-st century.

Now we are using traditional power sources, that is, oil, natural gas, coal and water power with the consumption of more than 50 billion barrels per year. It is evident that these sources are not unlimited.

That is why it is so important to use such renewable sources of energy as the sun, wind, geothermal energy and others. Research is being carried out in these fields.

One of the most promising researches is the development of power stations-with direct transformation of solar energy into electricity on the basis of photo-effect. It was Russia that was the first in the world to develop and test a photoelectric battery of 32,000 volts and effective area of only 0,5 sq.m., which made it possible to concentrate solar radiation. This idea is now being intensively developed in many countries.

However, the efficiency of a solar power station is considerably reduced because of the limited time of its work during the year. But it is possible to improve the efficiency of solar power stations by developing different combinations of solar power stations and traditional ones — thermal, atomic and hydraulic. Today some engineers are working at the problem of developing electric power stations with the use of a thermal-chemical cycle. It will operate on products of the transformation of solar energy, whereas the «solar» chemical reactor uses CO<sub>2</sub> and water steam of the thermal power station. The result is that we have a closed cycle.

In Kamchatka there are geothermal power stations operating on hot water-steam mixture from the depths of about a kilometre. In some projects water will be heated by the warmth of mountains at a depth of four—five km.

It is planned that plants working on the energy of the solar heat provided by the sun will be built on a larger scale.

That different wind energy plants are being developed is also well-known. These energy plants can be small (of several kilowatts) and large powerful systems.

It is important that all these advances in developing new sources of energy and improving the old ones help to solve the energy problem as a whole and they do not have negative effects on the environment.

## **9. Answer the questions:**

1. Why is it important to use renewable sources of energy?
2. What country was the first in the world to develop and test a photoelectric battery?
3. What is the most promising source of energy?
4. Is it possible to improve the efficiency of solar power stations?
5. What problem are some engineers working at today?

**10. Summarize the content of the text. Use the phrases:**

*The text provides information on...*

*The paper defines the phenomenon of ...*

*An attempt is made to...*

*The text points out...*

**Text 4. NUCLEAR POWER? WELL, YES**

Nuclear power – ядерная (атомная) энергетика

Nuclear reactor – ядерный (атомный) реактор

Energy demand - энергопотребление

Fossil fuel – природное (ископаемое) топливо

Although nuclear reactors have generated electricity commercially for more than 40 years and nearly 400 now in operation, two major accidents – in the US in 1979 and Chernobyl in the USSR in 1986 – have put the industry under a radioactive cloud. In the popular imagination, reactors are nuclear bombs; even if they don't explode, they go on accumulating waste that will finally cause a global catastrophe.

As a result, an energy source once considered as the fuel of the future became questionable. But not everywhere. Nuclear power provides nearly a quarter of the electricity generated in the industrialized Western world by the 24 - member countries of the Organization for Economic Cooperation and Development. In France more than 76 % of electric power is nuclear-generated, in Belgium – 62 %, Sweden – 50 %, Germany, Switzerland, Spain and Finland come in at one third, Japan – a little less; Britain, the US and Canada – under 20 %. Some countries have no nuclear power plants at all and don't want any.

Not only have the strong emotions of fear worked against nuclear power. Energy demand grew more slowly than expected in the past decade. Prices of oil and coal have reduced. However, energy prices can rise. Moreover, supplies of fossil fuel are limited, while energy needs and tide can't meet the increasing requirements. Besides, nuclear power doesn't add to global warming.

All these causes the people to believe that the world can't live and work without nuclear power.

### **11. Answer the questions:**

1. What is the text about?
2. What are nuclear reactors?
3. Why do people believe that world can't live and work without nuclear power?

### **12. Comment upon the following problems:**

1. Nuclear reactors are nuclear bombs.
2. An energy source once considered as the fuel of the future became questionable.
3. Energy demand grew more slowly than expected in the past decade.

### **13. Read and translate the text:**

#### **Text 5. POWER ENGINEERING**

power engineering – энергетика

electrical engineering - электротехника

electric power transmission – передача электроэнергии

power conversion - преобразование электроэнергии

control systems – системы управления

power grid – электросеть

three-phase electric power – трехфазная электрическая энергия

alternating current – переменный ток

single-phase electric power – однофазная электроэнергия

induction motors – асинхронные электродвигатели

power loss – потеря энергии

electrical substations – электрические подстанции

Power engineering is the subfield of electrical engineering that deals with power systems, specifically electric power generation, electric power transmission and electric power distribution, power conversion, and electromechanical devices. Out of necessity, power engineers also rely heavily on the theory of control systems. A power engineer supervises, operates, and maintains machinery and boilers that provide heat, power, refrigeration, and other utility services to heavy industry and large building complexes.

Power engineering was one of the earliest fields to be exploited in electrical engineering. Early problems solved by engineers include efficient and safe distribution of electric power.

Power Engineering deals with the generation, transmission and distribution of electricity as well as the design of a range of related devices. These include transformers, electric generators, electric motors and power electronics.

In many regions of the world, governments maintain an electrical network that connects a variety of electric generators together with users of their power. This network is called a power grid. Users purchase electricity from the grid avoiding the costly exercise of having to generate their own. Power engineers may work on the design and maintenance of the power grid as well as the power systems that connect to it. Such systems are called on-grid power systems and may supply the grid with additional power, draw power from the grid or do both.

Power engineers may also work on systems that do not connect to the grid. These systems are called off-grid power systems and may be used in preference to on-grid systems for a variety of reasons. For example, in remote locations it may be cheaper for a mine to generate its own power rather than pay for connection to the grid and in most mobile applications connection to the grid is simply not practical.

Today, most grids adopt three-phase electric power with an alternating current. This choice can be partly attributed to the ease with which this type of power can be generated, transformed and used. Often (especially in the USA), the power is split before it reaches residential customers whose low-power appliances rely upon singlephase electric power. However, many larger industries and organizations still prefer to receive the three-phase power directly because it can be used to drive highly efficient electric motors such as three-phase induction motors.

Transformers play an important role in power transmission because they allow power to be converted to and from higher voltages. This is important because higher voltages suffer less power loss during transmission. This is because higher voltages allow for lower current to deliver the same amount of power as power is the product of the two. Thus, as the voltage steps up, the current steps down. It is the current flowing through the components that result in both the losses and the subsequent heating. These losses, appearing in the form of heat, are equal to the current squared times the electrical resistance through which the current flows.

For these reasons, electrical substations exist throughout power grids to convert power to higher voltages before transmission and to lower voltages suitable for appliances after transmission.

Power engineering is usually broken into three parts:

Generation is converting other forms of power into electrical power. The sources of power include fossil fuels such as coal and natural gas, hydropower, nuclear power, solar power, wind power and other forms.

Transmission includes moving power over somewhat long distances, from a power station to near where it is used. Transmission involves high voltages, almost always higher than voltage at which the power is either generated or used. Transmission also includes connecting together power systems owned by various companies and perhaps in different states or countries. Transmission includes long medium and short lines.

