Министерство образования Республики Беларусь
Учреждение образования «Витебский государственный
университет имени П.М. Машерова»
Кафедра иностранных языков

Ю.А. Балло, Н.М. Шкатуло

АНГЛИЙСКИЙ ЯЗЫК ДЛЯ ФИЗИКОВ

Методические рекомендации

Витебск
ВГУ имени П.М. Машерова
2013

УДК 811.111(075.8)
ББК 81.432.1я73
Б20

Печатается по решению научно-методического совета учреждения образования «Витебский государственный университет имени П.М. Машерова». Протокол № 7 от 29.04.2013 г.

Авторы*:* преподаватели кафедры иностранных языков ВГУ имени П.М. Машерова **Ю.А. Балло, Н.М. Шкатуло**

Р е ц е н з е н т :
доцент кафедры английской филологии ВГУ имени П.М. Машерова,
кандидат педагогических наук *Л.И. Бобылева*

Балло, Ю.А.

Б20 Английский язык для физиков : методические рекомендации / Ю.А. Балло, Н.М. Шкатуло. – Витебск : ВГУ имени П.М. Машерова, 2013. – 51 с.

Основная цель издания – совершенствование навыков и умений в различных видах чтения, а также обучение устным формам общения по научной тематике.

Данные методические рекомендации предназначены для студентов дневного отделения физического факультета.

Учебное издание состоит из трех тематических разделов, содержащих профессионально-ориентированный текстовой материал и объединенных общей тематикой. В конце каждого раздела есть блок самоконтроля.

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ВВЕДЕНИЕ

На современном этапе развития общества все большую актуальность приобретает иноязычное профессиональное общение. Обусловленное социальным заказом общества, оно является одной из основных составляющих содержания обучения специалистов. В связи с этим задачи вузовского курса иностранного языка определяются коммуникативными и познавательными потребностями специалистов соответствующего профиля.

Данное учебное издание предназначено для студентов физического факультета высших учебных заведений дневной формы обучения.

Цель методических рекомендаций – сформировать у обучающихся навыки и умения различных видов чтения и говорения, развить способности извлекать и интерпретировать информацию, содержащуюся в оригинальных профессиональных текстах, а также осуществлять речевое взаимодействие для получения и обмена информацией. Соответственно, основное внимание в учебном издании уделяется работе с текстом как носителем информации и единицей деловой коммуникации, а также вербальному обеспечению речевого взаимодействия в профессиональной сфере. Это предполагает не только адекватное понимание, но и расширение активного и пассивного словарного запаса студентов.

Учебное издание состоит из трех тематических разделов (Unit), содержащих профессионально-ориентированный текстовой материал и объединенных общей тематикой. В конце каждого раздела есть блок самоконтроля (Self Check). Целенаправленный подбор текстов, основанный на принципе максимальной доступности в смысловом и языковом отношении, призван сформировать у обучаемых систему образов и понятий, относящихся к базовым профессиональным знаниям. Это активизирует познавательную деятельность студентов и будет способствовать приобщению к профессиональной концептуальной системе и развитию навыков профессионального сотрудничества на иностранном языке.

Разнообразный познавательный и информативный материал методических рекомендаций ориентирован как на аудиторную, так и на самостоятельную работу студентов с иноязычными аутентичными текстами. Организация материала в учебном издании предполагает также развитие творческой активности обучающихся.

UNIT I. PHYSICS AND ITS BASIC CONCEPTS

Text 1. What is physics?

Exercise 1. Brainstorming. What associations does the word "physics" call to mind? What does this science study? What do we need it for?

Exercise 2. Look through the derivatives of the words "physics" and "science". Complete the sentences below.

physics	***physical***	***physicist***

1. Glass breaking and water freezing are examples of … changes.
2. A … tries to understand what matter is and why it behaves the way it does.
3. … is the study of matter and energy and how they are related.

science	***scientific***	***scientist***

1. Our professor is a prominent … .
2. Physics and mathematics are fundamental … .
3. The students of our department take many … courses.

Exercise 3. Define the part of speech of the following words and translate them into Russian:

Nature – natural; experiment – experimental; theory – theoretical; accurate – accurately; to observe – observation; to relate – relation; to investigate – investigation.

Exercise 4. Read and memorize the following words.

phenomenon (*pl.*-na)	[fɪ′n⊃mɪnən (-nə)]	явление (*мн.* явления)
motion	[məʊʃn]	движение
heat	[hi:t]	тепло, теплота
sound	[saʊnd]	звук, шум
electricity	[ɪlek′trɪsɪtɪ]	электричество
magnetism	[′mægnɪtɪzəm]	магнетизм
light	[laɪt]	свет
research	[rɪ′sə:tʃ]	научное исследование
branch	[bra:ntʃ]	ветвь, отрасль
matter	[′mætə]	материя, вещество
energy	[′enədʒɪ]	энергия

concept	[ˈkɔnsept]	понятие
to relate	[rɪˈleɪt]	связывать, устанавливать отношение между ч.-либо
particle	[ˈpa:tɪkl]	частица
nucleus (*pl.*-lei)	[ˈnju:klɪəs (-laɪ)]	ядро (*мн.* ядра)

Exercise 5. Make sure you know all the words in the box. Read their definitions and match the words with their definitions.

motion heat sound electricity magnetism light matter energy particle nucleus

1. Anything that has mass and volume.
2. The central and most important part of an atom.
3. A change in position relative to fixed object.
4. The ability to cause changes in matter.
5. An energy transferred between materials (or parts of a material) that have different temperatures.
6. A very small piece of something.
7. The phenomenon of physical attraction for iron induced by a moving electric charge of current.
8. Energy producing brightness.
9. Something that can be heard.
10. Energy created by moving charged particles.

Exercise 6. Read the passage about one of the most ancient sciences about nature. Think of your title for it.

What is physics?

Physics is one of the most ancient sciences about nature. The word "physics" takes its origin from a Greek word meaning nature, or natural things.

Physics is the science studying various phenomena in nature: mechanical motion, heat, sound, electricity, magnetism and light. Knowledge obtained from the study of physics is important in other sciences, including astronomy, biology, chemistry and geology. There is also a close connection between physics and practical developments in engineering, medicine and technology. For example, engineers design automobiles and airplanes according to certain principles of physics. Laws and theories of physics have enabled engineers and scientists to put satellites into orbit and to receive information from space probes that travel to distant regions of the solar system. Research in physics has led to the use of radioactive materials in the study, diagnosis and treatment of certain diseases. In addition, theories and principles of physics explain the operation of many modern home conveniences, from vacuum cleaners to videotape recorders.

Physics is divided into two great branches: experimental physics and theoretical physics. Experimental physics is the science of making observations and devising experiments which give us accurate knowledge of the actual behaviour of natural phenomena. On the basis of experimental facts theoretical physics formulates laws and predicts the behaviour of natural phenomena. Every physical law is based on experiments and is devised to correlate and to describe accurately these experiments. The wider the range of experience covered by such a law, the more important it is.

Physics is the science devoted to the study of matter and energy. So, the basic concepts in all physical phenomena are the concepts of matter and energy. Physicists try to understand what matter is made up of. They seek to learn how energy is produced, how it travels from place to place and how it can be controlled. Physicists are also interested in how matter and energy are related to each other and how they affect each other over time and through space.

Physicists study a very wide range of topics. Some physicists investigate the tiny particles that make up matter. Others study the motion of objects. Still other physicists explore the nucleus or seek new ways of using light to communicate.

Exercise 7. The main idea of this passage is…:

1. …to tell the readers about the importance of physics nowadays.
2. ... to tell the readers that there is no need in physics nowadays.
3. ... to tell the readers about physics as a fundamental science.

Exercise 8. Answer the questions.

1. Is physics an ancient science? 2. Where does the word "physics" take its origin from? 3. What phenomena does physics study? 4. Does the knowledge of physical phenomena important for the development of other sciences? Show the connection of physics with other sciences. 5. What is physics divided into? 6. What is experimental physics? 7. What does theoretical physics do? 8. What are all physical laws based on? 9. What are the basic concepts in all physical phenomena? 10. What do physicists study?

Exercise 9. Work in pairs. Discuss the statements below. Say what you think about them and ask your partner if he/she agrees or disagrees with you.

1. Knowledge obtained from the study of physics is important in other sciences.
2. There are no connections between experimental and theoretical physics.
3. Physicists study a very wide range of topics.

Exercise 10. Complete this summary of the passage.

The headline of the article is ... . The article is devoted to one of the most ancient sciences about ... . Physics is the science studying various phenomena such as ... . Knowledge obtained from the study of physics is important in ... . Physics is divided into ... . This science is devoted to the study of ... and ... . Nowadays physicists ... a very wide range of topics

Exercise 11. Discussion.

"My brother wants to learn physics. I believe that if physics is his passion, he will be able to make a good career somewhere in this field, but our parents don't approve of his choice; they think it's not a much beneficial choice for him. They'd rather see him a lawyer or something...How can we convince them that career in physics can provide him with a successful future?"

Exercise 12. Translate the following sentences into English in writing.

1. Вся материя состоит из крошечных частиц, называемых (called) молекулами. 2. Физики планируют эксперименты и наблюдения, чтобы проверить свои гипотезы. 3. Когда научное умозаключение (conclusion) становится общепринятым, оно называется законом или принципом. 4. Понятие было обнаружено Эйнштейном (Einstein). 5. Учёные получили точные данные в эксперименте.

Text 2. Matter

Exercise 1. Brainstorming. What are the basic concepts in all physical phenomena? Can you give the definition of the word "matter"? What properties and states of matter do you know?

Exercise 2. Give the plural forms of the following nouns. Mind your spelling.

An object, a scientist, an atom, a particle, a proton, a neutron, a property, a type, a phenomenon, a criterion, a nucleus, a medium, a datum.

Exercise 3. Read and memorize the following words.

matter	[ˈmætə]	вещество

substance	[′s∧bstəns]	вещество
object	[′⊃bdʒıkt]	предмет, объект
inertia	[ı′nə:ʃjə]	инерция
to resist	[rı′zıst]	сопротивляться,
condition	[kən′dıʃn]	состояние, условие
quantity	[k′w⊃ntıtı]	количество
weight	[weıt]	вес
state	[steıt]	состояние
gaseous	[′gæsjəs]	газообразный
liquid	[′lıkwıd]	жидкий
solid	[′s⊃lıd]	твёрдый
cluster	[′kl∧stə]	сгусток, скопление (частиц)
glassy	[′gla:sı]	стеклообразный
physical property	[′fızık(ə)l ′pr⊃pətı]	физическое свойство
chemical property	[′kemık(ə)l′pr⊃pətı]	химическое свойство
density	[′densıtı]	плотность
volume	[′v⊃ljum]	объём
solubility	[ˌs⊃ljʊ′bılətı]	растворимость
conductivity	[ˌk⊃nd∧k′tıvətı]	проводимость

Exercise 4. Make sure you know all the words in the box. Read their definitions and match the words with their definitions.

inertia mass weight quark plasma   ***density solubility conductivity***

1. Quantitative measure of inertia.
2. A gas that contains approximately equal number of positive and negative electric charges.
3. The ability of matter to conduct heat or electricity.
4. A property of matter by which it stays still or, if moving, continues moving in a strait line unless it is acted on by a force outside itself.
5. The amount of mass for each unit of volume.
6. Gravitational force of attraction an object.
7. The ability of one kind of matter to dissolve in another.
8. A very small particle of matter.

