Міністерство освіти і науки України

НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ

«ОДЕСЬКА ПОЛІТЕХНІКА»

Методичні вказівки до практичних занять з англійської мови

**«АТОМНА ЕНЕРГЕТИКА »**

для здобувачів І курсу Інституту енергетики (ІЕ)

Одеса НУОП – 2023

Міністерство освіти і науки України

НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ

«ОДЕСЬКА ПОЛІТЕХНІКА»

Методичні вказівки до практичних занять

з англійської мови «**АТОМНА ЕНЕРГЕТИКА»**

для здобувачів І курсу Інституту енергетики (ІЕ)

Галузь знань: 14 Електрична інженерія

Спеціальність: 143 Атомна енергетика

Затверджено

на засіданні кафедри

іноземних мов

Протокол № 5 від 06.02.2023 p.

Одеса НУОП – 2023

Методичні вказівки до практичних занять з англійської мови за спеціальністю 143 Атомна енергетика, Галузь знань: 14 Електрична інженерія для здобувачів 1-го курсу Інституту енергетики (ІЕ). / Авт.: Т.І. Борисенко, М.М.Неврева , І.Ф.Дуванська - Одеса: НУОП, 2023- с.46.

Укладачі: Т.І Борисенко , доцент,

М.М.Неврева, доцент,

І.Ф. Дуванська, ст.викл.

Зміст

Передмова………………………………………………………………………………………4

Unit 1…………………………………………………………………………………………….5

Unit 2…………………………………………………………………………………………….8

Unit3…………………………………………………………………………………………….12

Unit 4……………………………………………………………………………………………16

Unit 5……………………………………………………………………………………………20

Unit 6……………………………………………………………………………………………23

Unit 7……………………………………………………………………………………………27

References………………………………………………………………………………………32

Keys……………………………………………………………………………………………..33

**Передмова**

Метою “Методичних вказівок” для самостійної роботи здобувачів є формування впродовж 46 годин самостійної роботи (вхідний рівень володіння мовою – В1) вмінь та навичок читання за тематикою Спеціальності: 143 ‟Атомна енергетика ” на І курсі навчання Інституту енергетики (ІЕ) з англійської мови (вихідний рівень володіння мовою – В2). За рахунок тренування і виконання читання текстів і комунікативних завдань здобувачі зможуть досягти практичного володіння англійською мовою за фахом.

Практичне володіння іноземною мовою в рамках даного курсу припускає наявність таких умінь, які дають можливість:

* вільно читати оригінальну літературу іноземною мовою у відповідній галузі знань;
* оформляти витягнуту з іноземних джерел інформацію у вигляді перекладу або резюме;
* робити повідомлення і доповіді іноземною мовою на теми, пов'язані з науковою роботою майбутнього фахівця;
* вести бесіду за фахом.

Кожний урок складається з тексту й комплексу мовних вправ, які розраховані на удосконалення навичок активізації словарного і граматичного мінімуму професійного спрямування.

“Методичні вказівки” забезпечують підготовку до міжнародного усного спілкування англійською мовою для спеціальних цілей, а саме - оволодіння лексичними, граматичними і стилістичними навичками, а також умінням читати, перекладати, згортати і розгортати усну англомовну інформацію наукового функціонального стилю, що передбачено вимогами Програми вивчення іноземних мов у нефілологічному ВНЗ.

**Unit 1**

Read the text: **Introduction to Computers and Programming.**

Think about some of the different ways that people use computers. At school, students use computers for tasks such as writing papers, searching for articles, sending email, and participating in online classes. At work**,** people use computers to analyze data, make presentations, conduct business transactions, communicate with customers and coworkers, control machines in manufacturing facilities, and do many other things. At home**,** people use computers for tasks such as paying bills, shopping online, communicating with friends and family, and playing computer games. And don’t forget that cell phones, iPods, Blackberries, car navigation systems, and many other devices are computers too. The uses of computers are almost limitless in our everyday lives. Computers can do such a wide variety of things because they can be programmed. This means that computers are not designed to do just one job, but to do any job that their programs tell them to do. A program is a set of instructions that a computer follows to perform a task. Microsoft Word is a word processing program that allows you to create, edit, and print documents with your computer. Adobe Photoshop is an image editing program that allows you to work with graphic images, such as photos taken with your digital camera. Programs are commonly referred to as software.

Software is essential to a computer because it controls everything the computer does. All of the software that we use to make our computers useful is created by individuals working as programmers or software developers. A programmer, or software developer, is a person with the training and skills necessary to design, create, and test computer programs. Computer programming is an exciting and rewarding career. Today, you will find programmers’ work used in business, medicine, government, law enforcement, agriculture, academics, entertainment, and many other fields. The physical devices that a computer is made of are referred to as the computer’s hardware. The programs that run on a computer are referred to as software.

Hardware. The term hardware refers to all of the physical devices, or components, that a computer is made of. A computer is not one single device, but a system of devices that all work together. Like the different instruments in a symphony orchestra, each device in a computer plays its own part. If you have ever shopped for a computer, you’ve probably seen sales literature listing components such as microprocessors, memory, disk drives, video displays, graphics cards, and so on. Unless you already know a lot about computers, or at least have a friend that does, understanding what these different components do might be challenging. A typical computer system consists of the following major components:

• The central processing unit (CPU)

• Main memory

• Secondary storage devices

• Input devices

• Output devices

Let’s take a closer look at each of these components.

**The CPU.** When a computer is performing the tasks that a program tells it to do, we say that the computer is running or executing the program. The central processing unit, or CPU, is a part of a computer that actually runs programs. The CPU is the most important component in a computer because without it, the computer could not run software. In the earliest computers, CPUs were huge devices made of electrical and mechanical components such as vacuum tubes and switches. The ENIAC **(**Electronic Numerical Integrator and Calculator), which is considered by many to be the world’s first programmable electronic computer, was built in 1945 to calculate artillery ballistic tables for the U.S. Army. This machine, which was primarily one big CPU, was 8 feet tall, 100 feet long, and weighed 30 tons. Today, CPUs are small chips known as microprocessors. In addition to being much smaller than the old electromechanical CPUs in early computers, microprocessors are also much more powerful. (**to be continued).**

**After text activity**

**Exercise 1.**  **Look up new words and word-combinations given below in your dictionary and memorize them:**

|  |
| --- |
| Input devices, output devices, blackberries,law enforcement, software, hardware, artillery ballistic tables, main memory, conduct business transactions, manufacturing facilities. |

**Exercise 2.**  **Answer the questions:**

1. Where and how do people use computers?
2. Why can computers do such a wide variety of things?
3. What does Microsoft Word allow you to do?
4. What does Adobe Photoshop allow you to do?
5. Why is Software essential to a computer?
6. What does a programmer, or software developer do?
7. Where will you find programmers’ work?
8. What does the term hardware refer to?
9. What major components does a typical computer system consist of?
10. When was the world’s first programmable electronic computer built?

**Exercise 3.**  Match the left part with the right:

|  |  |
| --- | --- |
| 1. The uses of computers | a) is a set of instructions that a computer follows to perform a task. |
| 2. A program | b) is the most important component in a computer. |
| 3. Computer programming | c) are almost limitless in our everyday lives. |
| 4. The CPU | d) are also much more powerful. |
| 5. The world’s first programmable electronic computer | e) CPUs were huge devices made of electrical and mechanical components such as vacuum tubes and switches. |
| 6. Microprocessors | f) because they can be programmed. |
| 7. In the earliest computers, | g) is an exciting and rewarding career. |
| 8. Computers can do such a wide variety of things | h) was built in 1945 to calculate artillery ballistic tables for the U.S. Army. |
| 9.In school, students use computers for tasks | i) such as paying bills, shopping online, communicating with friends and family, and playing computer games. |
| 10.At home, people use computers for tasks | j) such as writing papers, searching for articles, sending email, and participating in online classes. |

**Exercise 4. Place the words in a correct order:**

1.in our | are| almost| the uses of| computers | limitless | everyday lives.

2.to do |just one job |computers| are not | designed

3.is an exciting| computer programming| and| rewarding career.

4.is | the most important| the CPU| component| in a computer.

5.as microprocessors| today, | CPUs| are small chips |known

**Exercise 5. Fill in the blanks with appropriate words in the box.**

**(referred to; limitless; because; designed; a set of; program; print; an image; digital)**

. The uses of computers are almost \_\_\_\_1\_\_\_\_\_ in our everyday lives. Computers can do such a wide variety of things \_\_\_2\_\_\_\_\_\_they can be programmed. This means that computers are not \_\_\_\_\_\_3\_\_\_\_\_ to do just one job, but to do any job that their programs tell them to do. A program is \_\_\_\_4\_\_\_\_\_\_instructions that a computer follows to perform a task. Microsoft Word is a word processing\_\_\_\_\_\_5\_\_\_\_\_ that allows you to create, edit, and \_\_\_\_\_6\_\_\_\_\_\_ documents with your computer. Adobe Photoshop is \_\_\_7\_\_\_\_\_\_editing program that allows you to work with graphic images, such as photos taken with your \_\_\_8\_\_\_\_ camera. Programs are commonly \_\_\_\_9\_\_\_\_\_\_as software.