Distribution involves taking power from the transmission system to end users, converting it to voltages at which it is ultimately required. There are different levels of voltage for power distribution.

**14. Answer the questions:**

1. What does power engineering deal with?
2. What is the history of power engineering?
3. What components of power engineering do you know?
4. Is it possible to work on systems that do not connect to the grid?
5. Why do transformers play an important role in power transmission?

**15. Find the English equivalents for the following phrases in the text:**

Энергетические системы; выработка электрической энергии; теория систем управления; управлять оборудованием; распределение электроэнергии; электрические сети; разнообразные электрогенераторы; преобразовывать энергию; электрическое сопротивление; гидроэнергетика; солнечная энергия; энергия ветра; ядерная (атомная) энергетика; промежуточная стадия (ступень); конечный потребитель.

**16. Summarize the content of the text. Use the phrases:**

*The text deals with the problem of...*

*The text describes...*

*The text gives a detailed description of...*

## **Unit 4**

### **MASS MEDIA AND THEIR ROLE IN CONTEMPORARY SOCIETY**

**1. Read and translate the following international words:**

Politics, communication, process, individual, group, term, technical, type, publication, classify, electronically, function, specific, totalitarian, democratic, electorate, idea, contrast, rehabilitation, paralyze, focus, idealize.

**2. Practise the pronunciation of the following words:**

Lament, among, citizen, government, heterogeneous, disperse, audience, circulation, relative, population, through, target, entertainment, interpreting, influence, agenda, socialize, moreover, official, accountable, dual, capability, view, although, prominent, particularly, doggedly, resignation, award-winning, severely, wounded.

### 3. Read the text and give English equivalents to the following Russian words and word combinations:

Обычная жалоба, не ладят, для того, чтобы жить мирно, передача информации, от одного человека, разнородная аудитория, живущая в разных местах, основные примеры, тиражи, обычно, средства вещания, для целевого общения, СМИ, зарабатывать деньги, главным образом, развлекательные мероприятия, влияние на общественное мнение, формировать план работы, знакомить граждан с политической жизнью, способствовать, ответственный за свои действия, заметный, кинофильмы, наиболее сильные политические идеи, с упорством разоблачали, перенес болезненную реабилитацию, превратился.

### 4. Read and translate the text:

#### Text 1. PEOPLE, GOVERNMENT AND COMMUNICATIONS

lament - жалоба

to get along – ладить, жить мирно

heterogeneous – разнородный, различный

disperse – рассеиваться

technical device – техническое устройство, прибор

circulation —тираж

relative to – относительно, касательно

broadcast media – средства вещания

targeted - целенаправленный

entertainment – развлекательное мероприятие

agenda – повестка дня, план действий

promoting – способствующий

to be responsible to – ответственный за что-либо

moreover –более того

electorate - избиратели

accountable for – ответственный, подотчетный

voter – голосующий, избиратель

capability - способность

reflect – отражать

shape - формировать

prominent - заметный

motion pictures – кинофильм

convey – нести, содержать (информацию)

doggedly – упрямо, упорно



expose - разоблачать

resignation – уход в отставку

paramilitary - военизированный

seamy – зд. грязный

«We never *talk* anymore» is a common lament among people who are living together but not getting along very well. In politics, too, citizens and their government need to communicate in order to get along well. **Communication** is the process of transmitting information from one individual or group to another. Mass **communication** is the process by which individuals or groups transmit information to large, heterogeneous, and widely dispersed audiences. The term **mass media** refers to the technical devices employed in mass communication. The mass media are commonly divided into two types:

**1. Print media** communicate information through the publication of written words and pictures. Prime examples of print media are daily newspapers and popular magazines. Because books seldom have very large circulations relative to the population, they are not typically classified as a mass medium.

**2. Broadcast media** communicate information electronically through sounds or sights. Prime examples of broadcast media are radio and television. Although the telephone also transmits sounds, it is usually used for more targeted communications and so is not typically included within the mass media.

The mass media are in business to make money, which they do mainly by selling advertising through their major function, entertainment. We are more interested in the five specific functions the mass media serve the political system: *reporting* the news, *interpreting* the news, *influencing* citizens' opinions, *setting the agenda* for government action, and *socializing* citizens about politics.

Our special focus is on the role of the mass media in promoting communication from a government to its citizens *and* from citizens to their government. In totalitarian governments, information flows more freely in one direction (from government to people) than in the other. In democratic governments, information must flow freely in both directions; a democratic government can be responsible to public opinion only if its citizens can make their opinions known. Moreover, the electorate can hold government officials accountable for their actions only if voters know what their government has done, is doing, and plans to do. Because the mass media provide the major channels for this two-way flow of information, they have dual capability of reflecting and shaping our political views.

Although this text concentrates on political uses of the four most prominent mass media - newspapers, magazines, radio, and television - you should understand that political content can also be transmitted through other mass media, such as recording and

motion pictures. Rock actors like Peter Gabriel and U2 often express political ideas in their music.

And motion pictures often convey particularly intense political messages. In the 1976 film *All the President's Men*, Dustin Hoffman and Robert Redford played Carl Bernstein and Bob Woodward, the two Washington Post reporters who doggedly exposed the Watergate scandal in a series of articles that led to President Richard Nixon's resignation in 1974. This motion picture dramatized a seamy side of political life that contrasted sharply with an idealized view of the presidency. In his series of "Rambo" films Sylvester Stallone played a paramilitary superhero that solved difficult international problems through combat. In contrast, the award-winning *Born on the Fourth of July* starred Tom Cruise in the real-life story of Ron Kovic, who enlisted in the marines and was severely wounded in Vietnam. Paralyzed from the waist down, he underwent painful rehabilitation and turned into an antiwar-activist. This film presents a very different view of fighting.

### **5. Answer the questions:**

1. What is the difference between 'communication' and 'mass communication?'
2. What types are the mass media divided into?
3. What are the mass media main functions?
4. What conveys particularly intense political messages?

### **6. Choose the right variant:**

#### *2.1. Communication is*

- a) speaking on the telephone
- b) the transmitting information from one to another object
- c) individuals transmit information to large audience
- d) a device for transmitting information

#### *2.2. The mass media are commonly divided into ..... types.*

- a) three
- b) five
- c) four
- d) two

#### *2.3. Which doesn't refer to the print media?*

- a) books
- b) magazines
- c) newspapers
- d) posters

*2.4. Telephone isn't typically included within the mass media because*

- a) the quality of the sound is bad
- b) radio and television are more interesting for audiences
- c) it doesn't transmit information through sounds or sights
- d) it is commonly used for more specific communications

*2.5. The mass media make money by*

- a) selling valuable information
- b) interpreting the news
- c) selling advertising through entertainment
- d) reporting the news

*2.6. Mass media reflect and shape our political views because*

- a) they are responsible to public opinion
- b) they provide the major channels for two-way flow
- c) they report topical news
- d) they concentrate on political issues

## **7. Read and translate the text:**

### **Text 2. THE MASS MEDIA**

The mass media transmit information to large, heterogeneous, and widely dispersed audiences through print and broadcasts. The main function of the mass media is entertainment, but the media also perform the political functions of reporting news, interpreting news, influencing citizens' opinions, setting the political agenda, and socializing citizens about politics.