Exercise 5. Use the correct form of the adjectives in brackets. Translate the sentences.

1. Physics is one of the (ancient) sciences about nature. 2. The (wide) the range of experience covered by a law, the (important) it is. 3. An atom is the (small) quantity of an element. 4. (Little) clearly definable states of matter are plasma, clusters and the glassy state. 5. A material body can only move with a velocity (low) than that of light. 6. The rhythm of his clock is (fast) than the rhythm of the clocks on the ground. 7. A small particle of matter accelerated to 86 per cent of the speed of light has twice as (much) mass as it does when it is at rest. 8. The visible universe is made up chiefly of the two (light) elements: hydrogen and helium. 9. The (fast) the molecules move, the (hot) the substance is.

Exercise 6. Read the information about matter and give the examples of physical and chemical properties of matter.

Matter

Matter is the **substance** of which all things are made. All objects **consist** of matter. The objects may differ widely from one another. But they have one thing in common - they all occupy space. Therefore, scientists usually **define** matter as anything that occupies space. All matter has inertia. This means that it resists any change in its condition of rest or of motion. The quantity of matter in an object is called its **mass**, but scientists usually prefer to define mass as a measure of **inertia**. The earth's gravitational attraction for a given mass gives matter its **weight**.

All ordinary matter is made up of atoms. An **atom** is the smallest quantity of an element that can enter into chemical reaction to form a compound. Atoms are **composed of** particles called protons, neutrons, and electrons. Protons and neutrons, in turn, are made up of particles called quarks.

The atoms form larger particles called molecules. Water consists of molecules, each of which contains two atoms of hydrogen and one of oxygen. Atoms and molecules are extremely small. If the molecules in one drop of water were counted at the rate of 10 million each second, a person would need about 5 million years to count them all.

Matter in bulk may have **several states**, the most familiar of which are the gaseous, liquid, and solid states. Less clearly definable but also referred to as states of matter are plasma, clusters, and amorphous conditions such as the glassy state. Each such state exhibits properties that distinguish it from the others.

Matter has **two main types of properties** - physical and chemical.

Physical properties. People recognize certain kinds of matter by sight, smell, touch, taste, or hearing. We can recognize gold by color, sugar by taste, and gasoline by odor. These are examples of physical properties of matter. Another such property is density, the amount of mass for each unit of volume. Solubility (the ability of one kind of matter to dissolve in another) and conductivity (the ability of matter to conduct heat or electricity) are also physical properties. A physical **change** is a change in matter that involves no chemical reaction. When a substance **undergo**es a physical change, the composition of its molecules remains unchanged, and the substance does not lose its chemical identity. Melting, evaporating, and freezing are three types of physical change. Physical changes **include** any alteration in the shape and size of a substance. For example cutting, grinding, crushing, annealing, dissolving, or emulsifying produce physical changes. Still another physical change is sublimation, the change from a solid to a gas.

Chemical properties of matter **describe** how a substance acts when it undergoes chemical change. For example, a chemical property of iron is its ability to combine with oxygen in moist air to form iron oxide, or rust. Scientists call such changes in the composition of matter chemical changes. The properties of the original substance are lost, and new substances with new properties are produced. An example of a chemical change is the production of rust (iron oxide) when oxygen in the air reacts with iron. Chemical changes may also result in physical changes. For example, when wood (a solid) is burned, it is combined with oxygen gas to produce gaseous carbon dioxide (CO2), liquid water, and solid carbon.

Exercise 7. Divide the text into logical parts and give each part a suitable title.

Exercise 8. Agree or disagree with the statements, using the following phrases:

It seems to be right (wrong) … ***To my mind …***
I'm afraid you are mistaken … ***I (don't) believe that …***
I (can't) agree with the statement … ***In my opinion …***
As far as I know … ***It seems unlikely …***

1. All objects consist of matter. But they have nothing in common.
2. An atom is the smallest quantity of an element.
3. Atoms and molecules are not very small
4. The most familiar states of matter are the gaseous, liquid, solid and amorphous.
5. Matter has two main types of properties - physical and chemical.

Exercise 9. Work in pairs. Think of some questions to review the contents of the text and give answers.

Exercise 10. Using the key words give a brief summary of the passage.

Exercise 11. Discussion.

“There is convincing evidence that most of the matter in the universe is not visible. This invisible matter is called dark matter. Many scientists believe that dark matter may not be composed of atoms, or even of electrons, protons, neutrons, or quarks. Instead, it may be composed of yet undiscovered types of particles”.

Find some information in scientific articles about dark matter and discuss it in class.

Exercise 12. Translate the following sentences into English in writing.

1. Ещё древнегреческие философы высказали предположение (to suggest) о том, что любое вещество состоит из мельчайших неделимых (inseparable) частиц – атомов. 2. Открытие (discovery) явления радиоактивности и результаты опытов Резерфорда показали, что атомы состоят из электронов, протонов и нейтронов. 3. В 1963 г. М.Гелл-Ман и Дж.Цвейг предложили гипотезу (to offer a hypothesis) о существовании в природе частиц, названных кварками. 4. Газ, в котором значительная часть атомов или молекул ионизована (ionized), называется плазмой. 5. Аморфными называются тела, физические свойства которых одинаковы по всем направлениям (in all directions). Примерами аморфных тел могут служить куски затвердевшей смолы (resin), янтарь (amber), изделия из стекла.

Text 3. Energy

Exercise 1. Brainstorming. Do the following classroom activities: drop a ball to the floor, roll a toy car down a ramp. What did it take for each of these actions to occur?

Exercise 2. Read and memorize the following words.

to give (off)	[ˈgɪv əf]	выделять, испускать
to store	[st⊃:]	сохранять
force	[f⊃:s]	сила
to apply (to)	[əˈplaɪ]	прилагать
distance	[ˈdɪst(ə)ns]	расстояние
direction	[d(a)ɪˈrekʃn]	направление

to be equal to	[ˈi:kw(ə)l]	равен
power	[ˈpaʊə]	мощность
to distort	[dɪsˈtɔ:t]	деформировать
potential	[pəʊˈtenʃ(ə)l]	потенциальный
kinetic	[kaɪˈnetɪk]	кинетический
thermal	[ˈθə:m(ə)l]	термический, тепловой
nuclear	[ˈnju:klɪə]	ядерный
joule	[dʒu:l]	джоуль
to convert	[kənˈvə:t]	трансформировать, превращать

Exercise 3. Make sure you know all the words in the box. Read their definitions and match the words with their definitions.

energy force power work potential energy joule kinetic energy thermal energy nuclear energy

1. A time rate of doing work.
2. A unit of energy.
3. A push or a pull on an object or a body.
4. The energy produced by splitting the nuclei of atoms and used to produce electricity.
5. The ability to do work.
6. The use of force to produce a movement.
7. Heat energy.
8. A stored energy.
9. The energy of movement.

Exercise 4. Find Russian equivalents to the expressions with the word "energy".

A. To give off/to release energy; to store/to conserve energy; to produce energy; to convert/to transfer energy; to use/to apply energy; to absorb energy; to radiate energy; to consume energy, to waste energy; to deliver energy.

B. Выделять энергию; поглощать энергию; терять энергию; сохранять энергию; потреблять энергию; производить энергию; излучать энергию; превращать энергию; использовать энергию; доставлять энергию.

Exercise 5. Put the verbs in brackets into the correct tense and voice form.

1. The law of conservation and transformation of energy (to discover) in the middle of the 19th century. 2. Special credit in the discovery of this law (to belong) to the German scientists Robert Mayer and Herman Helmholtz and the British scientist James Joule. 3. The great Russian scientist Mikhail Lomonosov (to discover) another law — the law of conservation of mass — a hundred years before the discovery of the law of conservation and transformation of energy. 4. Mechanical energy — potential and kinetic — (to measure) in the same units as work. 5. In nature, engineering and everyday life we can constantly observe how one form of mechanical energy (to transform) into another: potential into kinetic, and kinetic into potential. 6. The mechanical energy of water often (to call) white coal. 7. For many centuries the energy of the wind or running water (to use) to set in motion machines, such as mills. 8. Now electric energy (to operate) machines at plants and factories, at collective and state farms and (to set) in motion trams, trolley-buses, ships and so on. 9. Solar energy (to use) widely in the near future. 10. Today nuclear energy (to use) in many branches of science and engineering.

Exercise 6. Read the passage about energy and prove that it is one of the most basic ideas of science.

Energy

All human life depends upon the energy in the universe. Most of the energy on earth comes from the sun. It travels from the sun to the earth in the rays that the sun gives off. The sun's rays are needed so that plants can make food. The food that plants make is the food on which all the animals in the world depend in order to live. Animals and human beings use the energy found in food to operate their bodies and muscles. The sun's energy is stored up in coal, wood, and oil, which people burn to do work for them. The sun evaporates the water which falls as rain. This causes rivers to flow and produces other energy that people can use.

Energy is one of the most basic ideas of science. All occurrences in the universe can be explained in terms of energy and matter. But the definition of energy is not at all simple since energy occurs in many different forms, and it is not always easy to tell how these forms are related to one another and what they have in common. One of the best-known definitions of energy is the classical definition used in physics: Energy is the ability to do work.

Physicists define work in a way that does not always agree with the average person's idea of work. In physics, work is done when a force applied to an object moves it some distance in the direction of the force. Mathematically, $W=Fs$, where W is the work done, F is the force applied, and s is the distance moved. If either F or s is equal to zero, W is also equal to zero.

People often confuse energy, power, and force. Force in mechanics is any action that tends to maintain or alter the position of a body or to distort it. In other words, it is a push or a pull on an object or body. Power in science and engineering, is a time rate of doing work or delivering energy.

Energy may exist in potential, kinetic, thermal, electrical, chemical, nuclear, or other various forms. All forms of energy are associated with motion. For example, any given body has kinetic energy if it is in motion. A tensioned device such as a bow or spring, though at rest, has the potential for creating motion; it contains potential energy because of its configuration. Similarly, nuclear energy is potential energy because it results from the configuration of subatomic particles in the nucleus of an atom.

In the metric system, energy is measured in joules. One joule equals the amount of work done by moving an object a distance of one meter against the opposition of one newton of force.

Energy can be converted from one form to another in various ways. Usable mechanical or electrical energy is, for instance, produced by many kinds of devices, including fuel-burning heat engines, generators, batteries, fuel cells, and magnetohydrodynamic systems.

Exercise7. Complete these sentences with the information from the text. Put them in the right order.

1. All occurrences in the universe can be explained in terms of …
2. It can be converted from …
3. Physicists define work …
4. All human life depends upon …
5. One of the best-known definitions of energy is …
6. Energy is measured in …
7. Force in mechanics is …
8. Energy may exist in …

Exercise 8. Answer the questions.

1. Where does energy on earth come from? 2. Why do we need the sun’s rays? 3. What is one of the most basic ideas of science? 4. The definition of energy is not simple, is it? 5. What is the classical definition of energy used in physics? 6. Give the definitions of force and power. 7. What forms may energy exist in? 8. Are all forms of energy associated with motion? Give examples. 9. How is energy measured in the metric system? 10. Can energy be converted from one form to another or not?

Exercise 9. Find the key words and give a brief summary of the passage.