**Exercise 6.** **Open the brackets, using the verbs in Present Indefinite. Choose the correct verb forms.**

1. A program **( is| are)** a set of instructions that a computer( **follows| follow**) to perform a task.

2. Software **( is| are)** essential to a computer because it controls everything the computer does.

3. The uses of computers **( is | are**) almost limitless in our everyday lives.

4. Students ( **has | have**) four exams in January.

5. The CPU ( **is | are**) the most important component in a computer.

6. Microsoft Word **( is | are** ) a word processing program that allows you to create, edit, and print documents with your computer.

7. Today, CPUs (**is |are**) small chips known as microprocessors.

8. Computer programming (**are| is)** an exciting and rewarding career.

9. There **( is| are**) laboratories, workshops and libraries in our University.

10. Every faculty ( **has| have**) its own computer center.

11. Our library ( **has| have**) a great number of books and magazines in all branches of science and technology.

12.We **( have | has**) industrial training in the third year.

13.The students often (**have| has**) interesting discussions after lectures.

14.There (**is| are**) a great number of goods that can be transported by air.

15.There (are| am ) lights in the middle of the crossing.

**Exercise 7.** **Open the brackets, using the verbs in Present Indefinite.** **Choose the correct verb forms.**

1.This **(mean| means**) that computers (**are| am)** not designed to do just one job.

2. Optical discs **( hold| holds**) large amounts of data.

3.The term hardware (**refers | refer**) to all of the physical devices, or components, that a computer ( **is| are** ) made of.

4.Like the different instruments in a symphony orchestra, each device in a computer

(**plays| play**) its own part.

5.At school, students (**use| uses**) computers for tasks such as writing papers, searching for articles, sending email, and participating in online classes.

6.And (**don’t| doesn′t**) forget that cell phones, iPods, Blackberries, car navigation systems, and many other devices (**is| are**) computers too.

7.A typical computer system (**consists | consist**) of the following major components.

8. Most computers (**have| has**) a disk drive mounted inside their case.

9.A floppy disk drive (**records |record**) data onto a small floppy disk, which can be removed from the drive.

10.A disk drive (**stores| store**) data by magnetically encoding it onto a circular disk.

**Exercise** **8.**   **Pick out all international words from the text.**

**Exercise** **9.** Compose a story on one of the topics (up to 100 words):

1. The uses of computers are almost limitless in our everyday lives.
2. Software is essential to a computer.
3. The major components of a typical computer system.

**Unit 2**

Read the text: **Introduction to Computers and Programming.**

**Main Memory** You can think of main memory as the computer’s work area. This is where the computer stores a program while the program is running, as well as the data that the program is working with. For example, suppose you are using a word processing program to write an essay for one of your classes. While you do this, both the word processing program and the essay are stored in main memory. Main memory is commonly known as random-access memory, or RAM. It is called this because the CPU is able to quickly access data stored at any random location in RAM. RAM is usually a volatile type of memory that is used only for temporary storage while a program is running. When the computer is turned off, the contents of RAM are erased. Inside your computer, RAM is stored in chips.

**Secondary Storage** is a type of memory that can hold data for long periods of time, even when there is no power to the computer. Programs are normally stored in secondary memory and loaded into main memory as needed. Important data, such as word processing documents, payroll data, and inventory records, is saved to secondary storage as well. The most common type of secondary storage device is the disk drive. A disk drive stores data by magnetically encoding it onto a circular disk. Most computers have a disk drive mounted inside their case. External disk drives, which is connected to one of the computer’s communication ports, are also available. External disk drives can be used to create backup copies of important data or to move data to another computer. In addition to external disk drives, many types of devices have been created for copying data, and for moving it to other computers. For many years floppy disk drives were popular. A floppy disk drive records data onto a small floppy disk, which can be removed from the drive. Floppy disks have many disadvantages, however. They hold only a small amount of data, they are slow to access data, and they can be unreliable. The use of floppy disk drives has declined dramatically in recent years, in favor of superior devices such as USB drives. USB drives are small devices that plug into the computer’s USB (universal serial bus) port, and appear to the system as a disk drive. These drives do not actually contain a disk, however. They store data in a special type of memory known as flash memory. USB drives, which are also known as memory sticks and flash drives, are inexpensive, reliable, and small enough to be carried in your pocket. Optical devices such as the CD (compact disc) and the DVD (digital versatile disc) are also popular for data storage. Data is not recorded magnetically on an optical disc, but is encoded as a series of pits on the disc surface. CD and DVD drives use a laser to detect the pits and thus read the encoded data. Optical discs hold large amounts of data, and, as recordable CD and DVD drives are now commonplace, they are good mediums for creating backup copies of data.

**Input** is any data the computer collects from people and from other devices. The component that collects the data and sends it to the computer is called an input device. Common input devices are the keyboard, mouse, scanner, microphone, and digital camera. Disk drives and optical drives can also be considered input devices because programs and data are retrieved from them and loaded into the computer’s memory.

**Output** is any data the computer produces for people or for other devices. It might be a sales report, a list of names, or a graphic image. The data is sent to an output device, which formats and presents it. Common output devices are video displays and printers. Disk drives and CD recorders can also be considered output devices because the system sends data to them in order to be saved.

Everything that a computer does, from the time you turn the power switch on until you shut the system down, is under the control of software. There are two general categories of software: system software and application software. Most computer programs clearly fit into one of these two categories. Let’s take a closer look at each.

**System Software**. The programs that control and manage the basic operations of a computer are generally referred to as system software. System software typically includes the following types of programs: An operating system is the most fundamental set of programs on a computer. The operating system controls the internal operations of the computer’s hardware, manages all of the devices connected to the computer, allows data to be saved to and retrieved from storage devices, and allows other programs to run on the computer.

**After text activity**

**Exercise 1.**  **Read and memorize using a dictionary:**

|  |
| --- |
| RAM (random-access memory),volatile, secondary storage, payroll data, inventory records, disk drive,backup copies, floppy disk drives, USB (universal serial bus ) drives, flash memory, DVD (digital versatile disc),retrieve, fit into. |

**Exercise 2.**  **Answer the questions:**

1. How is main memory commonly known?

2. What is a type of memory that can hold data for long periods of time?

3. Where is important data, such as word processing documents, payroll data, and inventory records, saved?

4.What is the most common type of secondary storage device?

5. What can external disk drives be used for?

6. What disadvantages do floppy disks have?

7.Where do drives store data?

8. What do CD and DVD drives use to detect the pits and thus read the encoded data?

9. How is the component that collects the data and sends it to the computer called?

10Why can Disk drives and Optical drives also be considered input devices?

11Why can Disk drives and CD recorders also be considered output devices?

12. What does the operating system do?

**Exercise 3.**  **Match English words and word-groups with their definitions.**

|  |  |
| --- | --- |
| 1. **Main Memory** | a) is a type of memory that can hold data for long periods of time, even when there is no power to the computer. |
| 2**. RAM** | b) can be used to create backup copies of important data or to move data to another computer. |
| 3. **Secondary Storage** | c) are small devices that plug into the computer’s USB (universal serial bus) port, and appear to the system as a disk drive. |
| 4. **A disk drive** | d) is usually a volatile type of memory that is used only for temporary storage while a program is running. |
| 5. **External disk drives** | e) is commonly known as random-access memory, or RAM. |
| 6. **A floppy disk drive** | f) is any data the computer collects from people and from other devices. |
| 7. **USB drives** | g) records data onto a small floppy disk, which can be removed from the drive. |
| 8. **Input** | h) stores data by magnetically encoding it onto a circular disk. |
| 9. **System software** | i) is any data the computer produces for people or for other devices. |
| 10. **Output** | j) the programs that control and manage the basic operations of a computer |

**Exercise 4. Put a tick (✓) if the sentence is right and a cross (×) if it is wrong. Correct the mistake.**

1. Main memory is commonly known as random-access memory, or RAM.
2. When the computer is turned off, the contents of RAM are stored.
3. Secondary Storage is a type of memory that can hold data for long periods of time.
4. Programs are normally stored in main memory and loaded into secondary memory as needed.
5. The most common type of secondary storage device is the disk drive.
6. External disk drives cannot be used to create backup copies of important data or to move data to another computer
7. USB drives are big devices that plug into the computer’s USB (universal serial bus) port, and appear to the system as a disk drive.
8. CD and DVD drives use a laser to detect the pits and thus read the encoded data
9. Input is any data the computer collects for people and for other devices.