The mass media in many countries are privately owned and in business to make money, which they do mainly by selling space or air time to advertisers. Both print and electronic media determine which events are newsworthy, a determination made on the basis of audience appeal. The rise of mass-circulation newspapers in the 1830s produced a politically independent press in the United States and Europe. In their aggressive competition for readers, those newspapers often engaged in sensational reporting, a charge sometimes leveled at today's media.

The broadcast media operate under technical, ownership, and content regulations set by the government, which tend to promote the equal treatment of political contests on radio and television more than in newspapers and news magazines.

The major media maintain staffs of professional journalists in major cities across the world. All professional journalists recognize rules for citing sources that guide their

reporting. What actually gets reported in the media depends on the media's gatekeepers, the publishers and editors.

Although more people today get more news from television than newspapers, newspapers usually do a more thorough job of informing the public about politics. Despite heavy exposure to news in the print and electronic media, the ability of most people to retain much political information is shockingly low-and less than it was in the mid-1960s. It appears that the problem is not with the media's inability to supply quality news coverage, but the lack of demand for it by the public. The role of the news media may be more important for affecting interactions among attentive policy elites than in influencing public opinion.

The media's elite including reporters from the major television networks tend to be more liberal than the public.

From the standpoint of majoritarian democracy, one of the most important effects of the media is to facilitate communications from the people to the government through the reporting of public opinion polls. The media zealously defend the freedom of the press, even to the point of encouraging disorder through criticism of the government and the granting of extensive publicity to violent protests, terrorist acts, and other threats to order.

#### **8. Develop the following ideas:**

1. The message of an article or a TV programme is more important than the form.
2. The media zealously defend the freedom of the press.
3. The media's elite tend to be more liberal than the public.
4. To facilitate communications from the people to the government is one of the most important effects of the media in democratic countries.

#### **9. Additional questions:**

1. What electronic media are of importance nowadays?
2. What helps newspaper publishers to win the competition for readers?

#### **10. Read and translate the text:**

### **Text 3. THE INTERNET**

The Internet is a magnificent global network with millions and millions of computers and people connected to one another where each day people worldwide exchange an immeasurable amount of information, electronic mail, news, resources and, more important, ideas.

It has grown at a surprising rate. Almost everyone has heard about it and an increasing number of people use it regularly. The current estimate is that over 70 million people are connected, in some way, to the Internet – whether they know it or not.

With a few touches at a keyboard a person can get access to materials in almost everywhere. One can have access to full-text newspapers, magazines, journals, reference works, and even books. The Web is one of the best resources for up-to-date information. It is a hypertext-based system by which you can navigate through the Internet. Hypertext is the text that contains links to other documents. A special program known as «browser» can help you find news, pictures, virtual museums, electronic magazines, etc. and print Web pages. You can also click on keywords or buttons that take you to other pages or other Web sites. This is possible because browsers understand hypertext markup language or code, a set of commands to indicate how a Web page is formatted and displayed.

Internet Video conferencing programs enable users to talk to and see each other, exchange textual and graphical information, and collaborate.

Internet TV sets allow you to surf the Web and have e-mail while you are watching TV, or vice versa. Imagine - watching a film on TV and simultaneously accessing a Web site where you get information on the actors of the film. The next generation of Internet-enabled televisions will incorporate a smart-card for home shopping, banking and other interactive services. Internet-enabled TV means a TV set used as an Internet device.

The Internet is a good example of a wide area network (WAN). For longdistance or worldwide communications, computers are usually connected into a wide area network to form a single integrated network. Networks can be linked together by telephone lines or fibre-optic cables. Modern telecommunication systems use fibreoptic cables because they offer considerable advantages. The cables require little physical space, they are safe as they don't carry electricity, and they avoid electromagnetic interference.

Networks on different continents can also be connected via satellites. Computers are connected by means of a modem to ordinary telephone lines or fibre-optic cables, which are linked to a dish aerial. Communication satellites receive and send signals on a transcontinental scale.

### **11. Answer the questions:**

1. What is the Internet? 2. How many people are connected to the Internet today? 3. What is Hypertext? 4. What are computers usually connected into? 5. What advantages do fibre-optic cables offer?

### **12. Read and translate the text:**

## Text 4. A “FREE PRESS” MUST MEAN JUST THAT

(by Adriana Lopez)

waffle – *ам. жарг.* болтать, пустословить

toll - потери

misdeed- преступление, злодеяние

trafficking - торговля

volatile – непостоянный, нестабильный

flawed – порочный, с изъяном

ambiguity – неясность, двусмысленность

loophole - лазейка

guerrilla – партизанский

withdraw – отзывать

take for granted – считать (что-либо) доказанным/ не требующим доказательства, само собой разумеющимся.

We take freedom of speech for granted in the United States, but in the rest of the hemisphere it is the exception, not the rule. The Organization of American States met to discuss this issue and, for a while, it looked as if the United States was waffling.

A draft of the Inter-American Declaration on Freedom of Expression stated that the OAS is «convinced that the unlawful restrictions on the exercise of freedom of expression not only violate individual human rights but threaten democratic society itself». But it also said that «freedom of expression may be subject to certain restrictions established under domestic law and international obligations».

That loophole could have licensed Latin American countries to ban – and punish – members of the press.

Journalists in Latin America already face enough threats. In the last decade the death toll has reached nearly 200. Thousands of journalists are being severely punished for exposing the misdeeds of their countries' powerful people. Attacks come as a direct result of their work. Reporters are subjected to harassment, kidnapping, torture, imprisonment and murder.

Gustavo Gorriti, a Peruvian journalist and recipient of the 1998 International Press Freedom Award of the Committee to Protect Journalists, has been continually harassed by the Peruvian and Panamanian governments. Gorriti has said that any journalist in Latin America who engages in serious, substantive reporting «will almost certainly face certain forms of harassment. You are literally taking your life in your hands».

Latin America's rocky road from dictatorship to democracy – with drug trafficking, government corruption, left-wing guerrilla groups and paramilitary organizations all putting up obstacles – has made journalism one of the most dangerous careers in this

volatile region. Peruvian novelist and one time presidential candidate Mario Vargas Llosa once noted that «a fully free press won't be secure until democratic values and a rule of law are more firmly embedded».

Fortunately, Victor Marrero, U.S. ambassador to OAS, withdrew the flawed draft late last month, citing «ambiguities which should be clarified». He requested that the draft return to a working group for further revision before being voted on. This belated move at least puts the United States on the right track. The U.S. government should not back any kind of press restriction, and Latin America should not have to deal with double standards when it comes to freedom.