Exercise 10. Work in pairs. Read a short dialogue about energy-saving and make up your own dialogues by analogy.

- Hi, Nick!
- Hi, Dan!

Yesterday we were taught how to conserve energy. I can say that I'm an energy super saver. I turn off unneeded lights, use cold water instead of hot when possible, I don't leave the refrigerator door open and many other things. And how do you save energy?- I turn off all appliances when I leave the room, open the curtains during a sunny day and use energy efficient light bulbs.

Exercise 11. Discussion.

"Many people are interested in going green, but don't know how to start. There are so many ways that renewable and alternative energy sources can protect the environment".

Give the tips how to implement green energy strategies at home.

Exercise 12. Translate the following sentences into English in writing.

1. Энергия (от греч. *energeia* – действие, деятельность) – общая количественная мера различных форм движения материи. В физике соответственно различным физическим процессам различают энергию механическую, тепловую, электромагнитную, гравитационную, ядерную и т.д. 2. Работа – количественная характеристика преобразования энергии в физических процессах. Работа системы положительна, если она отдает энергию, и отрицательна, если получает. 3. Сила – величина векторная и в каждый момент времени характеризуется численным значением, направлением в пространстве и точкой приложения. 4. Мощность – физическая величина, измеряемая отношением работы к промежутку времени, в течение которого она совершена. Ватт – единица мощности. 5. Джоуль - единица энергии, работы и количества теплоты СИ.

Self Check

1. Where does the word physics take its origin from?
   a) a Latin word b) a Greek word c) an English word
2. Physics is a science about …
   a) Physiology b) nature c) mechanics
3. Physics is divided into two great branches:
   a) historical and economical b) atomic and electronic
   c) experimental and theoretical
4. Physics is devoted to the study of …
   a) matter and energy b) matter and work c) matter and force
5. What are all physical laws based on?
   a) theories b) concepts c) experiments
6. A property of matter by which it continues in its existing state of rest or uniform motion in a straight line, unless that state is changed by an external force.
   a) force b) work c) inertia
7. All objects consist of …
   a) matter b) substance c) water
8. Matter in bulk may have several …
   a) statuses b) states c) forms
9. Matter has two main types of … - physical and chemical.
   a) properties b) states c)characteristics
10. The production of rust (iron oxide) is an example of …
    a) a physical change b)a chemical change c) both changes
11. A unit of energy.
    a) watt b) joule c) ohm
12. What is the ability to do work?
    a) energy b) electricity c) power
13. Any given body has … energy if it is in motion.
    a) potential b) thermal c) kinetic
14. All forms of energy are associated with
    a) matter b) motion. c) time
15. People often confuse energy, power, and …
    a) force b) work c) job

UNIT II. SCIENCE, TECHNOLOGICAL PROGRESS AND SOCIETY

Text 1. The Nobel Prize

Exercise 1. Brainstorming. Who founded the Nobel Prize? When was it founded? Where does it take place?

Exercise 2. Pay attention to the following word combinations. Pick out sentences with these words from the passage and translate them into Russian.

The Nobel Prize – Нобелевская премия;
The Nobel Memorial Prize in Economic Science – Премия памяти Нобеля по экономике;
The Nobel Foundation – Нобелевский фонд;
The Royal Swedish Academy of Sciences – Королевская академия наук;
The Karolinska Institute – Королевский медико-хирургический институт;
The Norwegian Nobel committee – Нобелевский комитет норвежского парламента.

Exercise 3. Read and memorize the following words.

to award	[ə′w⊃:d]	присуждать что-л.; награждать чем-л.
to commemorate	[kə′meməreɪt]	отмечать, праздновать
peace prize	[′pi:s ′praɪz]	премия по укреплению мира
to take place	[′teɪk ′pleɪs]	случаться, происходить
to select	[sɪ′lekt]	отбирать, выбирать
board of directors	[′b⊃:d ,əv ′d(a)ɪrektəz]	совет директоров
nomination	[,n⊃mɪ′neɪʃ(ə)n]	выставление, выдвижение кандидата
laureate	[′l⊃:rɪɪt]	лауреат
significance	[sɪg′nɪfikəns]	важность, значимость
to pioneer	[,paɪə′nɪə]	быть первооткрывателем;
superfluid	[,s(j)ʊ:pə′flu:ɪd]	сверхтекучесть
strong interaction	[′str⊃ŋ ,ɪntə′rækʃ(ə)n]	сильное взаимодействие
precision spectroscopy	[prɪ′sɪʒn spek ′tr⊃skəpɪ]	точная спектроскопия
blackbody	[,blæk′b⊃dɪ]	*физ.* абсолютно чёрное тело

groundbreaking	[ˈgraʊndbreɪkɪŋ]	большой, значительный
CCD (charge-coupled device)	[ˈtʃa:dʒˈkʌpld dɪˈvaɪs]	прибор с зарядовой связью (ПЗС)

Exercise 4. Mind the meanings of the following derivatives. Complete the sentences below.

To discover→ discovery → discoverer → discovered

1. These dinosaur remains were one of the most important … of the century. 2. Scientists around the world are working … a cure for Aids. 3. Alexander Fleming is the … of penicillin. 4. Who … America? 5. I was the lucky … of a very valuable painting. 6. Researchers in this field have made some new important … . 7. In 1974 Hawking … that black holes give off radiation. 8. The drug is not a new … – it's been known about for years.

Exercise 5. Choose the right word.

1. The Nobel Prize is any of the prizes that are *rewarded / awarded* annually by four institutions. 2. The money is taken from a fund established under the *will / want* of Alfred Bernhard Nobel. 3. The first Nobel prizes were given on December 10, 1901, the fifth anniversary of the death of the *founder / finder*. 4. An additional award, the Prize for Economic Science in Memory of Alfred Nobel, was *set in / set up* in 1968 by the Bank of Sweden, and the first award was given in 1969. 5. Each award consists of a gold medal and a diploma *bearing / passing* the winner's name and a sum of money, the *quantity / amount* depending on the income of the foundation. 6. The *collection / selection* of the prize-winners starts in the early autumn of the year preceding the awards. 7. A prize is either given *hole / entire* to one person, divided equally *between / among* at most two works, or shared jointly by two or three persons.

Exercise 6. Read the passage about the Nobel Prize and say in what fields it is awarded.

The Nobel Prize

The Nobel Prize is an annual international monetary prize. The prize was established by a Swedish chemist and the inventor of dynamite Alfred Bernhard Nobel who left 31 million Swedish kronor.

Under his will the capital was to be invested by his executors in safe securities and constitute a fund, the interest on which was to be annually distributed in the form of prizes "to those who, during the preceding year, shall have conferred the greatest benefit on mankind". The prize was to be awarded in five fields: physics, chemistry, physiology or medicine, literature, and peace. But in 1968 the Riksbank, the central bank of

Sweden, created an economics prize to commemorate the bank's 300th anniversary. This prize, called the Nobel Memorial Prize in Economic Science, was first awarded in 1969. The bank provides a cash award equal to the other Nobel prizes. The Nobel prizes are internationally recognized as the most prestigious awards in each of these fields with the Prize in Economics, which is commonly identified with them.

The first Nobel prizes were awarded on December 10, 1901, the fifth anniversary of Nobel's death. They are presented annually at ceremonies in Stockholm, Sweden, and in Oslo, Norway, on this day. In Stockholm, the king of Sweden presents the awards in physics, chemistry, physiology or medicine, literature, and economic sciences. The peace prize ceremony takes place at the University of Oslo in the presence of the king of Norway. After the ceremonies, Nobel Prize winners give a lecture on a subject connected with their prize-winning work. The winner of the peace prize lectures in Oslo, the others in Stockholm. The lectures are later printed in the Nobel Foundation's annual publication, *Les Prix Nobel* (The Nobel Prizes).

In his will, Nobel stated that the prizes for physics and chemistry would be awarded by the Royal Swedish Academy of Sciences, the prize for physiology or medicine by the Karolinska Institute in Stockholm, the literature prize by the Swedish Academy in Stockholm, and the peace prize by a five-person committee elected by the Norwegian Parliament. After the economics prize was created in 1968, the Swedish Academy of Sciences has held the responsibility of selecting the winners of that award.

The fund is controlled by a board of directors, which serves for two-year periods and consists of six members: five elected by the trustees of the awarding bodies mentioned in the will, and the sixth appointed by the Swedish government. All six members are either Swedish or Norwegian citizens.

All the prize-awarding bodies have set up Nobel committees consisting of three to five people who make recommendations in the selection process. Additional specialists with expertise in relevant fields assist the committees. The Nobel committees examine nominations and make recommendations to the prize-awarding institutions. After deliberating various opinions and recommendations, the prize-awarding bodies vote on the final selection, and then they announce the winner. The deliberations and voting are secret, and prize decisions cannot be appealed.

A prize for achievement in a particular field may be awarded to an individual, divided equally between two people, or awarded jointly among two or three people. According to the Nobel Foundation's statutes, the prize cannot be divided among more than three people, but it can go to an institution. A prize may go unawarded if no candidate is chosen for the year under consideration, but each of the prizes must be awarded at least once every five years. If the Nobel Foundation does not award a prize in a given year, the prize money remains in the trust. Likewise, if a prize is declined or not accepted before a specified date, the Nobel Foundation retains the prize money in its trust.

The prize amounts are based on the annual yield of the fund capital. In 1948 Nobel prizes were about $32,000 each; in 1997 they were about $1 million each. Since 2001 the grant has been 10,000,000 Swedish kronor (approximately $1.4 million as of August 2009). In addition to a cash award, each prizewinner also receives a gold medal and a diploma bearing the winner's name and field of achievement. Prizewinners are known as Nobel laureates.

The Nobel Prize in Physics requires that the significance of achievements being recognized is "tested by time." In practice it means that the lag between the discovery and the award is typically on the order of 20 years and can be much longer. For example, half of the 1983 Nobel Prize in Physics was awarded to Subrahmanyan Chandrasekhar for his work on stellar structure and evolution that was done during the 1930s. As a disadvantage of this approach, not all scientists live long enough for their work to be recognized. Some important scientific discoveries are never considered for a prize, as the discoverers may have died by the time the impact of their work is realized.

Among the latest Nobel Prizes in Physics are:

2008	1) YOICHIRO NAMBU for the discovery of the mechanism of spontaneous broken symmetry in subatomic physics. 2) MAKOTO KOBAYASHI and TOSHIHIDE MASKAWA for the discovery of the origin of the broken symmetry which predicts the existence of at least three families of quarks in nature.
2009	1) CHARLES K. KAO “for groundbreaking achievements concerning the transmission of light in fibers for optical communication”. 2) WILLARD S. BOYLE and GEORGE E. SMITH “for the invention of an imaging semiconductor circuit - the CCD sensor”.
2010	ANDRE GEIM and KONSTANTIN NOVOSELOV “for groundbreaking experiments regarding the two-dimensional material grapheme”
2011	SAUL PERLMUTTER, the other half jointly to BRIAN P. SCHMIDT and ADAM G. RIESS “for the discovery of the accelerating expansion of the Universe through observations of distant supernovae”.
2012	SERGE HAROCHE and DAVID J. WINELAND "for ground-breaking experimental methods that enable measuring and manipulation of individual quantum systems"

Exercise 7. Answer the following questions.