10. Outputis any data the computer produces for people or for other devices.

**Exercise 5. Fill in the blanks with appropriate words in the box.**

**(microphone; retrieved; collects; sends; devices; optical drives;)**

Input is any data the computer \_\_\_1\_\_\_\_\_\_\_ from people and from other devices. The component that collects the data and \_\_\_\_\_2\_\_\_\_\_ it to the computer is called an input device. Common input \_\_\_\_\_\_\_3\_\_\_\_\_\_ are the keyboard, mouse, scanner, \_\_\_\_\_4\_\_\_\_\_\_\_, and digital camera. Disk drives and \_\_\_\_\_\_5\_\_\_\_\_\_ can also be considered input devices because programs and data are **\_\_\_\_\_\_**6**\_\_\_\_\_\_\_** from them and loaded into the computer’s memory.

**Exercise 6. Open brackets choosing the right words:**

Output is any data the (computer | calculator) produces for people or for other (devices| appliances). It might be a (sales report/ defect report), a list of names, or a graphic image. The data is sent to an (output| input) device, which formats and presents it. Common output devices are video displays and printers. Disk drives and CD recorders can also be (considered| discussed) output devices because the system (sends | transmits) data to them in order to be saved.

**Exercise 7. Give the words that have similar meanings (synonyms).**

|  |
| --- |
| detect; display; discover; show, control; govern; order; book, save; preserve; gather;  memory; storage; main; principal; device; appliance; people; population; collect. |

**Exercise 8. Open the brackets, using Present Continuous. Choose the correct verb forms.**

1. When a computer (is | are) performing the tasks that a program tells it to do, we say that the computer (is| are) running or executing the program.
2. This is where the computer stores a program while the program (is | are) running, as well as the data that the program (is | are) working with.
3. RAM is usually a volatile type of memory that is used only for temporary storage while a program (is | are) running.
4. The more civilization (to develop), the greater the ecological problems (to become).
5. I (not to write) an article now. I (to listen) to the music.
6. Look at the sky: the clouds (to move) slowly, the sun (to appear) from behind the clouds, it (to get) warmer.
7. At present scientists in industrially developed countries (to work) on the theory of interaction of all the atmospheric and oceanic global processes that determine the climate and weather of the world. What you (to do) here now? – We (to listen) to tape-recordings.
8. We (to translate) a technical text now.
9. Water and air (is |are) becoming more and more polluted.
10. There (are| is) government and public organizations that (are| is) analyzing data on land, forest and air.
11. You (to have) a break?
12. What language you (to study)?
13. Science {is | are) becoming a leading factor in the progress of mankind.
14. At present mankind (is | are) making considerable investments to eliminate air pollution
15. Today the changes in the global climate and water balance (are| is) bringing about serious changes in the environment.
16. Many scientists (are | is) constantly carrying out experimental work to solve the problem of environment protection.
17. The company (is | are) making plans for the future.
18. It is evident that research (is| are) becoming more specialized now.
19. It is industrialization that (is| are) making ecological problems very serious.

**Exercise 9. Compose a story on one of the topics (up to 100 words).**

1. Main memory as the computer’s work area.
2. Secondary Storage can hold data for long periods of time.
3. Input and Output devices

**Unit 3**

Read the text: **Materials Science and Engineering.**

Materials Science and Engineering (MSE) combines engineering, physics and chemistry principles to solve real-world problems associated with nanotechnology, biotechnology, information technology, energy, manufacturing and other major engineering disciplines. Please take a few moments and reflect on what your life would be like without all of the materials that exist in our modernworld. Without these materials we wouldn’t have automobiles, cell phones, the internet, airplanes, nice homes and their furnishings, stylish clothes, nutritious (also “junk”) food, refrigerators, televisions, computers. Virtually every segment of our everyday lives is influenced to one degree or another by materials. Without them our existence would be much like that of our Stone Age ancestors. Historically, the development and advancement of societies have been intimately tied to the members’ ability to produce and manipulate materials to fill their needs. In fact, early civilizations have been designated by the level of their materials development (Stone Age, Bronze Age, Iron Age).

The earliest humans had access to only a very limited number of materials, those that occur naturally: stone, wood, clay, skins, and so on. Later, they discovered techniques for producing materials that had properties superior to those of the natural ones; these new materials included pottery and various metals. Furthermore, it was discovered that the properties of a material could be altered by heat treatments and by the addition of other substances. It was not until relatively recent times that scientists came to understand the relationships between the structural elements of materials and their properties. This knowledge, acquired over approximately the past 100 years, has empowered them to fashion, to a large degree, the characteristics of materials. Thus, tens of thousands of different materials have evolved with rather specialized characteristics that meet the needs of our modern and complex society, including metals, plastics, glasses, and fibers.

The development of many technologies that makes our existence so comfortable has been intimately associated with the accessibility of suitable materials. For example, automobiles would not have been possible without the availability of inexpensive steel or some other comparable substitute. In the contemporary era, sophisticated electronic devices rely on components that are made from what are called semiconducting materials.

Sometimes it is useful to subdivide the discipline of materials science and engineering into materials science and materials engineering subdisciplines. Strictly speaking, materials science involves investigating the relationships that exist between the structures and properties of materials. In contrast, correlations, designing or engineering the structure of a material to produce a materials engineering involves, on the basis of these structure – property predetermined set of properties. From a functional perspective, the role of a materials scientist is to develop or synthesize new materials, whereas a materials engineer is called upon to create new products or systems using existing materials and/or to develop techniques for processing materials.

Structure is, at this point, a nebulous term that deserves some explanation. In brief, the structure of a material usually relates to the arrangement of its internal components. Structural elements may be classified on the basis of size and in this regard there are several levels:

• Subatomic structure — involves electrons within the individual atoms, their energies and interactions with the nuclei.

• Atomic structure — relates to the organization of atoms to yield molecules or crystals.

• Nanostructure — deals with aggregates of atoms that form particles (nanoparticles) that have nanoscale dimensions (less that about 100 nm).

• Microstructure — those structural elements that are subject to direct observation using some type of microscope (structural features having dimensions between 100 nm and several millimeters).

• Macrostructure — structural elements that may be viewed with the naked eye (with scale range between several millimeters and on the order of a meter). **(to be continued).**

**After text activity**

**Exercise 1.**  **Look up new words and word-combinations given below in your dictionary and memorize them:**

|  |
| --- |
| Furnishings, nutritious,forerunner, superior; alter; approximately, empower, accessibility, sophisticated, predetermined, nebulous, aggregate, intimately, pottery. |

**Exercise 2. Match the left part with the right:**

|  |  |
| --- | --- |
| 1. Subatomic structure | a) relates to the organization of atoms to yield molecules or crystals |
| 2. Nanostructure | b) involves investigating the relationships that exist between the structures and properties of materials. |
| 3. Microstructure | c) is to develop or synthesize new materials, |
| 4. Atomic structure | d) deals with aggregates of atoms that form particles (nanoparticles) that have nanoscale dimensions (less that about 100 nm). |
| 5. Macrostructure | e) involves electrons within the individual atoms, their energies and interactions with the nuclei. |
| 6. The structure of a material | f) those structural elements that are subject to direct observation using some type of microscope (structural features having dimensions between 100 nm and several millimeters). |
| 7. Materials science | g) involves, on the basis of these structure – property correlations, designing or engineering the structure of a material to produce a predetermined set of properties. |
| 8. The role of a materials scientist | h) is called upon to create new products or systems using existing materials and/or to develop techniques for processing materials. |
| 9. A materials engineer | i) usually relates to the arrangement of its internal components |
| 10 Materials engineering | j) structural elements that may be viewed with the naked eye (with scale range between several millimeters and on the order of a meter). |

**Exercise 3.**   **Give the words that have opposite meanings (antonyms).**

|  |
| --- |
| microstructure, a few, modern, incomparable, involve;destroy, exclude; ancestor, descendant, individual, develop, decrease, expensive, create,comparable, many, outmoded; macrostructure, common, cheap. |

**Exercise 4. Answer the questions:**

1.What does Materials Science and Engineering (MSE) combine?

2. How have in fact, early civilizations been designated?

3. What materials did earliest humans have access to?

4. When did they discover techniques for producing materials?

5. When did scientists come to understand the relationships between the structural elements of materials and their properties.?

6. What has the development of many technologies that makes our existence so comfortable been intimately associated with?

7. What does materials science involve?

8. What is the role of a materials scientist from a functional perspective?

9. What is the role of a materials engineer?

10.What does the structure of a material usually relate to?