### **13. Questions for discussion:**

1. Is freedom of speech taken for granted in your country?
2. Are journalists in your country subjected to any forms of harassment? If yes, why?
3. Freedom of expression may be subject to certain restrictions. Do you agree with this statement?

## **PART 2. ESPECIAL FIELD OF SCIENCE AND RESEARCH. TECHNOLOGY TRENDS**

**1. Read and translate the text. Comment on the statement: «Science is a powerful engine by which the genius of the few is magnified by the talents of the many for the benefits of all».**

### **Text 1. SCIENCE AND SOCIETY IN THE USA**

entitlement – зд. установленная норма (панацея)

maintain – сохранять

generate – порождать

outright – полный

frustratingly – потрясающе, слишком уж

volatility – смена, перемена

commitment – обязательство (зд. вклад)

vistas – перспективы

embark – начинать (дело), зд. основываться

superstring – суперсерия или суперряд

give an account – объяснять, описывать

resolution – зд. расширение

underpinning – зд. свидетельство, пример

forestall – предвосхищать

poise – зδ. склоняться (балансировать)

pinnacle – зδ. кульминация

Science on the scale that it exists and is needed today can, however, be maintained only with large amounts of public support. Large-scale public support will be provided only if science and technology are meeting the critical needs of society. Intellectual progress, as measured by advances in specific public disciplines, is not in itself sufficient to generate such support. Perhaps it should be, but it is not. Public support for science may be wise policy, but is not an entitlement.

The central problem is that the costs of meeting the needs of society are too high, and the time scale for meeting them is too long. Both the ideals and the pragmatics of American society are based on improvement in the quality of life. We expect better health care, better education, economic security. We expect progress towards the reduction, if not outright elimination of poverty, disease, and the environmental degradation.

Progress towards these goals has recently been frustratingly slow and increasingly expensive. The heavy costs of providing and improving health care and education are examples.

The situation has produced a volatility in public opinion and mood that reflects a lack of confidence in the ability of government and other sectors of society, including science and technology, to adequately address fundamental social needs.

If this mood hardens into a lack of vision, of optimism, of belief in the future, a tremendous problem for science will result. Science, in its commitment to innovation and expanding frontiers of knowledge, is a thing of the future.

The vistas of science are inspiring. Condensed matter physics is embarked on materials by design, nanotechnology and high temperature superconductivity, each containing the seeds of new industries as well as new scientific understanding. Molecular biology is in full bloom with a vast potential for further intellectual progress, betterment of human (and plant and animal) health, and commercialization. Neuroscience seems poised for dramatic progress.

Research into the fundamental laws of physics is aiming at a pinnacle. There is a candidate theory - the superstring theory – which is proposed as a unification of all the known fundamental forces in nature and which is supposed to give an account, complete in principle, of all physical phenomena, down to the shortest distances currently imaginable. At the largest scales of distance, observational astronomy is uncovering meta-structures which enlarge the architecture of the universe a deepening of the problem of cosmology preliminary to its resolution.

Underpinning much of this progress, and progress in countless other areas as well has been the emergence of scientific computing as an enabling technology.



All this is first-rate science. All this is not enough – either to forestall change or to ensure adequate support for science in the present climate. Why it is not enough – and what else is required – are the subjects of a special inquiry.

## **2. Discussion.**

1. Are there statements in the text that you disagree with? What are they?
2. Are you aware of the latest achievements in your field of science? What are they?
3. Do you think the achievements of science are not sufficient to ensure adequate support for science?
4. If you were in power what would you do to support science in Russia?

## **3. Read and translate the text.**

### **Text 2. FAST REACTORS AS BURNERS OF PLUTONIUM**

There is no change in the view that the ultimate role of fast reactors is to make available the very large reserves of U-238 and other fertile isotopes, and by means of the breeding process to turn them into fissile isotopes such as Pu.239 and then fission them to generate useful energy in the form of heat. However in the medium term, before the breeding role is economically demanding, fast reactors have other purposes one of these is to consume plutonium.

At present there are large stocks of plutonium in several countries. These have arisen from two sources. Firstly commercial thermal power reactors have produced large amounts of plutonium. In some countries this plutonium lies in the unprocessed fuel in spent fuel stores; in others, where the spent fuel has been unprocessed, it has been separated and stored. Secondly significant quantities of plutonium have been released by the decommissioning of nuclear weapons. The relaxation of the "cold war" in the last decade has seen a substantial reduction in the stockpiles of nuclear warheads held by nuclear weapons states, particularly the USA and the former USSR. The fissile material from these warheads is now also in store.

Plutonium stocks from both these sources are seen in some quarters as constituting a danger, because they could in principle give rise to further proliferation of weapons. It is felt that as long as the plutonium is present there is a danger that it could be used for military purposes again, either, in the event of some future political catastrophe, by governmental agencies, or illicitly by terrorist or criminal groups.

At present this possibility is guarded against quite adequately by keeping plutonium, especially when it is chemically separated from irradiated fuel, under high security, but this is costly. An alternative is to use it as a nuclear fuel, and this may be attractive

in both economic and political terms. Plutonium is nowhere as well protected as when it is in the core of a reactor.

Plutonium can be used as a fuel in thermal reactors, and in some countries this is being done. Mixed UO<sub>2</sub>/PuO<sub>2</sub> fuel ("MOX") is commonly used in some PWR power reactors. However there are limits to the extent to which plutonium can be recycled in this way. Firstly in most existing PWR reactors the amount of MOX fuel which can be incorporated in the core is limited, typically to about 30%. At higher MOX loadings the effectiveness of the control rods would be unacceptably reduced, and the negative temperature coefficient of reactivity would be reduced by the effect of the fission resonance in Pu-239 at 0.3 eV. Secondly there is a limit to the number of times plutonium can be recycled in an LWR because of the build-up of Pu-240 and higher isotopes, which makes the coolant void coefficient of reactivity more positive. Thus although the amount of plutonium in store can be reduced by recycle in thermal reactors the overall effect on the total inventory is small and it cannot be destroyed entirely.

In a fast reactor, on the other hand, the greater reactivity allows these limitations to be avoided. In principle plutonium can be recycled indefinitely and the overall inventory can be reduced to a low level. For this reason there is interest in fast "burner" reactors (as opposed to "breeders") in several countries.

The activities undertaken so far have served to indicate the great flexibility of fast reactors, which can be used either to consume plutonium or to generate it, and can utilize plutonium with a wide range of isotopic composition, from weapons-grade material which is high in Pu.239 to plutonium which has been recycled several times in thermal or fast reactors and contains more than 50% of the non-fissile isotopes Pu.240 and Pu.242. During the next decade further work to optimize the performance of burner reactors can be expected.

#### **4. Find English equivalents to the following words:**

Part 1.