1. What is the Nobel prize? 2. Who established it? 3. What fields is this award given in? 4. When and where is the Nobel prize commemorated? 5. What institutions award the Nobel prize? 6. What is the function of Nobel committees? 7. How are prize-winners chosen? 8. How much is the Nobel prize? 9. What is a disadvantage of choosing Nobel laureates?

Exercise 8. Be prepared to say a few words about:

- The founder of the Nobel Prize.
- The fields in which the Nobel Prize is awarded.
- The procedure of choosing a prize-winner.
- The latest Nobel Prizes in Physics.

Exercise 9. Here are the twentieth-century discoveries and inventions in physics. Using the Internet, fill in the table. The data in the table are correct.

Data	Contributors	Discoveries and inventions
1900	Max Planck	
1911	Ernest Rutherford	
1929		the first cyclotron
1932	James Chadwick	
1946		the nuclear reactor
1947		the transistor
1952	Edward Teller	
1960		the first laser
1964	Murray Gell-Mann	
1971	The Intel Corporation	
1980		the compact disc
1983		the Internet

Contributors: Enrico Fermi, Philips Electronics N.V. and Sony Corporation, Ernest Lawrence, Theodore H. Maiman, Bell Telephone Laboratories physicists, Tim Berners Lee.

Discoveries and inventions: quantum theory, the neutron, the concept of the "quark", the first microprocessor, modern theory of atomic structure, the first hydrogen bomb.

Exercise 10. Work in pairs. Choose one of the discoveries from ex.9 and persuade your friend that this discovery is the most significant in physics.

Exercise 11. Translate the following sentences into English in writing.

1. Нобелевская премия — одна из наиболее престижных международных премий, присуждаемая за выдающиеся научные исследования, революционные изобретения или крупный вклад в культуру или развитие общества. 2. Нобелевские премии учреждены в соответствии с завещанием Альфреда Нобеля. 3. Согласно его завещанию, оставшийся после его смерти капитал (31 млн. шведских крон) составил Нобелевский фонд. 4. Согласно завещанию Нобеля, премия должна присуждаться за открытия, изобретения и достижения, сделанные в год присуждения.5. Ряд ученых умирает раньше, чем их открытия или изобретения проходят необходимую для присуждения премии «проверку временем».

Text 2. X-rays

Exercise 1. Brainstorming. Who discovered X-rays? What kinds of X-rays do you know? Where are they used?

Exercise 2. Read and memorize the following words.

X-rays	[ˈeksreɪz]	*часто pl.* рентгеновские лучи, рентгеновское излучение
cathode rays	[ˈkæθəʊd ˈreɪz]	катодовые лучи
to emit	[ɪˈmɪt]	излучать, выделять *(свет, тепло, запах и т. п.)*; выбрасывать
discharge tube	[dɪsˈtʃa:dʒ ˌtju:b]	газоразрядная трубка
visible	[ˈvɪzəbl]	видимый
ultraviolet	[ˈʌltrəˈvaɪəlɪt]	ультрафиолетовый
nuclear fission	[ˈnju:klɪə ˈfɪʃ(ə)n]	ядерное деление
angstrom	[ˈæŋstrəm, ˈæŋstrɔm]	ангстрем *(единица длины, 10^{-8} см)*
soft X-rays	[ˈsɔft ˈeksreɪz]	мягкий рентген
hard X-rays	[ˈha:d ˈeksreɪz]	жесткий рентген
opaque	[əʊˈpek]	непрозрачный; не пропускающий *(свет)*
incident beam	[ˈɪnsɪdənt ˈbi:m]	падающий луч
to diffract	[dɪˈfrækt]	дифрагировать, преломлять *(лучи)*
crystallography	[ˌkrɪstəˈlɔgrəfɪ]	кристаллография
spesimen	[ˈspesɪmɪn]	образец, экземпляр
cast metal	[ˈka:st ˈmetal]	литой металл
detection	[dɪˈtekʃ(ə)n dɪ	1) датчик

device	′vaɪs]	2) детектор
X-ray picture		рентгенограмма

Exercise 3. Translate the following sentences into Russian paying attention to negative constructions. Remember that in English two negatives are not used in the same construction as in Russian.

1. The gamma rays do not carry a charge of electricity and are not deflected by either an electric or a magnetic field. 2. The gamma rays are undeflected. 3. Not knowing the exact size and shape of the ring we cannot say what the exact function *f (r)* should be. 4. This never causes a violation of the conservation of energy principle. 5. No actual source emits radiation that is truly monochromatic. 6. No surface ever reflects all the light incident upon it. 7. It is impossible to describe the shape of a wave front in simple mathematical terms unless it is either plane or spherical. 8. Neither change in temperature nor electrical excitation nor any change in physical conditions affects the rate of decay of radioactive substances. 9. Unfortunately no such calculation has so far been reported.

Exercise 4. Make sure you know all the words in the box. Read their definitions and match the words with their definitions.

discharge tube	***fluorescence***	***diffraction***
X-rays	***emulsion***	***nuclear fission***

1. A type of radiation that can pass through objects that are not transparent and make it possible to see inside them.
2. A tube filled with low-pressure gas that glows when it conducts electricity at a given voltage.
3. The spontaneous or induced splitting of an atomic nucleus into smaller parts, usually accompanied by a significant release of energy.
4. A substance on the surface of photographic film that makes it sensitive to light.
5. The bending or spreading out of waves, e.g. of sound or light, as they pass around the edge of an obstacle or through a narrow aperture.
6. The emission of electromagnetic radiation, especially light, by an object or substance exposed to radiation or bombarding particles.

Exercise 5. Read the passage and name the main kinds and properties of X-rays.

X-rays

Wilhelm Röntgen (1845 – 1923) was the first person to receive the Nobel Prize in physics for his discovery of X-rays. Röntgen made his discovery while investigating the effects of cathode rays that were produced by electrical discharges through gases at low pressures (cathode rays are electrons that are emitted from the negative electrode, or cathode, of the discharge tube). Although many scientists had studied the properties of cathode rays, Röntgen discovered an effect that had escaped these earlier investigators — namely, that a surface coated with barium platinocyanide placed outside a discharge tube would emit light (fluoresce) even when it was shielded from the direct visible and ultraviolet light of the gaseous discharge. He deduced that an invisible radiation from the tube passed through the air and fluoresced the screen. He named these strange new rays X-rays to indicate their unknown nature.

The immediate value of X-rays was great, particularly to medicine, however, their importance was much greater to the whole of physics and natural knowledge, for the discovery of X-rays provided the key to many branches of physics. This discovery was followed by a number of unexpected discoveries like that of radioactivity in 1896, of the structure of crystals in 1912, of the neutron in 1932, of nuclear fission in 1938, and of mesons between 1936 and 1947. This revolutionary development includes great theoretical achievements of synthesis like Planck's quantum theory in 1900, Einstein's special relativity theory in 1905 and his general in 1916, the Rutherford-Bohr atom in 1913 and the new quantum theory in 1925.

X-rays are electromagnetic radiation ranging in wavelength from about 1/100 of an angstrom unit to 100 angstrom units. An angstrom unit equals about 4/1,000,000,000 of an inch (0.00000001 centimeter). The shorter the wavelength of the X-ray, the greater is its energy and its penetrating power. Longer wavelengths, near the ultraviolet-ray band of the electromagnetic spectrum, are known as soft X-rays. The shorter wavelengths, closer to and overlapping the gamma-ray range, are called hard X-rays. A mixture of many different wavelengths is known as "white" X-rays, as opposed to "monochromatic" X-rays, which represent only a single wavelength. Both light and X-rays are produced by transitions of electrons that orbit atoms, light by the transitions of outer electrons and X-rays by the transitions of inner electrons.

X-rays affect a photographic emulsion in the same way light does. Absorption of X-radiation by any substance depends upon its density and atomic weight. The lower the atomic weight of the material, the more transparent it is to X-rays of given wavelengths. When the human body is X-rayed, the bones, which are composed of elements of higher atomic weight than the surrounding flesh, absorb the radiation more effectively and therefore cast darker shadows on a photographic plate. Another type of radiation, which is known as neutron radiation and is now used in some types of radiography, produces almost opposite results. Objects that cast dark shadows in an X-ray picture are almost always light in a neutron radiograph.

X-rays also cause fluorescence in certain materials, such as barium platinocyanide and zinc sulphide. If a screen coated with such fluorescent material is substituted for the photographic films, the structure of opaque objects may be observed directly. This technique is known as fluoroscopy.

Another important characteristic of X-rays is their ionizing power, which depends upon their wavelength. The capacity of monochromatic X-rays to ionize is directly proportional to their energy. This property provides a method for measuring the energy of X-rays. When X-rays are passed through an ionization chamber, an electric current is produced that is proportional to the energy of the incident beam.

The principal uses of X-radiation are in the field of scientific research, industry, and medicine.

X-rays have been used to analyze the arrangement of atoms in many kinds of substances, particularly crystals. The atoms in crystals are arranged in planes, with regular spacing between each plane. When a beam of X-rays travels through a crystal, the planes of atoms act as tiny mirrors that diffract the rays into a regular pattern. Each type of crystal has a different diffraction pattern. Scientists have learned much about the arrangement of atoms in crystals by studying the various diffraction patterns. The study of how crystals diffract X rays is known as X-ray crystallography. Scientists also use X-rays to help analyze the structure and makeup of many complex chemical substances, such as enzymes and proteins.

A number of recent applications of X-rays in research are assuming increasing importance. Microradiography, for instance, produces fine-grain images that can be enlarged considerably. Two radiographs can be combined in a projector to produce a three-dimensional image called a stereoradiogram. Color-radiography is also used to enhance the detail of X-ray photographs; in this process, differences in the absorption of X-rays by a specimen are shown as different colors. Extremely detailed and analytical information is provided by the electron microprobe, which uses a sharply defined beam of electrons to generate X-rays in an area of specimen as small as 1 micrometer (about 1/25,000 in) square.

In industry X-rays are used to inspect products made of various kinds of materials, including aluminum, steel, and other cast metals. Radiographs reveal cracks and other defects in these products that are not visible on the surface. X-rays are also used to check the quality of many mass-produced products, such as transistors and other small electronic devices. Some metal detection devices work by means of X-rays. They include the scanners used at airports to check for weapons in luggage.

In medicine X-rays are widely used to make radiographs (X-ray pictures) of the bones and internal organs of the body. Radiographs help physicians detect abnormalities and disease conditions, such as broken bones or lung disease, inside a patient's body. Dentists take X-ray pictures to reveal cavities and impacted teeth.

Exercise 6. Complete the following sentences.

1. Wilhelm Röntgen received the Nobel Prize in physics for … . 2. The value of X-rays was … . 3. X-rays are … . 4. Absorption of X radiation depends upon … . 5. The main properties of X-rays are … . 6. The use of X-radiation in the field of scientific research is … . 7. In industry X-rays are used … . 8. In medicine X-rays are widely used … .

Exercise 7. Work in pairs. Think of some questions to review the contents of the text and give answers.

Exercise 8. Be prepared to say a few words about:

- The history of the discovery of X-rays.
- Different kinds of X-rays.
- The main properties of X-rays (fluorescence, ionization, X-ray diffraction)
- Applications of X-rays in different fields.

Exercise 9. Skim the passage rapidly (2 min.) and answer the following questions.

1. Did Becquerel observe in the experiment exactly what he expected to see?
2. What three rays did the original beam split into?
3. What were these rays called?