11. How may structural elements be classified?

**Exercise 5. Fill in the blanks with appropriate words in the box.**

**(a few; like; modern. cell phones; refrigerators; lives; advancement; designated**)

Please take \_\_\_\_\_1\_\_\_\_\_moments and reflect on what your life would be \_\_2\_\_\_\_\_\_\_ without all of the materials that exist in our \_\_\_\_3**\_\_\_\_\_** world. Believe it or not, without these materials we wouldn’t have automobiles, \_\_\_\_\_4\_\_\_\_\_\_\_\_, the internet, airplanes, nice homes and their furnishings, stylish clothes, nutritious (also “junk”) food, \_\_\_\_\_5\_\_\_\_\_\_\_\_, televisions, computers. Virtually every segment of our everyday \_\_\_\_6\_\_\_\_\_\_ is influenced to one degree or another by materials. Without them our existence would be much like that of our Stone Age ancestors. Historically, the development and \_\_\_\_\_\_7\_\_\_\_\_\_\_ of societies have been intimately tied to the members’ ability to produce and manipulate materials to fill their needs. In fact, early civilizations have been \_\_\_\_\_\_\_8\_\_\_\_\_ by the level of their materials development (Stone Age, Bronze Age, Iron Age).

**Exercise 6.**    **Pick out all international words from the text.**

**Exercise** **7.** **Open the brackets, using Present Perfect.**

1. That the problem of pollution and ecology (to become) the most important one for mankind is evident to all.

2. He (not to translate) the article yet.

3. Distance learning (to develop) over years from satellite video courses to modern video conferencing through personal computers.

4.The rain (to stop) but a cold wind is still blowing.

5. I never (to be) to London.

6. You (to make) any spelling mistakes in your dictation?

7. I (not to see) my cousin since last year.

8. Why you (to put) these things in the wrong place?

9. “We (not to meet) for such a long time!” said my friend. “Yes, indeed”, I answered, “and we both (to grow)”.

10. Water pollution (to become) a serious problem in many British rivers. (has become)

11. We have just (to talk) about it.

12. He has (to tell) us nothing about it.

13. She has not (to speak) yet.

14. Who has (to write) this article?

15. We have already (to learn) a lot of English words.

16. He has just (to do) something for us.

17. We already (to solve) the problem.

18. I (not to see) him since 1987.

19. My father knows so much because he (to travel) a lot.

20.But industrial pollution (to make) many sources of water undrinkable. (has made)

**Exercise** **8.** Compose a story on one of the topics (up to 100 words):

1. Materials Science and Engineering.
2. Virtually every segment of our everyday lives is influenced by materials.
3. The structure of a material.

**Unit 4**

Read the text: **Materials Science and Engineering.**

The notion of property deserves elaboration. While in service use, all materials are exposed to external stimuli that evoke some types of responses. For example, a specimen subjected to forces experiences deformation, or a polished metal surface reflects light. Virtually all important properties of solid materials may be grouped into six different categories: mechanical, electrical, thermal, magnetic, optical, and deteriorative. For each, there is a characteristic type of stimulus capable of provokingdifferent responses. These are noted as follows:

• Mechanical properties — relate deformation to an applied load or force; examples include elastic modulus (stiffness), strength, and resistance to fracture.

• Electrical properties — the stimulus is an applied electric field; typical properties include electrical conductivity and dielectric constant.

• Thermal properties — are related to changes in temperature or temperature gradientsacross a material; examples of thermal behavior include thermal expansion and heat capacity.

• Magnetic properties — the responses of a material to the application of a magnetic field; common magnetic properties include magnetic susceptibility and magnetization.

• Optical properties — the stimulus is electromagnetic or light radiation; index of refraction and reflectivity are representative optical properties.

• Deteriorative characteristics — relate to the chemical reactivity of materials; for example, corrosion resistance of metals.

In addition to structure and properties, two other important components are involved in the science and engineering of materials—namely, processing and performance. With regard to the relationships of these four components, the structure of a material depends on how it is processed. Furthermore, a material’s performance is a function of its properties.

**Classification of Materials** Solid materials have been conveniently grouped into three basic categories: metals, ceramics, and polymers, a scheme based primarily on chemical makeup and atomic structure. Most materials fall into one distinct grouping or another. In addition, there are the composites that are engineered combinations of two or more different materials. Another category is advanced materials—those used in high-technology applications, such as semiconductors, biomaterials, smart materials, and nanoengineered materials.

**Metals.** Metals are composed of one or more metallic elements (e.g., iron, aluminum, copper, titanium, gold, nickel), and often also nonmetallic elements (e.g., carbon, nitrogen, oxygen) in relatively small amounts. Atoms in metals and their alloys are arranged in a very orderly manner and are relatively dense in comparison to the ceramics and polymers. With regard to mechanical characteristics, these materials are relatively stiff and strong, yet are ductile, and are resistant to fracture, which accounts for their widespread use in structural applications. Many properties of metals are directly attributable to these electrons. For example, metals are extremely good conductors of electricity and heat, and are not transparent to visible light; a polished metal surface has a lustrous appearance. In addition, some of the metals (i.e., Fe, Co, and Ni) have desirable magnetic properties. Familiar objects made of metals and metal alloys: silverware (fork and knife), scissors, coins, a gear, a wedding ring, and a nut and bolt.

**Ceramics** are compounds between metallic and nonmetallic elements; they are most frequently oxides, nitrides, and carbides. For example, common ceramic materials include aluminum oxide, silicon dioxide, silicon carbide, silicon nitride. With regard to mechanical behavior, ceramic materials are relatively stiff and strong. Stiffness and strength are comparable to those of the metals. In addition, they are typically very hard**.** Historically, ceramics have exhibited extreme brittleness (lack of ductility) and are highly susceptible to fracture. **(to be continued)**

**After text activity**

**Exercise 1.**  **Look up new words and word-combinations given below in your dictionary and memorize them:**

|  |
| --- |
| Elaboration, evoke, specimen, provoking, gradients, heat capacity, susceptibility, refraction, reflectivity, stiff, ductile, fracture, attributable, lustrous, porcelain, deteriorative, malleable, fusible. |

**Exercise 2.**  **Answer the questions:**

1. How may all important properties of solid materials be grouped virtually?

2. How have solid materials been conveniently grouped?

3.What does the structure of a material depend on with regard to the relationships of these four components?

4.What is a material’s performance?

5. Where are advanced materials used?

6. What are metals composed of?

7. How are atoms in metals and their alloys arranged?

8. What are ceramics?

9. What do common ceramic materials include?

**Exercise 3.**  **Match English words and word-groups with their definitions:**

|  |  |
| --- | --- |
| 1. Mechanical properties | a) are related to changes in temperature or temperature gradients across a material; examples of thermal behavior include thermal expansion and heat capacity. |
| 2. Electrical properties | b) relate deformation to an applied load or force; examples include elastic modulus (stiffness), strength, and resistance to fracture. |
| 3. Thermal properties | c) the responses of a material to the application of a magnetic field; common magnetic properties include magnetic susceptibility and magnetization. |
| 4. Magnetic properties | d) the stimulus is an applied electric field; typical properties include electrical conductivity and dielectric constant. |
| 5. Optical properties | e) relate to the chemical reactivity of materials; for example, corrosion resistance of metals. |
| 6. Deteriorative characteristics | f) are compounds between metallic and nonmetallic elements; they are most frequently oxides, nitrides, and carbides. |
| 7. Metal | g) the number of heat units needed to raise the temperature of a body by one degree |
| 8.Ceramics | h)Engineered materials that sense and react to environmental conditions or have properties that can be altered in a controlled fashion by light, temperature. |
| 9.heat capacity | i) a solid material which is typically hard, shiny, malleable, fusible, and ductile, with good electrical and thermal conductivity (e.g. iron, gold, silver, and aluminium, and alloys such as steel. |
| 10. smart materials | j) the stimulus is electromagnetic or light radiation; index of refraction and reflectivityare representative optical properties. |

**Exercise 4. Group the synonyms according to their similarity.**

|  |
| --- |
| Light, radiation, emission, illumination, alter, field, refer; frequently, force, concept; notion, branch, characteristic, property, react,change, relate, often, power, respond. |

**Exercise 5.**    **Pick out all international words from the text.**

**Exercise 6. Fill in the gap with an appropriate word.**

**(lustrous; magnetic, dense, stiff, metallic, nonmetallic, arranged, fracture, properties, good)**

Metals are composed of one or more\_\_\_\_\_1\_\_\_\_\_\_\_\_ elements (e.g., iron, aluminum, copper, titanium, gold, nickel), and often also \_\_\_\_\_2\_\_\_\_\_\_ elements (e.g., carbon, nitrogen, oxygen) in relatively small amounts. Atoms in metals and their alloys are \_\_\_\_3\_\_\_\_\_\_ in a very orderly manner and are relatively\_\_\_\_\_\_4\_\_\_\_\_\_\_ in comparison to the ceramics and polymers. With regard to mechanical characteristics, these materials are relatively \_\_\_\_5\_\_\_\_\_\_\_ and strong, yet are ductile, and are resistant to\_\_\_\_\_6\_\_\_\_\_\_, which accounts for their widespread use in structural applications. Many \_\_\_\_\_7\_\_\_\_\_\_ of metals are directly attributable to these electrons. For example, metals are extremely\_\_\_\_\_\_8\_\_\_\_\_\_\_ conductors of electricity and heat, and are not transparent to visible light; a polished metal surface has a **\_\_\_\_\_**9**\_\_\_\_\_\_** appearance. In addition, some of the metals (i.e., Fe, Co, and Ni) have desirable\_\_\_\_\_\_10\_\_\_\_\_\_\_\_ properties.