- реакторы на быстрых нейтронах
- изотопы
- тепловая энергия
- топливо
- утилизация плутония
- источники
- тепловые реакторы
- облученное топливо
- ядерное вооружение
- ядерное топливо
- плутоний

- водо-водяной реактор
- переработка плутония
- активная зона
- регулирующий стержень
- коэффициент реактивности
- теплоноситель
- утилизировать

#### Part 2.

- неделящиеся изотопы
- доплеровский коэффициент
- натриевый плотностной коэффициент реактивности
- эксплуатационные характеристики
- смешанное оксидное топливо
- тепло-гидравлическая эффективность

### 5. Complete the sentences:

1. Plutonium stocks are seen in some quarters as constituting a danger, because they ...
2. Significant quantities of plutonium have been released by ...
3. Plutonium can be used as a fuel in ...
4. Firstly in most existing PWR reactors the amount of MOV fuel ...
5. Secondly there is a limit to ...
6. In principle plutonium can be ...
7. The activities undertaken so far have served to ...
8. During the next decade ...

### 6. Fill in the gaps with the missing words from the text:

1. There is interest in ... in several countries.
2. Plutonium is nowhere as well ... as when it is in the ... of a reactor.
3. There are no limits to the ... to which plutonium can be recycled.
4. Although the amount of plutonium in store can be ... , the overall effect on the total ... is small.
5. As long as plutonium is present there, there is a ... that it could be used for ... purposes again.
6. An alternative is to use it as ... , and this may be attractive in both economic and political terms.

### 7. Translate from Russian into English:

1. Плутоний может использоваться в качестве топлива в тепловых реакторах.
2. До тех пор пока плутоний хранится, существует опасность того, что он может

снова быть использован в военных целях либо государственными структурами в случае возникновения политической катастрофы, либо незаконными террористическими или преступными группами.

3. В среднесрочной перспективе, прежде чем воспроизводство топлива будет экономически обосновано, использование реакторов на быстрых нейтронах имеет другие цели, и одна из них – утилизация плутония.

4. Запасы плутония из этих источников в некоторых кругах рассматриваются как представляющие опасность, поскольку, в принципе, они могут привести к дальнейшему распространения оружия.

5. Большое количество плутония было наработано коммерческими тепловыми реакторами.

#### **8. Answer the questions:**

1. What is the ultimate role of fast reactors?
2. What are the sources of plutonium?
3. Who can use plutonium for military purposes nowadays?
4. Where is MOX commonly used?
5. Why is there interest in fast burner reactors in several countries?
6. What are the main goals of the activities undertaken so far?

#### **9. Read and translate the text.**

##### **Text 3. FAST REACTORS AS INCINERATORS OF NUCLEAR WASTE**

Another role which fast reactors may be called upon to fulfill is that of waste reduction. Long-lived radioactive materials are produced by the operation of reactors of all types and, with the exception of the few that have commercial applications, have to be treated as waste. The most intensely radioactive are the "high-level wastes" (HLW) from irradiated fuel – either the spent fuel itself if it is not reprocessed, or the waste streams from the reprocessing plant. The main contributors to the high radioactivity are the fission products and the isotopes of elements beyond uranium in the periodic table (apart from plutonium). The latter are often referred to as "minor actinides" (MAs). The long-lived fission products and minor actinides set severe demands on the arrangements for safe waste disposal, in that it is necessary to ensure that they are kept isolated until they have decayed to activity levels at which they pose no danger to the health of people and other living organisms. In some cases this requires secure containment for many millennia.

By 2012 it is estimated that there will be more than 300,000 tons of spent fuel, including 3,000 tons of plutonium and of the order of 100 tons of Np-237 and of americium (the amounts depending on the decay times). There will also be about 250 tons of Tc-99, 90 tons of Cs-135 and 60 tons of I-129.

In most countries the policy is to construct waste repositories, which will ensure the adequate protection of the environment for the foreseeable future, but in some quarters the opinion that it is not right to impose on future generations the obligation to care for the waste products of the present day is gaining in influence. If it is eventually decided that it would be better to destroy (or "incinerate") the HLW rather than store it fast reactors will play an important part.

MA isotopes can be transmuted more efficiently in fast reactors than thermal because most have a lower ratio of capture to fission for fast neutrons. However' for the efficient transmutation of fission product isotopes a soft spectrum is required, so moderating assemblies situated around the core of a fast reactor are favoured.

The materials of greatest importance are the long-lived isotopes of neptunium, americium and curium, Np-237, Am-241, Am-243, Cm-242 and Cm-244. Neptunium can be eliminated by recycling it with the plutonium. In fact, Np-237 is a good burnable poison, and including 2.5 % of it in the fuel of a fast reactor has only small effects on the Doppler coefficient and the sodium void reactivity. In the reprocessing plant it would not be separated but would pass out in the plutonium stream and incorporated in mixed Np-Pu-U fuel elements.

Americium, on the other hand, has such high gamma activity that it could not be made into new fuel in the normal fabrication plant. It would have to be separated in the reprocessing plant and fabricated into separate fuel elements or "targets", which would be irradiated in the radial blanket. Studies have been made of subassemblies containing 40 % by weight of Am in the form of oxide in a matrix of Al<sub>2</sub>O<sub>3</sub>. It is estimated that, if the neutron damage dose to the structural components of the subassemblies is limited to 200 dpa, 63 % of the Am can be transmuted.

The transmutation products would include a high percentage of Pu-238 and Cm-244. A limit has to be placed on the Pu-238 concentration if the irradiated targets are to be reprocessed by the Purex process because its high alpha activity degrades the reprocessing solvent.

The "SPIN" programme in France and the "OMEGA" programme in Japan are addressed to MA destruction, but so far none of the processes of separation, fabrication, or irradiation has been implemented on a commercial scale, and indeed there are significant problems, particularly in separation of americium and making it into targets for irradiation. In the next decade, therefore, it is likely that there will be extensive work on these aspects of MA destruction' and on the performance of fast reactors with a significant MA loading. This will include test irradiations of MA fuel assemblies.

The destruction of radioactive fission products is more difficult because the neutron cross-sections are lower and they cannot be fissioned. As a result even in a fast reactor there are not enough excess neutrons to destroy fission products at a greater rate than they are being produced. However it may be possible to reduce the quantities of

some of the longest-lived fission products, such as I-129, Cs-135, Kr-93 and Tc-99, by irradiation in fast reactors. This would reduce the long-term demands on waste repositories. Because absorption cross sections are greater for thermal neutrons than fast the long-lived fission products are best incinerated in special moderating subassemblies placed in the radial blanket. The next decade may see irradiation testing of targets containing long-lived fission products.

### **10. Find English equivalents to the following words:**

- реакторы на быстрых нейтронах
- долгоживущие радиоактивные материалы
- радиационное излучение
- отработавшее топливо
- продукты деления
- гамма-активность
- топливные элементы
- повреждающая доза
- утилизация
- компоновка реакторов
- хранилище отходов

### **11. Complete the sentences:**

1. The main contributors to the high radioactivity are ...
2. The long-lived fission products and minor actinides set ...
3. By 2010 it is estimated that there will be more than 300,000 tons of ...
4. In most countries the policy is to construct waste repositories, which will ...
5. MA isotopes can be transmuted more efficiently in fast reactors than thermal because ...
6. The materials of greatest importance are the long-lived isotopes of ...
7. Americium, on the other hand, has such high gamma activity that ...
8. The "SPIN" programme in France and the "OMEGA" programme in Japan are addressed to ...
9. The destruction of radioactive fission products is more difficult because ...
10. However it may be possible to reduce the quantities of ...