In order to study the nature of the discovered radiation, Becquerel arranged the following very simple experiment. He placed a small amount of uranium in a deep hole made in a lead block so that only a thin beam of radiation emerged from the groove. He also placed a magnet over the block in such a way that the magnetic lines of force were running perpendicular to the direction of the emerging beam. Under these conditions one could expect three different results.

If the radiation emitted by uranium were short electromagnetic waves similar to X-rays, no deflection should take place.

If, on the other hand, the radiation were fast-moving electric particles, like the cathode and anode rays in J.J. Thomson’s tube, the beam should be deflected to the left in the case of a negative charge and to the right in the ease of a positive one. In Becquerel’s experiment all three things happened, and the original beam emerging from the hole split into three parts. The part that consisted of particles carrying a positive charge was named a-rays and was later proved (by Rutherford) to be a stream of doubly ionized helium atoms, i.e. a stream of helium nuclei. The part consisting of negatively charged particles, which turned out to be ordinary electrons, was named (β-rays, whereas the undeflected beam formed by short-wave electromagnetic radiation similar to X-rays received the name of γ-rays.

Exercise 10. Re-read the passage and say a few words about the three kinds of radioactive rays.

Exercise 11. Give a headline to the text.

Exercise 12. Translate the following passage into English in writing.

До открытия природной радиоактивности в конце XIX в. ядерные процессы оставались неизвестными.

Испускание излучения ураном, открытое в 1896 г. А.Беккерелем, было первым явлением ядерного происхождения, наблюдаемым человеком. В то время были только что открыты В.Рентгеном Х-лучи, создаваемые катодными лучами в трубках, в которых наблюдалась также сильная флуоресценция. А.Пуанкаре выдвинул гипотезу, что испускание Х- лучей может быть связано с явлением флуоресценции. А.Беккерель, желая проверить это предположение, использовал в качестве флуоресцирующих веществ соли урана, применявшиеся в работах его отцом. Он обнаружил, что соли действительно испускают излучение, способное производить фотографическое действие через листок бумаги и ионизировать воздух подобно рентгеновским лучам, однако испускание этого излучения наблюдается также хорошо и с нефлуоресцирующими соединениями урана. Мари Кюри предприняла изучение этого нового явления в декабре 1897: она произвела ионизационным методом точное измерение интенсивности излучения урана и показала, что аналогичное излучение испускается торием.

Text 3. The Laser

Exercise 1. Brainstorming. Who built the first laser? What are the main types of lasers?

Exercise 2. Read and memorize the following words.

beam	[bi:m]	луч

optical cavity	[′⊃ptık(ə)l ′kævıtı]	оптический резонатор
continuous beam	[kən′tınjuəs]	непрерывный пучок
pulsed lasers		импульсный лазер
continuous-wave laser		лазер непрерывного излучения
solid-state laser		лазер на твёрдом теле, твердотельный лазер
semiconductor laser	[,semıkən′d∧ktə]	полупроводниковый лазер
gas laser		газовый лазер
dye laser	[daı]	лазер на красителе, лазер на красителях
crystal laser		лазер на кристалле
diode laser	[′daıəʊd]	лазерный диод, диодный лазер
infrared	[,ınfrə′red]	инфракрасный
carbon dioxide laser	[′ka:b(ə)n daı ′⊃ksaıd]	лазер на углекислом газе
to convert	[′k⊃nvə :t]	преобразовывать
dissolved	[dı′z⊃lvd]	растворенный

Exercise 3. Devide the following participles into two groups: participle I and participle II.

Transmitted, looking for, called, enclosing, reflected, made, enclosed, adjusted, information-carrying, opening, convinced.

Exercise 4. Make up word-combination.

Model: concerned with
discussing a theory

1. transmitted
2. looking for
3. a structure
4. a reflected
5. a rod
6. enclosed
7. used
8. infrared
9. dissolved
10. the information-carrying

a. in eye surgery
b. in glass
c. capacity
d. over long distances
e. light
f. a problem
g. in a liquid
h. beams
i. made of a solid material

j. enclosing the active medium

Exercise 5. Read the passage, name the types of lasers and be ready to discuss their differences.

The laser

Laser is a device that produces a very narrow, powerful beam of light. Some beams are thin enough to drill 200 holes on a spot as tiny as the head of a pin. The ability to focus laser light so precisely makes it extremely powerful. For example, some beams can pierce a diamond, the hardest natural substance. Others can trigger a small nuclear reaction. A laser beam also can be transmitted over long distances with no loss of power. Some beams have reached the moon.

In 1960, the American physicist Theodore H. Maiman built the first laser. His laser used a ruby rod as its active medium. At first, lasers had few uses, and scientists often thought of them as "a solution looking for a problem." Today, however, lasers rank among the most versatile and important tools in modern life.

A typical laser has three main parts. These parts are (1) an energy source, (2) a substance called an active medium, and (3) a structure enclosing the active medium known as an optical cavity. The energy source supplies an electric current, light, or other form of energy. The atoms of the active medium can absorb the energy, store it for a while, and release the energy as light. Some of this light triggers other atoms to release their energy. More light is added to the triggering light. Mirrors at the ends of the optical cavity reflect the light back into the active medium. The reflected light causes more atoms to give off light. The light grows stronger, and part of it emerges from the laser as a narrow beam. Some beams are visible. Others consist of invisible forms of radiation.

There are four main types of lasers. These types are (1) solid-state lasers, (2) semiconductor lasers, (3) gas lasers, and (4) dye lasers.

Solid-state lasers use a rod made of a solid material as the active medium. Substances made of crystals or glass are widely used. The most common crystal laser contains a small amount of the element neodymium (chemical symbol Nd) enclosed in an yttrium aluminum garnet (YAG) crystal. It is called an Nd:YAG laser. In some lasers, the neodymium is enclosed in glass. Flash lamps are generally used to pump the active mediums of solid-state lasers. Nd:YAG and Nd:glass lasers are used widely in industry to drill and weld metals. They are also found in range finders and target designators.

Semiconductor lasers, also called diode lasers, use semiconductors, which are materials that conduct electricity but do not conduct it as well as copper, iron, or other true conductors. Semiconductors used in lasers include compounds of metals such as gallium, indium, and arsenic. The semiconductor in a laser consists of two layers that differ in their electric properties. The junction between the layers serves as the active medium. When current flows across the junction, a population inversion is produced. Flat ends of the semiconductor materials serve as mirrors and reflect the photons. Stimulated emission occurs in the junction region. Semiconductor lasers are the most commonly used type of laser because they are smaller and lighter and use less power than the other kinds. Their size makes them ideal for use in CD and videodisc players and for fiber-optic communications.

Gas lasers use a gas or mixture of gases in a tube as the active medium. The most common active mediums in gas lasers include carbon dioxide, argon, krypton, and a mixture of helium and neon. The atoms in gas lasers are excited by an electrical current in the same way that neon signs are made to light. Gas lasers are commonly used in communications, eye surgery, entertainment, holography, printing, and scanning. Many gas lasers produce infrared beams. The most important one is the carbon dioxide laser. It ranks among the most efficient and powerful lasers. Carbon dioxide lasers convert 5 to 30 percent of the energy from their energy source into laser light. Many other lasers convert only about 1 percent of the energy they get. Carbon dioxide lasers can produce beams ranging from less than 1 watt to more than 1 million watts. They are often used to weld and cut metals. They also are used as laser scalpels and in range finders.

Dye lasers use a dye as the active medium. Many kinds of dyes can be used. The dye is dissolved in a liquid, often alcohol. A second laser is generally used to pump the atoms of the dye. The most important property of dye lasers is that they are tunable - that is, a single laser can be adjusted to produce monochromatic beams over a range of wavelengths, or colors. Tunable lasers are valuable to researchers who investigate how materials absorb different colors of light.

Today, the enormous information-carrying capacity of optical fibers is opening a new era in home entertainment, communication, and computer technology. Even so, researchers remain convinced that the most exciting and revolutionary uses of lasers still lie ahead.

Exercise 6. Work in pairs. Begin the following sentences with the words:

I wonder (if)…	***I'm interested to know …***
I want to know…	***It is interesting to know…***
I'd like to know …	***It is of great interest for me …***

Model: These data are reliable.

I want to know if these data are reliable.

1. Laser is a device that produces a very narrow, powerful beam of light.

2. What makes it extremely powerful? 3. Who built the first laser? 4. A typical laser has three main parts. What are they? 5. There are four main types of lasers. Name them. 6. Solid-state lasers use a rod made of a solid material as the active medium. 7. Semiconductor lasers, also called diode lasers, use semiconductors. 8. Gas lasers use a gas or mixture of gases in a tube as the active medium. 9. Dye lasers use a dye as the active medium.
10. Where can we use lasers?

Exercise 7. Be prepared to say a few words about:

- The structure of the laser.
- The types of lasers and their differences.
- Fields of applications.

Exercise 8. Find the key words and give a brief summary of the passage.

Exercise 9. Discussion. You have learnt that laser can be focused to produce great heat. Discuss in class how this property of laser light might be used in medicine.

Exercise 10. Translate the following passage into English in writing.

Применение лазеров

Широкое применение лазеров обусловлено свойствами их излучения — малой расходимостью луча, монохроматичностью и когерентностью излучения.

Полупроводниковые лазеры используются в качестве прицелов ручного оруждия и указок, в проигрывателях компакт-дисков, как мощные источники света в маяках. Газовые лазеры применяются в геодезических нивелирах, дальномерах и теодолитах; в метрологии — как эталоны частоты и времени; для записи голограмм. Лазеры на красителях и других рабочих средах используются для зондирования атмосферы. Мощные технологические лазеры на парах металлов и молекулах (в основном на $CO2$) — для резки, сварки и обработки материалов. Эксимерные лазеры применяются в медицине для терапевтического воздействия и хирургического вмешательства. Лазеры используют для осуществления термоядерной реакции (т. н. «инерциальный способ»), сортировки изотопов, в тонких физических и химичесчких экспериментах.

Self Check

1. When were the first Nobel Prizes awarded?
a) 1968 b) 1901 c) 1969
2. Where are Nobel Prizes awarded?
a) in Stockholm b) in Oslo c) in Stockholm and Oslo
3. In what field is the Nobel Prize not awarded?
a) literature b) mathematics c) physics
4. Who examines nominations and makes recommendations to the prize-awarding institutions?
a) the Nobel committees b) a board of directors c) laureates
5. According to the Nobel Foundation's statutes, how many people can't the Nobel prize be divided among?
a) 1 b) 2 c) 3
6. Whom were X-rays discovered by?
a) Isaac Newton b) Wilhelm Röntgen c) Albert Einstein
7. X-rays are measured in … .
a) ohms b) newtons c) angstroms
8. Longer wavelengths, near the ultraviolet-ray band of the electromagnetic spectrum, are known as … .
a) soft X-rays b) hard X-rays c) "white" X-rays
9. The shorter wavelengths, closer to and overlapping the gamma-ray range, are called … .
a) soft X-rays b) hard X-rays c) "white" X-rays
10. A mixture of many different wavelengths is known as … .
a) soft X-rays b) hard X-rays c) "white" X-rays
11. Who built the first laser?
a) Albert Fert b) Theodore H. Maiman c) Zhores I.Alferov
12. A typical laser has … main parts.
a) 2 b) 3 c) 4
13. There are … main types of lasers.
a) 2 b) 3 c) 4
14. What lasers use gas or mixture of gases in a tube as the active medium?
a) solid-state lasers b) dye lasers c) gas lasers
15. What lasers use a rod made of a solid material as the active medium?
a) solid-state lasers b) dye lasers c) gas lasers

UNIT III. MODERN ISSUES, DISCOVERIES AND TECHNOLOGIES

Text 1. Nuclear energy

Exercise 1. Brainstorming. What is nuclear energy? Where is it applied?