**Exercise 7. Open the brackets, using Past Simple, Past Continuous, Past Perfect.**

1.We (not to rest) yesterday.

2**.** You (to come) home at six o’clock yesterday?

3. Who (to ring) you up an hour ago?

4. He (to enter) the Aviation Institute last year.

5.John (to prepare) report all day yesterday6.We (to discuss) the first industrial revolution, the one that (to take) place some centuries ago

7.The World Health Organization (WHO) (to study) air pollution around the world for over eight years**.** 8. By the beginning of the lecture the laboratory assistant (to bring) all the necessary diagrams.

9.She (to finish) her test when we (to come).

10.The practical use of electricity on a larger scale (**to become**) possible after developing electromagnetic machines, generators and transformers.

**Exercise 8. Open the brackets, using Future Simple, Future Continuous, Future Perfect.**

1.The third-year students (to have) industrial training next summer.

2.Specialized study and courses (to help) students to become specialists and prepare them for their future work.

3.In July they (to take) their exams for the whole month.

4.What you (to do) in the laboratory tomorrow morning? We (to watch) the operation of a new device.

5.They (not to pass) their exams by the time you return.

6. It is evident that electricity (to be) the energy of the future.

7.My friend (to take) the course in English next semester.

8.I still (to study) English in two years′ time.

9.Soon millions of turbines (to turn) wind into electricity.

10.Irrigation technology (to become) more efficient.

**Exercise** **9.** Compose a story on one of the topics (up to 100 words):

1. All important properties of solid materials
2. Classification of Materials
3. Metals are extremely good conductors of electricity and heat.

**Unit 5**

Read the text: **Materials for Nuclear Engineering**

**Nuclear engineering** is a branch of engineering concerned with applying [nuclear fission](http://nuclear-power.com/nuclear-power/fission/) and [nuclear fusion](http://nuclear-power.com/nuclear-power/nuclear-fusion/) and applying other sub-atomic physics based on the principles of [nuclear physics](http://nuclear-power.com/nuclear-power/reactor-physics/atomic-nuclear-physics/). In general, nuclear engineering deals with applying [nuclear energy](http://nuclear-power.com/nuclear-power/nuclear-energy/) in various branches, including [nuclear power plants](http://nuclear-power.com/nuclear-power-plant/), naval propulsion systems, food production, or medical diagnostic equipment such as MRI machines.(MRI is an abbreviation for `magnetic resonance imaging.

In general, there are two basic types of materials that are used in nuclear power plants.

**Materials have specific nuclear properties**. These materials must fulfill very specific requirements that originate, especially in interactions of atomic nuclei. This class corresponds to the nuclear fuels, neutron-absorbing materials, or alloys of[low neutron capture cross-sections](http://nuclear-power.com/nuclear-power/reactor-physics/nuclear-engineering-fundamentals/neutron-nuclear-reactions/neutron-capture-radiative-capture/neutron-capture-cross-section/). Proper nuclear properties are a priority for these materials, and the best chemical state (atomic properties) could be selected (e.g.,, [boron as a neutron absorber](http://nuclear-power.com/glossary/boron-10/) can be used in water solution as [boric acid](http://nuclear-power.com/glossary/boron-10/boric-acid-chemical-shim/) or as boron carbide –  B4C in [control rods](http://nuclear-power.com/nuclear-power-plant/control-rods/)).

**Standard engineering materials.** These materials do not differ from the material used in other engineering branches. Nuclear engineering puts higher requirements on the quality and reliability of all materials than in other engineering branches. This class corresponds, for example, to alloys, such as structural steels, stainless steels, aluminum alloys, etc. A few specific alloys have been developed for particular applications, such as Zr alloys in water reactors, which also belong to materials with specific nuclear properties. ( Zr symbol the chemical element zirconium).

**Materials** essential for designing nuclear power plants can be divided into the following groups:

**Nuclear Fuels.** [Nuclear fuel](http://nuclear-power.com/nuclear-power-plant/nuclear-fuel/) is generally any material that can be ‘burned’ by [nuclear fission](http://nuclear-power.com/nuclear-power/fission/) to derive [nuclear energy](http://nuclear-power.com/nuclear-power/nuclear-energy/). Common nuclear reactors use [enriched uranium](http://nuclear-power.com/nuclear-power-plant/nuclear-fuel/uranium/enriched-uranium/) and [plutonium](http://nuclear-power.com/nuclear-power-plant/nuclear-fuel/plutonium/) as fuel. Most PWRs (PWR- abbreviation pressurized-water reactor) use uranium fuel, which is in the form of uranium dioxide, but other fuels and matrices are developed.

**Neutron Moderators.** The [moderator](http://nuclear-power.com/neutron-moderator/), which is important in thermal reactors, is used to moderate, that is, to slow down [neutrons](http://nuclear-power.com/nuclear-power/reactor-physics/atomic-nuclear-physics/fundamental-particles/neutron/) from fission to thermal energies. Commonly used moderators include regular (light) water (roughly 75% of the world’s reactors), solid graphite (20% of reactors), and heavy water (5% of reactors). Beryllium and beryllium oxide (BeO) have been used occasionally, but they are very costly.

**Neutron Absorbers.** The materials that absorb neutrons are used in the reactor core in the following three cases:

In control rods, that are an important safety system of nuclear reactors.

As [burnable absorbers](http://nuclear-power.com/nuclear-power-plant/nuclear-fuel/burnable-absorbers-burnable-poisons/), which can be dispersed uniformly in fuel or placed in certain sections.

As additives to a moderator for compensation of an excess reactivity.

**Coolants.** In a nuclear power plant, water and steam are common fluids used forheat exchange in the primary circuit (from the surface of fuel rods to the coolant flow) and in the secondary circuit. But many other materials can be used for this purpose. In power reactors, carbon dioxide, heavy water, helium, or liquid metals can be used.

**Radiation Shielding.** Radiation shielding usually consists of barriers of lead, concrete, or water. Many materials can be used for radiation shielding, but there are many situations in radiation protection. It depends on the type of radiation to be shielded, its energy, and many other parameters. For example, even [depleted uranium](http://nuclear-power.com/nuclear-power-plant/nuclear-fuel/uranium/depleted-uranium/) can be used as good protection from gamma radiation, but on the other hand, uranium is inappropriate [shielding of neutron radiation](http://nuclear-power.com/nuclear-power/reactor-physics/atomic-nuclear-physics/fundamental-particles/neutron/shielding-neutron-radiation/).

**After text activity**

**Exercise 1. Read and memorize using a dictionary:**

|  |
| --- |
| [Nuclear fission](http://nuclear-power.com/nuclear-power/fission/), [nuclear fusion](http://nuclear-power.com/nuclear-power/nuclear-fusion/), [nuclear power plants](http://nuclear-power.com/nuclear-power-plant/), naval propulsion systems, alloys of[low neutron capture cross-sections](http://nuclear-power.com/nuclear-power/reactor-physics/nuclear-engineering-fundamentals/neutron-nuclear-reactions/neutron-capture-radiative-capture/neutron-capture-cross-section/); neutron absorber; [boric acid](http://nuclear-power.com/glossary/boron-10/boric-acid-chemical-shim/) , boron carbide, [control rods](http://nuclear-power.com/nuclear-power-plant/control-rods/), quality, reliability, [enriched uranium](http://nuclear-power.com/nuclear-power-plant/nuclear-fuel/uranium/enriched-uranium/), fuel, uranium dioxide, matrices plural form of matrix, [moderator](http://nuclear-power.com/neutron-moderator/), slow down, roughly,burnable, dispersed, uniformly,additives, excess, heat exchange , barriers of lead, radiation shielding, [depleted uranium](http://nuclear-power.com/nuclear-power-plant/nuclear-fuel/uranium/depleted-uranium/), inappropriate, originate. |

**Exercise 2.**  Match the left part with the right:

|  |  |
| --- | --- |
| 1.Nuclear engineering | a) must fulfill very specific requirements that originate, especially in interactions of atomic nuclei. |
| 2.Materials with specific nuclear properties. | b) is a branch of engineering concerned with applying [nuclear fission](http://nuclear-power.com/nuclear-power/fission/) and [nuclear fusion](http://nuclear-power.com/nuclear-power/nuclear-fusion/) |
| 3.Standard engineering materials | c) is generally any material that can be ‘burned’ by [nuclear fission](http://nuclear-power.com/nuclear-power/fission/) to derive [nuclear energy](http://nuclear-power.com/nuclear-power/nuclear-energy/). |
| 4. [Nuclear fuel](http://nuclear-power.com/nuclear-power-plant/nuclear-fuel/) | d) is used to moderate, that is, to slow down [neutrons](http://nuclear-power.com/nuclear-power/reactor-physics/atomic-nuclear-physics/fundamental-particles/neutron/) from fission to thermal energies. |
| 5. The [moderator](http://nuclear-power.com/neutron-moderator/) | e) are the materials that absorb neutrons. |
| 6.Neutron absorbers | f) usually consists of barriers of lead, concrete, or water. |
| 7. In power reactors, | g) are an important safety system of nuclear reactors. |
| 8. Radiation shielding | h) water and steam are common fluids used forheat exchange in the primary circuit |
| 9.Control rods | i) carbon dioxide, heavy water, helium, or liquid metals can be used. |
| 10. In a nuclear power plant, | j)do not differ from the material used in other engineering branches. |

**Exercise 3. Answer the following questions:**

1.What does nuclear engineering deal with in general?