### **12. Translate from Russian into English:**

1. Долгоживущие радиоактивные материалы образуются в процессе эксплуатации реакторов всех типов и, за исключением тех немногих, которые могут быть использованы в коммерческих целях, должны рассматриваться как отходы.

2. Основным источником высокой радиоактивности являются продукты деления и изотопы элементов стоящих выше урана в периодической таблице химических элементов (помимо плутония)
3. В реакторах на быстрых нейтронах младшие актиниды могут быть преобразованы эффективнее, чем в тепловых, потому что большинство из них имеют более низкое соотношение сечения захвата к сечению деления в области высоких энергий нейтронов.
4. Предполагается, что к 2012 будет накоплено более 300 000 тонн отработавшего топлива.

### **13. Answer the questions:**

1. How are long-lived radioactive materials produced?
2. What are the main contributors to the high radioactivity?
3. What will the policy in most countries ensure?
4. Why can MA isotopes be transmuted more efficiently in fast reactors than in thermal ones?
5. What materials are of greatest importance?
6. What will happen if the neutron damage dose to the structural components of the subassemblies is limited to 200 dpa?
7. What can you say about the "SPIN" programme in France and the "OMEGA" programme in Japan?
8. Why is the destruction of radioactive fission products difficult?

### **14. Read and translate the text.**

#### **Text 4. RF WAVEGUIDE BASICS**

Waveguides are used in a variety of applications to carry radio frequency energy from one point to another. In their broadest terms a waveguide is described as a system of material that is designed to confine electromagnetic waves in a direction defined by its physical boundaries. This definition gives a very broad view of waveguides, but indicates that waveguide theory can be applied in a number of areas and in a variety of different ways.

Electromagnetic waves propagating in open space travel out in all directions and can be thought of as spherical waves traveling out from a central source. As a result the power intensity decreases as the distance increases - it is proportional to the power of the source divided by the square of the distance. The waveguide operates by confining the electromagnetic wave so that it does not spread out and losses resulting from this effect are eliminated. Typically a waveguide is thought of as a transmission line compris-

ing a hollow conducting tube, which may be rectangular or circular within which electromagnetic waves are propagated. Unlike coaxial cable, there is no centre conductor within the waveguide. Signals propagate within the confines of the metallic walls that act as boundaries. The signal is confined by total internal reflection from the walls of the waveguide.

Waveguides will only carry or propagate signals above a certain frequency, known as the cut-off frequency. Below this the waveguide is not able to carry the signals. The cut-off frequency of the waveguide depends upon its dimensions. In view of the mechanical constraints this means that waveguides are only used for microwave frequencies. Although it is theoretically possible to build waveguides for lower frequencies the size would not make them viable to contain within normal dimensions and their cost would be prohibitive.

As a very rough guide to the dimensions required for a waveguide, the width of a waveguide needs to be of the same order of magnitude as the wavelength of the signal being carried. As a result, there is a number of standard sizes used for waveguides as detailed in another page of this tutorial. Also other forms of waveguide may be specifically designed to operate on a given band of frequencies.

There is a number of different types of RF waveguide that can be used, bought and designed.

Typically waveguides are thought of as being rectangular in cross section as this is the most common form of waveguide. However other types and approaches may be used.

**Rectangular waveguide:** This is the most commonly used form of waveguide and has a rectangular cross section.

**Circular waveguide:** Circular waveguide is less common than rectangular waveguide. They have many similarities in their basic approach, although signals often use a different mode of propagation.

**Circuit board stripline:** This form of waveguide is used on printed circuit boards as a transmission line for microwave signals. It typically consists of a line of a given thickness above an earth plane.

In addition to these basic forms, there are also **flexible waveguides**. These are most widely seen in the rectangular format. Flexible waveguide is often used to connect to antennas, etc that may not be fixed or may be moveable.

Waveguides are more expensive than other forms of RF feeder. However waveguides offer a number of advantages that mean they are the only feasible solution in many applications. Although waveguide is not nearly as widely used as other forms of feeder such as coax, it still forms an essential method of transferring RF power, especially at microwave frequencies.



In order to be able to use waveguides to their best effect, it is necessary to have a basic understanding of waveguide theory, including waveguide propagation and the waveguide propagation constant. While waveguide theory can become particularly involved, it is not the aim here to delve too deeply into the waveguide theory mathematics.

Waveguide theory is based around electromagnetic wave theory because the waves propagating along waveguides are electromagnetic waves that have been constrained, typically within a hollow metal tube. The constraining boundaries of the metal tube prevent the electromagnetic wave from spreading out and thereby reducing in intensity according to the inverse square law. As a result, losses are very low.

### **15. Find English equivalents to the following words:**

- волновод
- распространение электромагнитных волн
- сферические волны
- быть разделенным
- коаксиальный кабель
- размеры
- микроволновые частоты
- амплитуда

### **16. Complete the sentences:**

1. A waveguide is described as a system of material that is designed to ...
2. The waveguide operates by confining the electromagnetic wave so that ...
3. Unlike coaxial cable, there is no ...
4. Signals propagate within the confines of the metallic walls that ...
5. Waveguides will only carry or propagate signals above ...
6. The cut-off frequency of the waveguide depends upon ...
7. Although it is theoretically possible to build waveguides for lower frequencies...
8. Waveguides are more expensive than ...
9. In order to be able to use waveguides to their best effect, it is necessary to ...
10. Waveguide theory is based around electromagnetic wave theory because ...

### **17. Fill in the gaps with the missing words from the text:**

1. Waveguides are used in a variety of applications to carry ... from one point to another.
2. Electromagnetic waves propagating in open space travel out in all directions and can be thought of as ... traveling out from a central source.
3. Typically a waveguide is thought of as a ... comprising a hollow conducting tube, which may be rectangular or circular within which electromagnetic waves are propagated.

4. The signal is confined by ... from the walls of the waveguide.
5. In view of the ... this means that waveguides are only used for microwave frequencies.
6. ... is often used to connect to antennas, that may not be fixed or may be moveable.
7. The constraining boundaries of the metal tube prevent the electromagnetic wave from spreading out and thereby reducing in intensity according to ... .

### **18. Answer the questions:**

1. In what directions do the electromagnetic waves propagating in open space travel out?
2. Why do the waveguides confine waves from propagating in certain directions?
3. How does the waveguide operate?
4. Is there any central conductor within the waveguides?
5. What is the signal confined by?
6. What are metallic walls in a waveguide used for?
7. What does the cut-off frequency of the waveguide depend upon?
8. Why is it practically difficult to create a waveguide for low frequency waves (lower than microwave frequencies)?