Exercise 2. Read and memorize the following words.

nuclear energy	[′nju:klıə ′enədʒı]	атомная энергия, ядерная энергия
fission	[′fıʃ(ə)n]	расщепление, деление атомного ядра при цепной реакции
nuclear radiation	[′nju:klıə ,reıdı ′eıʃ(ə)n]	ядерное излучение
exposure	[ıks′pəυʒə]	воздействие
radiation sickness	[,reıdı′eıʃ(ə)n ′sıknəs]	лучевая болезнь
pollutant	[pə′lu:t(ə)nt]	загрязняющий агент,
hazardous	[′hæzədəs]	опасный, рискованный
uranium ore	[jυə′reınıəm ′ɔ:]	урановая руда
mining	[′maınıŋ]	добыча, разработка месторождения
disposal	[dıs′pəυz(ə)l]	захоронение, сбрасывание
fuel cycle	[′fjυəl ′saıkl]	топливный цикл (реактора)
processing	[′prəυsesıŋ]	обработка, переработка
manufacturing	[,mænjυ′fæktʃ(ə)rıŋ]	производство
inspection	[ın′spekʃ(ə)n]	контроль

Exercise 3. Look through the derivatives of the word "nucleus". Complete the sentences below.

nucleus	***nuclei***	***nuclear***	***non-nuclear***

1. Neutrons and protons are bound together in the ………. of an atom. 2. There has been a lot of criticism of the new …….. power program. 3. A team from MIT used radio waves to excite the …….. of copper atoms in their sample and measured exactly which frequencies were absorbed. 4. The main cause of the complacency about future energy supplies was

undoubtedly the emergence of ……… energy. 5. The repulsive force within the ……. is enormous. 6. The agreement is the first postwar treaty to reduce ……… weapons in Europe. 7. These define the …….. of a new scientific and engineering discipline.

Exercise 4. Open the brackets using the gerund. Name the function of the gerund in the sentence.

Model: Careers in nuclear energy cover a wide range of occupations and fields as nuclear engineering, uranium (to mine) and (to process), reactor (to manufacture).

Careers in nuclear energy cover a wide range of occupations and fields as nuclear engineering, uranium *mining* and *processing*, reactor *manufacturing*.

1. Scientists and engineers have found many uses for this energy, especially in (to produce) electricity.
2. Instead of (to use) such fuels as coal or oil, almost all reactors use uranium.
3. These vessels have a reactor to create heat for (to make) the steam.
4. The (to fission) of 1 short ton of uranium fuel, for example, provides about as much heat energy as the (to burn) of 3 million short tons of coal or 12 million barrels of oil.
5. The problem of safely (to store) uranium wastes has not yet been solved.
6. Nuclear power plants produce energy by (to fission) U-235.
7. (To separate) the U-235 from the U-238 in these ores is extremely difficult and costly.
8. The (to process) begins with the mining of uranium ore.

Exercise 5. Make sure you know all the words in the box. Read their definitions and match the words with their definitions.

nucleus nuclear reactor uranium radiation fission power plant

1. A building or group of buildings where electricity is produced.
2. The central part of an atom that contains most of its mass and that carries a positive electric charge.
3. The act or process of splitting the nucleus, when a large amount of energy is released.
4. A large structure used for the controlled production of nuclear energy.
5. Using, producing or resulting from nuclear energy.

6. A chemical element. It is a heavy, silver-white, radioactive metal, used mainly in producing nuclear energy.
7. Powerful and very dangerous rays that are sent out from radioactive substances.

Exercise 6. Read the passage and be ready to discuss the advantages and disadvantages of nuclear energy.

Nuclear energy

Nuclear energy, also called atomic energy, is the most powerful kind of energy known. It produces the tremendous heat and light of the sun and the shattering blast of nuclear weapons. Nuclear energy results from changes in the nucleus (core) of atoms. Scientists and engineers have found many uses for this energy, especially in producing electricity. But they do not yet have the ability to make full use of nuclear power. If nuclear energy were fully developed, it could supply all the world's electricity for millions of years.

Engineers have invented devices called nuclear reactors to produce and control nuclear energy. A nuclear reactor operates somewhat like a furnace. But instead of using such fuels as coal or oil, almost all reactors use uranium. And instead of burning in the reactor, the uranium fissions - that is, its nuclei split in two. As a nucleus splits, it releases energy largely in the form of heat. The fission of 1 pound (0.45 kilogram) of uranium releases as much energy as the burning of 1,140 short tons (1,030 metric tons) of coal.

Nuclear energy also powers some submarines and other ships. These vessels have a reactor to create heat for making the steam that turns the ship propellers. In addition, the fission that produces nuclear energy is valuable because it releases particles and rays called nuclear radiation that have uses in medicine, industry, and science. However, nuclear radiation can be extremely dangerous. Exposure to damaging amounts of radiation can result in a condition called radiation sickness.

Almost all the world's electricity is produced by thermal and hydroelectric power plants. Thermal plants use the force of steam from boiling water to generate electricity. Hydroelectric plants use the force of rushing water from a dam or waterfall. The great majority of thermal plants burn fossil fuels, chiefly coal and oil, to produce the heat needed to boil water. Fossil fuels developed from the remains of plants and animals that died many millions of years ago. The remaining thermal plants fission uranium to create heat.

Hydroelectric plants cost much less to operate than do fossil-fuel plants. They are also cleaner than fossil-fuel plants, which produce much air pollution. But few countries have enough natural water power to

generate large amounts of hydroelectricity. Most countries therefore depend mainly on fossil-fuel plants for their electric power.
The earth has only a limited supply of fossil fuels. Yet the worldwide demand for electricity increases every year. Nuclear plants may thus become more and more important. But today, they produce only about 16 per cent of the world's electricity.

Nuclear power plants have two main advantages over fossil-fuel plants. (1) A nuclear plant uses much less fuel than does a fossil-fuel plant. The fissioning of 1 short ton (0.9 metric ton) of uranium fuel, for example, provides about as much heat energy as the burning of 3 million short tons (2.7 million metric tons) of coal or 12 million barrels of oil. (2) Uranium, unlike fossil fuels, does not release chemical or solid pollutants into the air during use.

In spite of its advantages, nuclear energy has three main disadvantages that have slowed the development of nuclear power in the United States. (1) Nuclear plants cost more to build than fossil-fuel plants. (2) Nuclear plants are potentially hazardous. To make them as safe as possible, they must meet certain government regulations that fossil-fuel plants do not have to meet. For example, a nuclear plant must satisfy government authorities that it can quickly and automatically deal with any kind of emergency. In addition, many Americans have opposed the construction of new plants since a 1979 accident at the Three Mile Island nuclear power plant near Harrisburg, Pa. (3) Uranium continues to produce dangerous radiation long after it has been used up as a fuel for nuclear energy. The problem of safely storing uranium wastes has not yet been solved.

All large commercial nuclear power plants produce energy by fissioning U-235. But U-235 makes up less than 1 per cent of the uranium found in nature. More than 99 per cent of all natural uranium consists of U-238. The two types occur together in uranium ores, such as carnotite and pitchblende. Separating the U-235 from the U-238 in these ores is extremely difficult and costly. For this reason, the fuel used in reactors consists largely of U-238. But the fuel has enough U-235 to produce a chain reaction. Nuclear fuel requires special processing before and after it is used. The processing begins with the mining of uranium ore and ends with the disposal of fuel wastes. The entire process is known as the nuclear fuel cycle.

Careers in nuclear energy cover a wide range of occupations and require widely varying amounts of training. A high percentage of the jobs require a college degree or extensive technical education. Many of these jobs are in large research laboratories, which work to improve nuclear processes and to lessen their hazards. Other careers requiring advanced training are in such areas as uranium mining and processing, reactor manufacturing and inspection, power plant operation, and government regulation. Many colleges and universities offer undergraduate and graduate degrees in such highly specialized fields as nuclear engineering, nuclear physics, and nuclear technology.

Exercise 7. Put into the right order.

1. How nuclear energy is produced.
2. Terms used in nuclear energy.
3. Careers in nuclear energy.
4. Advantages and disadvantages of nuclear energy.
5. The Role of Nuclear Energy in Power Production.

Exercise 8. Work in pairs. Answer the following questions.

1. What is nuclear energy? 2. Where is it applied? 3. What is used to produce nuclear energy? 4. Do all reactors use uranium or radium? 5. What is nuclear radiation? Why is it dangerous? 6. How is all the world's electricity produced? 7. What two advantages do nuclear power plants have over fossil-fuel plants? 8. What is U-235? Why are scientists seeking a replacement for it? 9. What careers are connected with nuclear energy?

Exercise 9. Give a brief summary of the passage.

Exercise 10. Skim the passage as fast as you can and choose the answer that suits the following questions best.

1. Why are the two fragments ineffective in producing further fission processes?
   a) They do not carry enough energy.
   b) They carry too high electric charges.
   c) They carry no charge at all.
2. What process is responsible for nuclear energy liberation?
   a) uranium fission.
   b) a secondary process accompanying nuclear fission.
   c) breakup of a uranium nucleus.

In spite of the fact that each of the two fragments produced in the fission of a uranium nucleus carries about 100 Mev of energy, these fragments are quite ineffective in producing further fission processes; this is due to the fact that the fission fragments carry a very high electric charge and are consequently strongly repelled by the other uranium nuclei with which they may collide. Thus, the discovery of uranium fission would not contribute anything to the problem of the large-scale liberation of nuclear energy if it were not for a secondary process that was found to accompany nuclear fission.

It was discovered that apart from the two large fragments of the original nucleus, there are always several extra neutrons emitted in the breakup. In the case of U^{235} the average number of "fission neutrons" formed is 2.5 per uranium nucleus. These fission neutrons formed in the breakup of one uranium nucleus may collide with the surrounding uranium nuclei and produce more fission and still more fission neutrons and if the conditions are favourable, the breeding (расширенное воспроизводство) of fission neutrons goes crescendo as does the breeding of PL^{248}. Thus we get a branching chain reaction (разветвленная цепная реакция) and in practically no time all the nuclei of uranium in a given pile of this material break up with the liberation of a tremendous amount of energy.

Exercise 11. Discussion.

"Nuclear power plants: their advantages and disadvantages over fossil-fuel plants".

Exercise 12. Translate the following sentences into English.

1. Ядерная (атомная) энергетика – это отрасль энергетики, использующая ядерную энергию для электрификации и теплофикации; область науки и техники, разрабатывающая методы и средства преобразования ядерной энергии в электрическую и тепловую. Основа ядерной энергетики — атомные электростанции.
2. По прогнозам специалистов, доля ядерной энергетики в общей структуре выработки электроэнергии в мире будет непрерывно возрастать при условии реализации основных принципов концепции безопасности атомных электростанций. 3. Главные принципы этой концепции — существенная модернизация современных ядерных реакторов, усиление мер защиты населения и окружающей среды от вредного техногенного воздействия, подготовка высококвалифицированных кадров для атомных электростанций, разработка надежных хранилищ радиоактивных отходов и др.