2. How many basic types of materials are used in nuclear power plants?

3.What does this class ofmaterials with specific nuclear properties correspond to?

4.What does this class with standard engineering materials correspond to?

5.How can materials essential for designing nuclear power plantsbe divided into?

6. Where are the materials that absorb neutrons used?

7. Where are water and steam forheat exchange in the primary circuit used?

8. What does radiation shielding usually consist of?

9. What materials can be used for radiation shielding?

**Exercise 4. Are these sentences True or False?**

**1.**Nuclear engineering is the branch of engineering concerned with applying [nuclear fission](http://nuclear-power.com/nuclear-power/fission/) and [nuclear fusion](http://nuclear-power.com/nuclear-power/nuclear-fusion/).

**2.** In general, there are three basic types of materials that are used in nuclear power plants.

3.These materials have specific nuclear properties. and mustn′t fulfill very specificrequirements that originate, especially in interactions of atomic nuclei.

4.Standard engineering materials differ from the material used in other engineering branches.

5. A few specific alloys have been developed for particular applications, such as Zr alloys in water reactors, which also belong to materials with specific nuclear properties.

6. Common nuclear reactors use [enriched uranium](http://nuclear-power.com/nuclear-power-plant/nuclear-fuel/uranium/enriched-uranium/) and [plutonium](http://nuclear-power.com/nuclear-power-plant/nuclear-fuel/plutonium/) as fuel.

**Exercise 5. Put the words into the right order. Check your answers with the text**

1.In power reactors| can| carbon dioxide| heavy water| helium| or| liquid metals| be used.

2.can| many| materials | be used| for |radiation shielding.

3.gamma radiation | for example, |even |[depleted uranium](http://nuclear-power.com/nuclear-power-plant/nuclear-fuel/uranium/depleted-uranium/) |be used |as| good protection| from | can.

4.particular| applications| a few| specific alloys| have been developed| for |

**Exercise 6. Fill in the blanks with appropriate words in the box.**

(1. requirements;2. nuclei; 3. corresponds; 4.a priority; 5. selected;6. solution)

These materials must fulfill very specific \_\_\_\_\_\_1\_\_\_\_\_\_\_\_\_ that originate, especially in interactions of atomic \_\_\_\_\_2\_\_\_\_\_\_\_\_. This class \_\_\_\_\_\_\_\_3\_\_\_\_\_\_\_\_\_to the nuclear fuels, neutron-absorbing materials, or alloys of[low neutron capture cross-sections](http://nuclear-power.com/nuclear-power/reactor-physics/nuclear-engineering-fundamentals/neutron-nuclear-reactions/neutron-capture-radiative-capture/neutron-capture-cross-section/). Proper nuclear properties are \_\_\_\_\_\_\_\_4\_\_\_\_\_\_\_\_\_ for these materials, and the best chemical state (atomic properties) could be \_\_\_\_\_\_5\_\_\_\_\_\_\_\_\_(e.g.,, [boron as a neutron absorber](http://nuclear-power.com/glossary/boron-10/) can be used in water \_\_\_\_\_\_\_\_6\_\_\_\_\_\_\_\_ as [boric acid](http://nuclear-power.com/glossary/boron-10/boric-acid-chemical-shim/) or as boron carbide –  B4C in [control rods](http://nuclear-power.com/nuclear-power-plant/control-rods/)).

**Exercise** **7. Open the brackets using the verbs in Present, Past, Future Simple Passive:**

1.All materials (to expose) to external stimuli that evoke some types of responses.

2.A composite (to compose) of two or more individual materials that come from the categories previously discussed- metals, ceramics, and polymers

3. A large number of composite types (to represent) by different combinations of metals, ceramics, and polymers.

4. At the last competition the first prize (to win) by our team

5.That problem (to discuss) at out meeting.

6.The exams (to take) in January.

7.We (to give) a new task tomorrow.

8.In summer you (to send) to a big plant for your industrial training.

9.The development of science closely (to connect) with the development of higher education. 10.The scientific and technological progress of a country (to determine) by the qualification of specialists.

**Exercise** **8. Open the brackets using the verbs in Present, Past Continuous Passive and Present, Past, Future Perfect Passive:**

1.What grammar (to explain) when you came in?

2.Numerous questions (to discuss) by the commission now.

3.New methods of research (to use) in our lab nowadays.

4.Computers and lasers widely (to introduce) at plants and factories this year.

5.The air in many cities (to pollute) by traffic and industry by the next year.

6.Today′s global economy (to form) by market, not by the principals of ecology

7.A new deep-level tunnel (to complete) in London this week.

8.The new apparatus already (to install) when the delegation arrived

9.The temperature (to maintain) at the point of 20 degrees since the beginning of the experiment. 10.A new research (to carry out) successfully by our team.

**Exercise** **9.** Compose a story on one of the topics (up to 100 words):

1. Nuclear engineering deals with applying [nuclear energy](http://nuclear-power.com/nuclear-power/nuclear-energy/) in various branches.
2. Materials have specific nuclear properties.
3. Materials essential for designing nuclear power plants.

**Unit 6**

**Read the text: Energy and the environment.**

Energy consumption is inherent in almost all types of human activity, namely, home heating, cooking, moving vehicles, industry, agricultural production, etc. The development of diverse types of energy on a global scale has led to an unprecedented increase in living standards.

Today’s people are very energy dependent. We do not think about where the energy comes from, until we turn off the light or the heating. If this happens, we cannot fully live or work.

The main sources of energy available now to humans can be classified as follows:

• fossil fuel (coal and oil shale, oil, natural gas);

• nuclear and thermonuclear energy;

• renewable energy resources (energy of water, wind, sun, thermal waters, wood, peat, etc.).

Energy production significantly affects the state of environment. Combustion of fossil solid and liquid fuels is accompanied by the renewable of sulphur, carbon dioxide and carbon monoxide, as well as nitrogen oxides, dust, soot, and other pollutants.

Open-pit coal mining and peat extraction lead to changes in natural landscapes. Oil and oil product spills during production and transportation can destroy all living things in huge areas (water areas). Very bad impact on the landscape, flora and fauna is produced by the infrastructure necessary for coal, oil, and gas production.

Construction and operation of large hydroelectric power plants lead to: resettlement of people from the flooding zone, destruction of valuable fish species, for which dams become obstacles on the way to spawning area, loss of forests and high-fertile lands, increased risk of destructive earthquakes in the foothills and mountain areas, increased risk of catastrophic floods in areas downstream, change of landscapes and their destruction.

Nuclear power is potentially dangerous because of possible accidents at power plants, accompanied by the release of radioactive materials into the environment. In addition, there are problems of nuclear waste processing and disposal, which are very expensive and do not have a reliable engineering solution. Nuclear waste remains hazardous for hundreds and thousands of years. This topic is especially relevant for Ukraine, which suffered from the consequences of the Chernobyl nuclear power plant explosion.

Despite the obvious advantages, renewable energy sources can also have a negative impact on the environment. The operation of plants producing energy from renewable energy sources is associated with the withdrawal from circulation of significant land plots and is likely to be accompanied by some negative consequences for the environment in the future: landscape changes (windmills, solar panels), increased noise (wind turbines), soil pollution (geothermal power plants and biomass plants), harmful effects on other natural resources (tidal power plants).

In recent years, global politicians and people have expressed concerns about the escalation of global environmental problems – such as acid precipitation, climate

change and the impact of these processes on the environment

Considering the above situation, energy saving can be considered a rational decision. It should become a priority in the development strategy of any country because the reserves of traditional energy sources are limited.