### **9. Read and translate the text.**

#### **Text 5. HISTORY OF FIBER OPTIC TECHNOLOGY AND FIBER OPTIC SYSTEMS**

People have used light to transmit information for hundreds of years. However, it was not until the 1960s, with the invention of the laser that widespread interest in optical (light) systems for data communication began. The invention of the laser prompted researchers to study the potential of fiber optics for data communications, sensing, and other applications. Laser system could send a much larger amount of data than telephone, microwave, and other electrical systems. The first experiment with the laser involved letting the laser beam transmit freely through the air. Researches also conducted experiments letting the laser beam transmit through different types of waveguides.

Glass fibers soon became the preferred medium for fiber optic research. Initially, the very large losses in the optical fibers prevented coaxial cables from being replaced. **Loss** is the decrease in the amount of light reaching the end of fiber. Early fibers had losses around 1,000 dB/km making them impractical for communications use. In 1969, several scientists concluded that impurities in the fiber material caused the signal loss in optical fibers. The basic fiber material did not prevent the light signal from reaching the end of the fiber. These researchers believed it was possible to reduce the losses in opti-

cal fibers removing the impurities. By removing the impurities, construction of low-loss optical fibers was possible.

There are two basic types of optical fibers, multimode fibers and single mode fibers. In 1970, Corning Glass Works made a multimode fiber with losses under 20 dB/km. This same company, in 1972, made a high silica-core multimode optical fiber with 4 dB/km minimum attenuation (loss). Currently, multimode fibers can have losses as low as 0.5 dB/km at wavelengths around 1300 nm. Single mode fibers available with losses lower than 0.25 dB/km at wavelengths around 1500 nm.

Developments in semiconductor technology, which provided the necessary light sources and detectors, furthered the development of fiber optics. Conventional light optics, such as lamps and lasers, were not easily used in fiber optic systems. These light sources tended to be too large and required lens systems to launch light into the fiber. In 1971, Bell Laboratories developed a small area light-emitting diode (LED). This light source was suitable for low-loss coupling to optical fibers. Researchers could then perform source-to-fiber jointing easily and repeatedly. Early semiconductor sources had operating lifetimes of only a few hours. However, by 1973, projected lifetimes of lasers advanced from a few hours to greater than 1,000 hours. By 1977, projected lifetimes of lasers advanced to greater than 7,000 hours. By 1979, these devices were available with projected lifetimes of more than 100,000 hours.

In addition, researchers also continued to develop new fiber optic parts. The types of new parts developed included low-loss fibers and fiber cables, splices, and connectors. These parts permitted demonstration and research on complete fiber optic systems. Advances in fiber optics have permitted the introduction of fiber optics into present applications.

These applications are mostly in the telephone long-haul systems, but are growing to include cable television, computer networks, video systems, and data links. Research should increase system performance and provide solutions to existing problems in conventional applications. The impressive results from early research show there are many advantages offered by fiber optic systems.

## **10. Find English equivalents to the following words:**

- оптические системы передачи данных
- волоконная оптика
- волновод
- стеклянные волокна
- коаксиальный кабель
- примеси
- многомодовые / одномодовые волокна
- кварцевая сердцевина

- полупроводниковая технология
- линза
- соединительные разъемы
- телефонные системы дальней связи

### **11. Complete the sentences:**

1. Laser system could send a much larger amount of data than ...
2. The first experiment with the laser involved letting the laser beam transmit ...
3. Researches also conducted experiments letting the laser beam transmit through...
4. Glass fibers soon became the preferred medium for ...
5. Early fibers had losses around 1,000 dB/km making them ...
6. There are two basic types of optical fibers, ...
7. Developments in semiconductor technology, which provided the necessary light sources and detectors, furthered ...
8. In addition, researchers also continued to develop ...
9. Research should increase system performance and provide solutions to ...

### **12. Fill in the gaps with the missing words from the text:**

1. People have used ... to transmit information for hundreds of years.
2. Initially, the very large losses in the optical fibers prevented ... from being replaced.
3. ... is the decrease in the amount of light reaching the end of fiber.
4. In 1969, several scientists concluded that ... in the fiber material caused the signal loss in optical fibers.
5. In 1970, Corning Glass Works made a ... with losses under 20 dB/km.
6. Conventional light optics, such as ..., were not easily used in fiber optic systems.
7. These light sources tended to be too large and required ... to launch light into the fiber.
8. These applications are mostly in the ... , but are growing to include cable television, computer networks, video systems, and data links.

### **13. Translate from Russian into English:**

1. Потери – это уменьшение количества света, достигающего конца волокна.
2. Ранние полупроводниковые источники имели действующие сроки службы только несколько часов.
3. Разработки в полупроводниковой технологии, которые обеспечили необходимые световые источники и детекторы, содействовали развитию полупроводниковой техники.
4. Эти световые источники были слишком большими и требовали системы линз для запуска света в волокно.

5. Этот легкий источник был подходящим для присоединения к оптическим волокнам с наименьшими потерями.

**14. Answer the questions:**

1. Why is the light so useful in transmitting information?
2. What are the other means of sending data?
3. Why did the researchers let the laser beam transmit through different types of waveguides?
4. Why were the early fibers impractical for communication?
5. What was the main achievement of Corning Glass Works company in creating optical fibers?
6. What were the operating lifetimes of early semiconductor sources?
7. How can fiber optic system be applied in data communication?

**15. Read and translate the text.**

**Text 6. FIBER OPTIC SYSTEMS**

System design has centered on long-haul communications and the subscriberloop plant. The subscriber-loop plant is the part of a system that connects a subscriber to the nearest switching center.

Cable television is an example. Limited work has also been done on shortdistance applications and some military systems. Initially, central office trunking required multimode optical fibers with moderate to good performance. Fiber performance depends on the amount of loss and signal distortion introduced by the fiber when it is operating at a specific wavelength. Long-haul systems require single mode optical fibers with very high performance. Single mode fibers tend to have lower loss and produce less signal distortion.

In contrast, short-distance and military systems tend to use only multimode technology. Examples of short-distance systems include process control and local area networks (LANs). Short-distance and military systems have many connections.

The larger fiber core and higher fiber numerical aperture (NA) of multimode fibers reduce losses at these connections.

In military and subscriber-loop applications, system design and parts selection are related. Designers consider trade-offs in the following areas:

- Fiber properties
- Types of connections
- Optical sources
- Detector types

Designers develop systems to meet stringent working requirements, while trying to maintain economic performance. It is quite difficult to identify a standard system design approach. This module identifies the type of components chosen by the Navy for shipboard applications.

Future system design improvements depend on continued research. Researchers expect fiber optic product improvements to upgrade performance and lower costs for short-distance applications. Future systems center on broadband services that will allow transmission of voice, video and data. Services will include television data retrieval, video word processing, electronic mail, banking, and shopping.