Text 2. Silicon Valley

Exercise 1. Brainstorming. What is Silicon Valley? Why is it called so? Who is the creator of Silicon Valley?

Exercise 2. Pay attention to the following words. Pick out sentences with these words from the passage and translate them into Russian.

Silicon Valley - Силиконовая долина, Кремниевая долина (район в штате Калифорния, США; технопарк, мировой центр компьютерной и электронной индустрии);

Hewlett-Packard Company - корпорация Hewlett-Packard - производитель электронной и вычислительной техники, а также принадлежащая ей торговая марка.
MIT – сокр. от Massachusetts Institute of Technlogy Массачусетский технологический институт, Эм-Ай-Ти (США)

Exercise 3. Read and memorize the following words.

to spring up	[′sprıŋ′˄p]	возникать
software	[′s⊃ftwεə]	программное обеспечение, программы .
digital	[′dıdʒıt(ə)l]	цифровой
crucial to	[′krʊ: ʃ(ə)l]	ключевой; решающий
to pursue research	[pə′sjʊ: rı′sə:tʃ]	продолжать исследование
start-up	[′sta:t ′˄p]	пуск предприятия, "стартап" (недавно созданная фирма, обычно интернет-компания)
to integrate	[′ıntıgreıt]	совмещать; объединять; интегрировать
radar jamming	[′reıda: ′dʒæmıŋ]	радиолокационные помехи
electronic countermeasure technology	[ı◌̩lek′tr⊃nık ′kaʊntə◌̩meʒə tekn ′⊃lədʒı]	технология радиоэлектронного противодействия
microwave electronics	[′maıkrəweıv ı◌̩lek′tr⊃nıks]	электроника СВЧ (сверхвысокие частоты)
recipient	[rı′sıpıənt]	получатель
to spearhead	[′spıəhed]	возглавлять (что-л.)
to grant leases	[′gra:nt ′li:sız]	предоставить право на аренду
to specialize in	[′speʃ(ə)laız ′ın]	специализироваться (в чём-л., на чём-л.)

Exercise 4. Find synonyms to the following words.

A. Intellectual, to derive from, company, emphasis, to switch, to dominate, to owe, responsible, to pursue, to invest.

B. To change, to be obligated, mental, to fund, business, to carry out, stress, accountable, to prevail, to come from.

Exercise 5. Fill in the right form of the Infinitive. Mind the particle "to".

1. Other countries have attempted (create) their own "Silicon Valleys." 2. Terman set out (build) Stanford into a major centre of radio and communications research. 3. He also encouraged students such as William Hewlett and David Packard and Eugene Litton (establish) local

companies. 4. Terman also invested in these "start-up" enterprises, personally demonstrating his desire (integrate) the university with industry in the region. He solicited military contracts for academic research (fund).
5. Such statistics are important, but they cannot (capture) the essence of the Valley. 6. It cannot (erase) the fact that the region's economic power is a product of its past as well as its present. 7. They have often failed (re-create) elements that were crucial to the success of the original.

Exercise 6. Make sure you know all the words in the box. Read their definitions and match the words with their definitions.

silicon semiconductor digital radar software integrated circuit

1. A chemical element. It exists as a grey solid or as a brown powder and is found in rocks and sand.
2. Using a system of receiving and sending information as a series of the numbers one and zero, showing that an electronic signal is there or is not there.
3. An electromagnetic wave that is shorter than a radio wave but longer than a light wave.
4. A solid substance that conducts electricity in particular conditions, better than insulators but not as well as conductors.
5. A small microchip that contains a large number of electrical connections and performs the same function as a larger circuit made from separate parts.
6. The branch of science and technology that studies electronic currents in electronic equipment.

Exercise 7. Read the passage, define its main idea and give your headline to it .

Silicon Valley

Silicon Valley is an industrial region around the southern shores of San Francisco Bay, California, U.S., with its intellectual centre at Palo Alto, home of Stanford University.

Its name is derived from the dense concentration of electronics and computer companies that have sprung up there since the mid-20th century, silicon being the base material of the semiconductors employed in computer circuits. The economic emphasis in Silicon Valley has now partly switched from computer manufacturing to research, development, and marketing of computer products and software.

Early in the 20th century the area now called Silicon Valley was a region dominated by agriculture and known as the “Valley of the Heart's Delights” owing to the popularity of the fruits grown in its orchards. The very name is synonymous with the rise of the computer and electronics industry as well as the emergence of the digital economy and the Internet. As such, Silicon Valley is also a state of mind, an idea about regional economic development, and part of a new mythology of American wealth. Other U.S. states and even other countries have attempted to create their own “Silicon Valleys,” but they have often failed to re-create elements that were crucial to the success of the original.

If any single person is responsible for Silicon Valley, it is the electrical engineer and administrator Frederick E. Terman (1900–1982). While a graduate student at the Massachusetts Institute of Technology (MIT; Ph.D., 1924), Terman saw how the faculty at Cambridge actively pursued research as well as contact with industry through consulting and the placement of students in corporations.

Terman set out to build Stanford into a major centre of radio and communications research. He also encouraged students such as William Hewlett and David Packard (of the Hewlett-Packard Company) and Eugene Litton (of Litton Industries, Inc .) to establish local companies. Terman also invested in these “start-up” enterprises, personally demonstrating his desire to integrate the university with industry in the region.

When the United States entered World War II in 1941, Terman was made director of Harvard University's Radio Research Laboratory, which was dedicated to producing radar jamming and other electronic countermeasure technologies. At war's end he returned to Stanford as dean of engineering, intent on transforming Stanford into a West Coast MIT. First, he selected technologies for research emphasis; given his wartime work on microwave radar, he began with microwave electronics. Second, he solicited military contracts to fund academic research by faculty members who had worked in microwave technology during the war.

By 1949 Stanford had become one of the top three recipients of government research contracts, overshadowing all other electronics departments west of the Mississippi River.

In 1951 Terman spearheaded the creation of the Stanford Industrial (now Research) Park, which granted long-term leases on university land exclusively to high-technology firms. Soon Varian Associates, Inc. (now Varian Medical Systems, Inc.), Eastman Kodak Company, General Electric Company, Admiral Corporation, Lockheed Corporation (now Lockheed Martin Corporation), Hewlett-Packard Company, and others turned Stanford Research Park into America's premier high-technology manufacturing region. A mutually beneficial relationship developed: professors consulted with the rent-paying tenants, industrial researchers taught courses on campus, and companies recruited the best students. The park was Silicon Valley in miniature. As more firms moved to the region, fueling demand for basic electronic components, technical skills, and business supplies, many former high-technology employees started their own companies. Long before the personal computer, the start-up was the culture of the Valley.

In 1956 William Shockley, Nobel Prize-winning coinventor of the transistor, established his new Shockley Semiconductor Laboratory in the park.

Since the invention of the integrated circuit, Silicon Valley and growth have been nearly synonymous. In 1959 there were roughly 18,000 high-technology jobs in the area. From 1992 to 1999 Silicon Valley added more than 230,000 jobs (an increase of 23 percent) and accounted for roughly 40 percent of California's export trade. To fill the growing need for high-technology workers, particularly engineers, the United States relaxed immigration quotas for aliens with special training, and the region experienced a large influx of workers from India and China. Electronics, computers, and computer software made the region's wealth. Such statistics are important, but they cannot capture the essence of the Valley or the history that has made such a remarkable place possible.

Most current residents see the Valley as a product of raw, naked capitalism, a place where cubicle workers exist on a diet of fast food, where venture capitalists drive luxury cars and specialize in particular types of computer chips, and where bright young men and women can pitch their ideas, obtain financial support, and wait for the initial public offering of stock in their enterprise to transform them from hard-working individuals into hard-working millionaires. Yet even historical amnesia - an important part of Valley culture, with its emphasis on the “new new thing” - cannot erase the fact that the region's economic power is a product of its past as well as its present, of military contracts as well as venture capital. Silicon Valley is an economically mature region whose childhood and adolescence were paid for by U.S. tax dollars.

Exercise 8. Work in pairs. Answer the questions. Begin your answers with the words:

To my mind…	***To my knowledge…***
From my point of view…	***As far as I know…***
In my opinion…	***As far as I can judge…***

1. What is Silicon Valley? 2. Where is it situated? 3. Early in the 20th century it was called the “Valley of the Heart's Delights”, wasn’t it? 4. Have other countries attempted to create their own “Silicon Valleys” or agricultural areas? 5. Who was the creator of Silicon Valley? 6. Which

companies were the first in Silicon Valley? 7. What was the sphere of Terman's interest? 8. What was made by Shockly? 9. How many jobs were accounted in Silicon Valley? 10. Where were the workers from? 11. Why is Silicon Valley state of mind or way of living too?

Exercise 9. Find the key words and give a brief summary of the passage.

Exercise 10. Discussion.

You are the participant of the international congress. Be ready with the presentation **"Contemporary Silicon Valley".**

Exercise 11. Translate the following sentences into English in writing.

1. Силиконовая долина - крупная промышленная конурбация в калифорнийской долине Санта-Клара, к югу от Сан-Франциско с самой высокой в мире концентрацией предприятий электронной промышленности. 2. В Силиконовой долине действуют свыше 3 тысяч фирм. Сотни из них выпускают компьютеры, около тысячи специализируются на программном обеспечении. Здесь работают около 40% американских инженеров, занятых в сфере информационных технологий. 3. Технологии и продукция Силиконовой долины в короткий срок изменили мир, а сама она стала нарицательным понятием и образцом для подражания во многих странах. 4. Начало Силиконовой долине было положено в 1951, когда вице-президент Станфордского университета Фред Терман, с целью улучшения финансового положения, начал сдавать в долгосрочную аренду принадлежащие университету земельные участки. Через два десятилетия Силиконовая долина превратилась в мировой центр электроники.

Text 3. The Large Hadron Collider

Exercise 1. Brainstorming. What do you know about the Large Hadron Collider? When was it launched? Was it a success?

Exercise 2. Pay attention to the following words. Pick out sentences with these words from the passage and translate them into Russian.

The Large Hadron Collider (LHC) **-** Большой адро́нный колла́йдер
*the European Organization for Nuclear Research (*от *фр. Conseil Européen pour la Recherche Nucléaire, CERN)* - Европейский совет ядерных исследований
The Higgs boson **-** бозон Хиггса

Exercise 3. Read and memorize the following words.

collider	[kə′laıdə]	коллайдер, (ускорительная) установка на встречных пучках
makeup	[′meık∧p]	состав, строение, структура
gluon	[′glu:⊃n]	глюон *(переносчик взаимодействия между кварками)*
split	[splıt]	1) расщепление, раскалывание 2) разрыв, раскол
Big bang		Большой взрыв (начальная стадия расширения Вселенной)
particle accelerator	[′pa:tıkl ək ′seləreıtə]	ускоритель заряженных частиц, ускоритель частиц
to collide	[kə′laıd]	сталкиваться; соударяться
particle beam	[′pa:tıkl ′bi:m]	пучок частиц
TeV		ТэВ (тераэлектронвольт)
to fire	[′faıə]	*зд.* запустить
clockwise	[′kl⊃kwaız]	1. движущийся по часовой стрелке 2. по часовой стрелке
counterclockwise	[,kaʊntə ′kl⊃kwaız]	1. движущийся против часовой стрелки 2. против часовой стрелки
trial runs	[′traıəl ′r∧nz]	экспериментальные работы
stream	[stri:m]	поток
circuit	[′sə:kıt]	замкнутое пространство, область, цикл
cryogenics	[,kraıəʊ ′dʒenıks]	физика низких температур
quench	[kwent∫]	1) гашение 2) быстрое охлаждение
shutdown	[′∫∧tdaʊn]	остановка, отключение, выключение

Exercise 4. Mind the meanings of the following derivatives. Complete the sentences below.