**Exercise 1 Look up new words given below in your dictionary and memorise them:**

consumption, inherent, diverse, fossil fuel, oil shale, renewable, release, pollutants, pit coal mining, peat extraction, landscapes, destructions, impact resettlement, obstacles, spawning area, fertile lands, nuclear waste, **withdrawal**, acid precipitation

**Exercise 2. Complete the collocations with the noun a-e. Study their Ukrainian translation**

|  |  |
| --- | --- |
| 1.  Oil \_\_ – нафтовий сланець | a,. precipitation |
| 2. open-pit coal \_\_ – видобуток вугілля відкритим способом | b. floods |
| 3. acid \_\_ – кислотні опади | c. peat |
| 4. \_\_ extraction – видобуток торфу | d. shale |
| 5. catastrophic \_\_ – катастрофічні повені | e. mining |

**Exercise 3. Answer the following questions:**

1. What has led to an unprecedented increase in living standards?

2. Why are people very energy dependent?

3. How can the main sources of energy be classified?

4.What significantly affects the state of environment?

5.What is combustion of fossil solid and liquid fuels accompanied by?

6.What can destroy all living things in huge areas (water areas).?

7. Why is nuclear power potentially dangerous?

8. What is the operation of plants producing energy from renewable energy sources associated with?

9.Why have people expressed concerns about the escalation of global environmental problems?

10.What should become a priority in the development strategy of any country?

**Exercise 4. Decide whether the statements are true or false and correct them if necessary:**

1. Living standards are directly proportional to energy consumption.

2. Extraction, mining and combustion of fossil fuels destroy the surface of the earth.

3. Surrounding area of hydroelectric power plants is destructed.

4. There are many reliable technologies of nuclear waste storage.

5. The use of renewables has positive consequences for the environment.

6.. Lack of traditional energy sources is a matter of concern for people globally.

**Exercise 5. Which sentence on the right goes with the sentence on the left?**

|  |  |
| --- | --- |
| 1. Energy consumption is | a, the state of environment. |
| 2. We do not think about where the energy comes from, | b. to changes in natural landscapes |
| 3. Energy production significantly affects | c. until we turn off the light or the heating. If this happens, we cannot fully live or work. |
| 4. Open-pit coal mining and peat extraction | d. because of possible accidents at power plants |
| 5. Nuclear power is potentially dangerous | e. inherent in almost all types of human activity |

**Exercise 6. Make up questions. Change the form of the verb, add the auxiliary one and the proper prepositions if necessary**.

1. How / energy production influence / the environment?

2. What / open-pit coal mining, peat extraction, oil and oil product spills lead /?

3. How / construction and operation / hydroelectric power plants affect the surrounding area?

4. Why / to be / the topic / nuclear power especially relevant / Ukraine?

5. What /environmental problems / to be / to be / solve / in the near future?

**Exercise 7**

**a). Form nouns from the given verbs:**

to consume, to produce, to act, to classify, to depend, to extract, to dispose, to express, to precipitate, to circulate.

**b) form adjectives from the given nouns**: globe, agriculture, significance, value, hazard, destruction, catastrophe, explosion, advantage, harm.

**Exercise 8. Fill in the gaps with the modal verbs: may, can, must.**

1.\_\_\_\_\_\_\_\_\_\_ you speak French? Unfortunately, I speak only English.

2. You\_\_\_\_\_\_ smoke here, don’t you know?

3. You\_\_\_\_\_\_\_ read this text: it is easy enough.

4. You \_\_\_\_\_\_study hard to pass the exam.

5. Tony is very clever. He \_\_\_\_\_\_\_ speak three languages.

6. I’m interested in environment problems. I think we\_\_\_\_\_\_learn to live in harmony with nature.

7. At what time\_\_\_\_\_\_ you come to the university?

8. \_\_\_\_\_\_ I take your dictionary? No, I’m still translating the text.

9.Peter \_\_\_\_\_ return the book to the library, we all want to read it.

**Exercise 9. Fill in the gaps with the modal verbs: can, must, may, should.**

1. I feel I \_\_\_\_\_do something before it is too late.

2. You \_\_\_\_\_\_\_\_work more, you \_\_\_\_\_\_\_\_\_ miss lessons.

3.Your questions surprise me, you \_\_\_\_\_\_\_\_\_ know this.

4. Though it is unpleasant mission, I feel I\_\_\_\_\_\_\_ tell him the truth.

5. He\_\_\_\_\_\_ answer the teacher’s questions yesterday, but he\_\_\_\_\_\_\_ answer the same questions today.

6. He\_\_\_\_\_\_not have learned the news, that’s why he looks as if nothing had happened.

**7**. If you see anything unusual, you\_\_\_\_\_\_\_\_\_call the police.

8. You\_\_\_\_\_\_\_\_have studied the material thoroughly, you have no mistakes in the paper.

9. Libraries are quite free, and anyone who likes\_\_\_\_\_\_get books there.

**Exercise 10. Compose a story on one of the topics (up to 100 words):**

1.Today’s people are very energy dependent

2. The main sources of energy available now to humans.

3. Impact on the environment caused by the production of electrical energy.

**Unit 7**

**Nuclear power plant**

**Read the text**

Nuclear power plants are a type of [power plant](https://energyeducation.ca/encyclopedia/Power_plant) that use the process of [nuclear fission](https://energyeducation.ca/encyclopedia/Nuclear_fission) in order to [generate electricity](https://energyeducation.ca/encyclopedia/Generate_electricity). They do this by using [nuclear reactors](https://energyeducation.ca/encyclopedia/Nuclear_reactor) in combination with the [Rankine cycle](https://energyeducation.ca/encyclopedia/Rankine_cycle), where the [heat](https://energyeducation.ca/encyclopedia/Heat) generated by the reactor converts water into [steam](https://energyeducation.ca/encyclopedia/Steam), which spins a [turbine](https://energyeducation.ca/encyclopedia/Turbine) and a [generator](https://energyeducation.ca/encyclopedia/Generator). [Nuclear power](https://energyeducation.ca/encyclopedia/Nuclear_power) provides the world with around 11% of its total [electricity](https://energyeducation.ca/encyclopedia/Electricity), with the largest producers being the United States and France.

Aside from the source of [heat](https://energyeducation.ca/encyclopedia/Heat), nuclear power plants are very similar to [coal-fired power plants](https://energyeducation.ca/encyclopedia/Coal-fired_power_plant). However, they require different safety measures since the use of [nuclear fuel](https://energyeducation.ca/encyclopedia/Nuclear_fuel) has vastly different properties from [coal](https://energyeducation.ca/encyclopedia/Coal) or other [fossil fuels](https://energyeducation.ca/encyclopedia/Fossil_fuel). They get their [thermal power](https://energyeducation.ca/encyclopedia/Thermal_power) from splitting the [nuclei](https://energyeducation.ca/encyclopedia/Nuclei) of [atoms](https://energyeducation.ca/encyclopedia/Atom) in their reactor core, with [uranium](https://energyeducation.ca/encyclopedia/Uranium) being the dominant choice of [fuel](https://energyeducation.ca/encyclopedia/Fuel) in the world today. [Thorium](https://energyeducation.ca/encyclopedia/Thorium) also has potential use in nuclear power production, however it is not currently in use. Below is the basic operation of a [boiling water power plant](https://energyeducation.ca/encyclopedia/Boiling_water_reactor), which shows many components of a power plant, along with the [generation of electricity](https://energyeducation.ca/encyclopedia/Electricity_generation)

**Nuclear Reactor**

The reactor is a key component of a power plant, as it contains the fuel and its [nuclear chain reaction](https://energyeducation.ca/encyclopedia/Nuclear_chain_reaction), along with all of the [nuclear waste](https://energyeducation.ca/encyclopedia/Nuclear_waste) products. The reactor is a heat source for the power plant, just like the [boiler](https://energyeducation.ca/encyclopedia/Boiler) is for a [coal](https://energyeducation.ca/encyclopedia/Coal) plant. Uranium is the dominant [nuclear fuel](https://energyeducation.ca/encyclopedia/Nuclear_fuel) used in nuclear reactors, and its fission reactions are what produce the heat within a reactor. This heat is then [transferred](https://energyeducation.ca/encyclopedia/Heat_transfer) to the reactor's coolant, which provides heat to other parts of the nuclear power plant.

Besides their use in power generation, there are other types of nuclear reactors that are used for [plutonium](javascript:%20void(0)) manufacturing, the propulsion of ships, aircraft and satellites, along with research and medical purposes. The power plant encompasses not just the reactor, but also cooling towers, turbines, generators, and various safety systems. The reactor is what makes it differ from other [external heat engines](https://energyeducation.ca/encyclopedia/External_heat_engine).

**Steam Generation**

The production of [steam](https://energyeducation.ca/encyclopedia/Steam) is common among all nuclear power plants, but the way this is done varies immensely. The most common power plants in the world use [pressurized water reactors](https://energyeducation.ca/encyclopedia/Pressurized_water_reactor), which use two loops of circling water to produce steam. The first loop carries extremely hot [liquid](https://energyeducation.ca/encyclopedia/Liquid) water to a [heat exchanger](https://energyeducation.ca/encyclopedia/Heat_exchanger), where water at a lower pressure is circulated. It then heats up and [boils](https://energyeducation.ca/encyclopedia/Boiling_point) to steam, and can then be sent to the turbine section. Boiling, the second most common reactor in power generation, heat the water in the core directly to steam.