### **16. Find English equivalents to the following words:**

- магистральная связь
- кабельное телевидение
- многомодовые оптические волокна
- стекловолокно
- длина волны
- локальные вычислительные сети
- управление производственным процессором
- волоконная сердцевина
- числовая апертура

### **17. Complete the sentences:**

1. The subscriber-loop plant is the part of a system that ...
2. Fiber performance depends on the amount of loss and signal distortion introduced by the fiber when ...
3. Single mode fibers tend to have ...
4. Examples of short-distance systems include ...
5. It is quite difficult to identify ...
6. Researchers expect fiber optic product improvements to ...
7. Services will include ...

### **18. Fill in the gaps with the missing words from the text:**

1. Initially, central office trunking required ... with moderate to good performance.
2. Examples of ... include process control and local area networks (LANs).
3. The larger fiber core and higher fiber ... (NA) of multimode fibers reduce losses at these connections.
4. This module identifies the type of components chosen by ... for shipboard applications.
5. Future systems center on ... that will allow transmission of voice, video and data.

### **19. Translate from Russian into English:**

1. Первоначально, центральные офисные магистрали требовали многомодовые оптические волокна с хорошей производительностью.
2. Примерами систем короткого расстояния являются управление производственным процессом и локальные вычислительные сети.
3. Будущие системы сосредотачиваются на широком спектре услуг, которые позволяют передавать голос, видео и данные.
4. Системы для короткого расстояния и военные системы могут использовать многомодовые технологии.
5. Этот модуль идентифицирует типы компонентов, выбранных флотом для корабельных приложений.

### **20. Answer the questions:**

1. What did the central office trunking require initially?
2. What does fiber performance depend on?
3. What do long-haul systems require?
4. Why single mode fibers tend to have lower loss?
5. What are the examples of short-distance systems?
6. What do designers develop systems for?
7. What will broadband services allow?

### **21. Answer the questions:**

1. What is your field of science/research?
2. What is your particular area of research? What are you specializing in?
3. What are the latest achievements in this field of science?
4. What fundamental discoveries have been made in your field of science/ research?
5. Can you name some outstanding researchers in your field of science? What contribution have they made?
6. Do achievements in your branch of science/ research influence everyday life? In what way?
7. What further developments can you predict in your field of science/ research?

### ***Active vocabulary***

- to do/to carry out/ to carry on/ to conduct research
- to contribute/ to make a contribution to
- to influence/ to affect
- to study/ to investigate/ to explore
- to put forward an idea
- to suggest an idea/ a theory/a hypothesis

- to advance/ to develop/ to modify a theory
- to predict/ to forecast/ to foresee
- to accumulate knowledge
- field of science/ research
- latest/recent achievements/developments/advances
- an outstanding/prominent/world-known scientists/researcher

**22. Complete the following sentences. Speak about your field of science/ research.**

1. I do/ carry out research in the field of...
2. It is the branch of science that studies...
3. Major developments include advances in ...
4. Remarkable advances have been made ...
5. My current field of science/research is ...
6. It is difficult/ not difficult to foresee/predict ... .

***Active vocabulary***

- to deal with/ to consider the problem
- to be the subject of special/particular interest
- to be interested in
- to be of great/little/no interest/importance/significance/value/use
- to take up the problem
- to work on the problem
- a lot of/little/no literature is available on the problem

**23 Answer the questions:**

1. What is your research problem?
2. What is the subject of your research?
3. What is of special interest in the problem of your research?
4. Why has the interest in this problem increased considerably in recent years?
5. What concept is your research based on?
6. Is there much literature available on your research problem?
7. What are the main aspects of the problem that have been considered?

***Active vocabulary***

- purpose/aim/objective/goal/target
- a method/a technique/ a procedure
- detection/identification/observation
- measurement/calculation/computation/approximation
- consideration/generalization/deduction/assumption



- modeling/simulation
- advantages/merits
- disadvantages/shortcomings/limitations
- accurate/precise
- accuracy/precision
- reliable/valid/conventional/effective/useful/valuable
- data/results/method
- to make an experiment/analysis
- to reveal/to find/to confirm/to prove evidence
- to study/to examine
- to collect data
- to create
- to improve
- to work out/to develop/to design
- to verify/to check
- to approve/ to disapprove an assumption
- to use/to employ/to apply
- to allow/to permit/to provide
- to come into use
- results/findings/data/observations/evidence
- comprehensive/extensive
- detailed
- remarkable/encouraging/convincing
- preliminary
- sufficient/insufficient
- to collect/to get/to receive/to obtain data
- to treat the problem
- to succeed in/to make progress in/to be a success
- to fail in
- to be similar to/ to be the same as
- to coincide/ to be consistent with
- to agree with/to fit the assumption
- to support/in support of
- to conclude/to come to/to bring to a conclusion/to make conclusions

#### **24. Answer the questions:**

1. What is the subject of your current research?
2. What is the purpose of your research?
3. What method do you employ? Why?

4. What are the advantages of the method used over other methods or techniques?
5. What does the method consist in?
6. Do you find the method reliable/precise? Why?
7. How much time will it take you to complete your research successfully?
8. Have you already obtained any research results?
9. Has your research been successful?
10. Do your results coincide with those obtained by other researchers?
11. Are your results of theoretical or practical interest?
12. Do the data/results/observations/findings allow you to come to any definite conclusion(s)?
13. What conclusions have you come to?
14. How long will it take you to finish your research?
15. Are you going to publish the results obtained?

**25. Complete the sentences with the words from the Active vocabulary section. Speak about the purpose of your current research, the method used and the results obtained.**

1. Currently I ...
2. I make the experiments/analyses in order to ...
3. The purpose of my experiments/analyses is to ...
4. In our current research we ... the method of ....
5. The method/technique allows/permits ... to ....
6. The method/ technique makes it possible to ...
7. The method proves to be ...
8. At present a lot of work is being done to ...
9. The results we have ... so far cannot be used to ....
10. The evidence appears to ...
11. As a result of numerous experiments performed we have obtained sufficient data to ....
12. We have come to the conclusion that ... .

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## СОДЕРЖАНИЕ

|  | Стр. |
|--|------|
| ВВЕДЕНИЕ   | 3    |
| PART 1.  | 4    |
| Unit 1. EDUCATION IN MODERN SOCIETY. HIGHER EDUCATION                      | 4    |
| Unit 2. THE QUALITY OF ENVIRONMENT. ENVIRONMENT PROTECTION                 | 10   |
| Unit 3. ENERGY SOURCES AND PROBLEMS OF SURVIVAL IN POST-INDUSTRIAL SOCIETY | 22   |
| Unit 4. MASS MEDIA AND THEIR ROLE IN CONTEMPORARY SOCIETY                  | 31   |
| PART 2. ESPECIAL FIELD OF SCIENCE AND RESEARCH.                            |      |
| TECHNOLOGY TRENDS  | 39   |
| СПИСОК ИСПОЛЬЗУЕМОЙ ЛИТЕРАТУРЫ   | 59   |

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Медведева Светлана Александровна  
Голуб Лариса Николаевна

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