To collide→ collision → collider → colliding

1. Research at Fermilab is performed by directing a high-energy beam of particles at a stationary target, or by … beams of protons and antiprotons. 2. The LHC will also be used … lead (Pb) heavy ions with a collision energy of 1,150 TeV. 3. The LHC physics program is mainly based on proton–proton … . 4. The world's largest particle … passed its first major tests by firing two beams of protons in opposite directions. 5. One of the drawbacks of …-beam systems is that actual interactions

between particles are relatively rare. 6. Scientists would be able to conduct … for their experiments within a few months. 7. The paths of the beams will cross, and a few protons will … . 8. The Large Hadron Collider is the world's largest and highest-energy particle accelerator, intended … opposing particle beams.

Exercise 5. Translate the sentences paying attention to the construction Complex Subject.

Model: A new discovery *is believed* to contribute to the development of physics.

Полагают, что новое открытие внесет вклад в развитие физики.

1. That power station is known to be situated on the Angara River. 2. These devices are considered to be very effective. 3. Many books are known to be published in our country every year. 4. You are supposed to graduate in four years. 5. Radium is said to be very radioactive. 6. This device was known to have been designed in that laboratory. 7. His invention is considered to be of great importance. 8. The sun is known to represent a mass of compressed gases. 9. The new rocket is expected to go into operation next year. 10. This type of rocket is believed to have many advantages. 11. For a long time the atom was thought to be indivisible. 12. The helium atom was found to have two electrons.

Exercise 6. Make sure you know all the words in the box. Read their definitions and match the words with their definitions.

collider	***makeup***	***quark***	***gluon***	***clockwise***
counterclockwise	***beam***	***shutdown***	***the big bang***	

1. The way in which the parts or ingredients of something are put together: composition.
2. A theoretical elementary particle without mass, thought to be involved in binding the subatomic particles quarks together.
3. A line of light, electric waves or particles.
4. In the opposite direction to the movement of the hands of a clock.
5. The act of closing a factory or business or stopping a large machine from working, either temporarily or permanently.
6. A particle accelerator in which two beams of particles moving in opposite directions are made to collide.
7. A very small part of matter (= a substance).
8. The single large explosion that some scientists suggest created the universe.
9. Moving around in the same direction as the hands of a clock.

Exercise 7. Read the passage and say why this discovery is of great interest to physicists.

The Large Hadron Collider

The Large Hadron Collider (LHC) is described as the biggest physics experiment in history. Smaller colliders have been used for decades to study the makeup of the atom. Less than 100 years ago scientists thought protons and neutrons were the smallest components of an atom's nucleus, but in stages since then experiments have shown they were made of still smaller quarks and gluons and that there were other forces and particles.
But now scientists aim to recreate conditions of a split after the big bang, which they theorize was the massive explosion that created the universe and hope that the LHC will help them to understand the makeup of the universe.

The Large Hadron Collider is the world's largest and highest-energy particle accelerator, intended to collide opposing particle beams, of either protons at energy of 7 TeV per particle, or lead nuclei at an energy of 574 TeV per nucleus. It was built by the European Organization for Nuclear Research (CERN) with the intention of testing various predictions of high-energy physics. It is funded by and built in collaboration with over 10,000 scientists and engineers from over 100 countries as well as hundreds of universities and laboratories. The total cost of the project is expected to be 4.6 billion Swiss francs (€3 billion) for the accelerator and 1.1 billion Swiss francs (€700 million) for the CERN contribution to the experiments.

The collider is designed to push the proton beam close to the speed of light, whizzing 11,000 times a second around the tunnel. The CERN experiments could reveal more about "dark matter," antimatter and possibly hidden dimensions of space and time. It could also find evidence of the hypothetical particle — the Higgs boson — which is sometimes called the "God particle" because it is believed to give mass to all other particles, and thus to matter that makes up the universe.

The upcoming experiments at the Large Hadron Collider have sparked fears among the public that the LHC particle collisions might produce doomsday phenomena: the collision of protons could eventually imperil the Earth by creating micro-black holes, subatomic versions of collapsed stars whose gravity is so strong they can suck in planets and other stars. But CERN examined these concerns and concluded that the experiments at the LHC present no danger and that there is no reason for concern. The American Physical Society, the world's second largest organization of physicists, also confirmed the conclusion.

The first beam was circulated through the collider on the morning of 10 September 2008 in Geneva, Switzerland. CERN successfully fired the protons around the tunnel in stages, three kilometres at a time. The particles were fired in a clockwise direction into the accelerator and successfully steered around it at 10:28 local time. The LHC successfully completed its first major test: after a series of trial runs, two white dots flashed on a computer screen showing the protons travelled the full length of the collider. It took less than one hour to guide the stream of particles around its inaugural circuit. CERN next successfully sent a beam of protons in a counterclockwise direction, taking slightly longer at one and a half hours due to a problem with the cryogenics, with the full circuit being completed at 14:59.

On 19 September 2008, a quench occurred in about 100 bending magnets in sectors 3 and 4, causing a loss of approximately six tonnes of liquid helium, which was vented into the tunnel, and a temperature rise of about 100 kelvins in some of the affected magnets. Vacuum conditions in the beam pipe were also lost. Shortly after the incident CERN reported that the most likely cause of the problem was a faulty electrical connection between two magnets, and that — due to the time needed to warm up the affected sectors and then cool them back down to operating temperature — it would take at least two months to fix it. The analyses confirmed that the incident was indeed initiated by a faulty electrical connection. A total of 53 magnets were damaged in the incident and were repaired or replaced during the winter shutdown.

TimelineDate	**Event**
2008-09-10	CERN successfully fired the first protons around the entire tunnel circuit in stages.
2008-09-19	Magnetic quench occurred in about 100 bending magnets in sectors 3 and 4, causing a loss of approximately 6 tonnes of liquid helium.
2008-09-30	First "modest" high-energy collisions planned but postponed due to accident.
2008-10-16	CERN released a preliminary analysis of the incident.
2008-10-21	Official inauguration.
2008-12-05	CERN released detailed analysis.
November 2009	The LHC will resume operation at 3.5 TeV.
End of 2010	The LHC will be shut down and work will begin on it to allow it to operate at 7 TeV.

The LHC will resume operation in November 2009 initially at 3.5 TeV and once a significant amount of test data has been gathered will be increased to 5 TeV. At the end of 2010 the LHC will be shut down and work will begin on it to allow it to operate at 7 TeV.

Exercise 8. Work in pairs. Agree or disagree with the statements, using the following phrases:

It seems to be right (wrong) …	***I'm afraid you are mistaken …***
I (can't) agree with the statement …	***On the contrary …***
I (don't) believe that …	***To my mind ….***
In my opinion …	***As far as I know…***
Nowadays it is considered that …	***As it is known …***

1. The Large Hadron Collider is the world's largest particle collider.
2. The purpose of the LHC is to understand the makeup of the universe.
3. The LHC is expected to prove the existence of the Higgs boson.
4. Scientists feared that the collision of protons could eventually lead to the big bang.
5. The launching (запуск) of the LHC was a success.

Exercise 9. Answer the following questions.

1. The Large Hadron Collider is the biggest physics experiment in history, isn't it? 2. What were early ideas of the makeup of the atom? 3. What is the LHC? 4. Who funded the LHC? 5. How much does it cost? 6. What is the LHC believed to prove? 7. Do people fear the experiments at the LHC? Why or why not? 8. Was the experiment a success?

Exercise 10. Be prepared to say a few words about:

- The LHC as the biggest physics experiment in history.
- The stages of the LHC experiment.

Exercise 11. Discussion. Prove that the experiment with The Large Hadron Collider is rather important for modern science.

Exercise 12. Translate the following sentences into English in writing.

1. Эксперименты показали, что ядро атома состоит из кварков и глюонов. 2. Ученые надеются, что БАК поможет понять строение вселенной и найдет доказательство существования гипотетической частицы - бозона Хиггса. Бозон нестабилен и имеет большую массу. 3. БАК — ускоритель заряженных частиц на встречных пучках, предназначенный для разгона протонов и тяжёлых ионов (ионов свинца) и изучения продуктов их соударений. 4. БАК породил страхи среди общественности, так как люди полагали, что столкновение частиц вызовет явление конца света. 5. 10 сентября был произведён официальный запуск коллайдера. Запущенный пучок протонов успешно прошёл весь периметр коллайдера по часовой стрелке.

Self Check

1. Nuclear energy is also called … .
a) heat energy b) atomic energy c) light energy
2. What devices are invented to produce and control nuclear energy?
a) nuclear bombs b) nuclear power stations c) nuclear reactors
3. What substance do nuclear reactors use?
a) coal b) uranium c) oil
4. What do uranium fissions release?
a) nuclear radiation b) pollutants c) nuclear weapon
5. Almost all the world's electricity is produced by … power plants.
a) thermal b) hydroelectric c) thermal and hydroelectric
6. Silicon Valley is situated in … .
a) the USA b) Belarus c) the UK
7. Silicon Valley is called so because … .
a) there is much silicon there.
b) there are many electronics and computer companies there.
c) there are many valleys there.
8 . … is responsible for Silicon Valley.
a) Frederick E. Terman
b) William Hewlett and David Packard
c) Eugene Litton
9. Who established a new Semiconductor Laboratory in the park?
a) Eugene Litton b) Frederick E. Terman c) William Shockley
10. What invention helped Silicon Valley to develop and grow?
a) transistor b) integrated circuit c) a personal computer
11. What is The Large Hadron Collider (LHC)?
a) the world's largest and highest-energy particle accelerator
b) the world's largest power station
c) the world's largest satellite
12. The smallest components of an atom's nucleus are … .
a) protons and neutrons b) quarks and gluons c) quarks and protons
13. What is the main aim of the LHC?
a) help the scientists to understand the makeup of the universe.
b) to investigate quarks and gluons
c) to push the proton beam close to the speed of light
14. When did the experiment start?
a) on 10 October 2008
b) on 19 September 2009
c) on 19 September 2008

15. Was the first attempt of the LHC a success ?
a) yes b) no

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АНГЛИЙСКИЙ ЯЗЫК ДЛЯ ФИЗИКОВ

Методические рекомендации

Технический редактор *Г.В. Разбоева*
Компьютерный дизайн *И.В. Волкова*

Подписано в печать .2013. Формат 60x84 $^{1}/_{16}$. Бумага офсетная.
Усл. печ. л. 3,02. Уч.-изд. л. 2,59. Тираж экз. Заказ

Издатель и полиграфическое исполнение – учреждение образования
«Витебский государственный университет имени П.М. Машерова».
ЛИ № 02330/110 от 30.01.2013.

Отпечатано на ризографе учреждения образования
«Витебский государственный университет имени П.М. Машерова».
210038, г. Витебск, Московский проспект, 33.