**Turbine and Generator**

Once steam has been produced, it travels at high [pressures](https://energyeducation.ca/encyclopedia/Pressure) and [speeds](https://energyeducation.ca/encyclopedia/Speed) through one or more [turbines](https://energyeducation.ca/encyclopedia/Turbine). These get up to extremely high speeds, causing the steam to lose [energy](https://energyeducation.ca/encyclopedia/Energy), therefore, condensing back to cooler [liquid](https://energyeducation.ca/encyclopedia/Liquid) [water](https://energyeducation.ca/encyclopedia/Water). The rotation of the turbines is used to spin an electric [generator](https://energyeducation.ca/encyclopedia/Generator), which produces electricity that is sent out to the [electrical grid](https://energyeducation.ca/encyclopedia/Electrical_grid).

**Cooling Towers**

Perhaps the most iconic symbol of a nuclear power plant is the cooling towers. They work to reject [waste heat](https://energyeducation.ca/encyclopedia/Waste_heat) to the [atmosphere](https://energyeducation.ca/encyclopedia/Atmosphere) by the transfer of heat from hot water (from the turbine section) to the cooler outside [air](https://energyeducation.ca/encyclopedia/Air). Hot water cools in contact with the air and a small portion, around 2%, evaporates and raises up through the top. Moreover, these plants do not release any [carbon dioxide](https://energyeducation.ca/encyclopedia/Carbon_dioxide)—the primary [greenhouse gas](https://energyeducation.ca/encyclopedia/Greenhouse_gas) that contributes to [climate change](https://energyeducation.ca/encyclopedia/Climate_change).

Many nuclear power plants simply put the waste heat into a river, lake or ocean instead of having cooling towers. Many other power plants like [coal-fired power plants](https://energyeducation.ca/encyclopedia/Coal-fired_power_plant) have cooling towers or these large bodies of water as well. This similarity exists because the [process of turning heat into electricity](https://energyeducation.ca/encyclopedia/Thermodynamics) is almost identical between nuclear power plants and coal-fired power plants.

**Efficiency**

The [efficiency](https://energyeducation.ca/encyclopedia/Efficiency) of a nuclear power plant is determined similarly to other [heat engines](https://energyeducation.ca/encyclopedia/Heat_engine)—since technically the plant is a large heat engine. The amount of [electric power](https://energyeducation.ca/encyclopedia/Electric_power) produced for each unit of [thermal power](https://energyeducation.ca/encyclopedia/Thermal_power) gives the plant its [thermal efficiency](https://energyeducation.ca/encyclopedia/Thermal_efficiency), and due to the [second law of thermodynamics](https://energyeducation.ca/encyclopedia/Second_law_of_thermodynamics) there is an upper limit to how efficient these plants can be.

Typical nuclear power plants achieve efficiencies around 33-37%, comparable to fossil fueled power plants. Higher [temperature](https://energyeducation.ca/encyclopedia/Temperature) and more modern designs like the [Generation IV nuclear reactors](https://energyeducation.ca/encyclopedia/Generation_IV_nuclear_reactors) could potentially reach above 45% efficiency.

**Exercise 1 Look up new words given below in your dictionary and memorise them:**

convert, spin, , splitting, reactor core, [nuclear waste](https://energyeducation.ca/encyclopedia/Nuclear_waste) products, coolant, encompass, propulsion, cooling towers, , [external heat engines](https://energyeducation.ca/encyclopedia/External_heat_engine), loop, [heat exchanger](https://energyeducation.ca/encyclopedia/Heat_exchanger), reject [waste heat](https://energyeducation.ca/encyclopedia/Waste_heat), evaporate, primary [greenhouse gas](https://energyeducation.ca/encyclopedia/Greenhouse_gas), [thermal efficiency](https://energyeducation.ca/encyclopedia/Thermal_efficiency).

**Exercise 2. Answer the questions:**

1.What type of a [power plant](https://energyeducation.ca/encyclopedia/Power_plant) is a nuclear power plant?

2.What process is used in nuclear power plants in order to [generate electricity](https://energyeducation.ca/encyclopedia/Generate_electricity)?

3.What type of plants are nuclear power plants very similar to?

4.Where do nuclear power plants  get their [thermal power](https://energyeducation.ca/encyclopedia/Thermal_power) from?

5.How much of total [electricity](https://energyeducation.ca/encyclopedia/Electricity) in the world does n[uclear power](https://energyeducation.ca/encyclopedia/Nuclear_power) provide?

6.What countries are the largest producers of [nuclear power](https://energyeducation.ca/encyclopedia/Nuclear_power)?

7.What is a key component of a power plant?

8.What does a power plant encompass?

9.What is the second most common reactor in power generation?

10.How do cooling towers work?

11.How is the [efficiency](https://energyeducation.ca/encyclopedia/Efficiency) of a nuclear power plant determined?

**Exercise 3. Agree or disagree with the following statements marking them as – True or False and correct them.**

1.[Nuclear power](https://energyeducation.ca/encyclopedia/Nuclear_power) provides the world with around 15% of its total [electricity](https://energyeducation.ca/encyclopedia/Electricity).

2. Nuclear power plants are very similar to [coal-fired power plants](https://energyeducation.ca/encyclopedia/Coal-fired_power_plant).

3. Nuclear power plants get their [thermal power](https://energyeducation.ca/encyclopedia/Thermal_power) from splitting the [nuclei](https://energyeducation.ca/encyclopedia/Nuclei) of [atoms](https://energyeducation.ca/encyclopedia/Atom) in their reactor core.

4. Cooling towers are key components of a power plant.

5.Hot water cools in contact with the air and a big portion, around 10%, evaporates and raises up through the top.

6.These plants release much [carbon dioxide](https://energyeducation.ca/encyclopedia/Carbon_dioxide).

7. Many nuclear power plants simply put the waste heat into a river, lake or ocean instead of having cooling towers.

8.This similarity exists because the [process of turning heat into electricity](https://energyeducation.ca/encyclopedia/Thermodynamics) is almost identical be in nuclear power plants and coal-fired power plants.

9. The [efficiency](https://energyeducation.ca/encyclopedia/Efficiency) of a nuclear power plant is quite different from other [heat engines](https://energyeducation.ca/encyclopedia/Heat_engine).

**Exercise 4. Which sentence on the right goes with the sentence on the left?**

|  |  |
| --- | --- |
| 1.Nuclear power plants are a type of a [power plant](https://energyeducation.ca/encyclopedia/Power_plant) | a. use [pressurized water reactors](https://energyeducation.ca/encyclopedia/Pressurized_water_reactor), |
| 2.The reactor is | b. to spin an electric [generator](https://energyeducation.ca/encyclopedia/Generator), which produces electricity that is sent out to the [electrical grid](https://energyeducation.ca/encyclopedia/Electrical_grid). |
| 3.The most common power plants in the world | c. is the cooling towers. |
| 4.The rotation of the turbines is used | d. a key component of a power plant. |
| 5.The most iconic symbol of a nuclear power plant | e that uses the process of [nuclear fission](https://energyeducation.ca/encyclopedia/Nuclear_fission) in order to [generate electricity](https://energyeducation.ca/encyclopedia/Generate_electricity) |

**Exercise 5. Fill in the gap with an appropriate word.**

1- require, 2- potential, 3- source, 4- splitting,5- similar, 6- production, 7-fossil, 8- core, 9-measures, 10 fuel

Aside from the \_\_\_\_\_\_\_\_of [heat](https://energyeducation.ca/encyclopedia/Heat), nuclear power plants are very \_\_\_\_\_\_\_\_\_to [coal-fired power plants](https://energyeducation.ca/encyclopedia/Coal-fired_power_plant). However, they \_\_\_\_\_\_different safety \_\_\_\_\_\_\_since the use of [nuclear \_\_\_\_\_\_](https://energyeducation.ca/encyclopedia/Nuclear_fuel) has vastly different properties from [coal](https://energyeducation.ca/encyclopedia/Coal) or other [\_\_\_\_\_\_\_ fuels](https://energyeducation.ca/encyclopedia/Fossil_fuel). They get their [thermal power](https://energyeducation.ca/encyclopedia/Thermal_power) from \_\_\_\_\_\_\_\_\_the [nuclei](https://energyeducation.ca/encyclopedia/Nuclei) of [atoms](https://energyeducation.ca/encyclopedia/Atom) in their reactor \_\_\_\_\_\_\_with [uranium](https://energyeducation.ca/encyclopedia/Uranium) being the dominant choice of [fuel](https://energyeducation.ca/encyclopedia/Fuel) in the world today. [Thorium](https://energyeducation.ca/encyclopedia/Thorium) also has \_\_\_\_\_\_use in nuclear power \_\_\_\_\_\_\_\_however it is not currently in use.

**Exercise 6. Write questions for the following answers.**

[1.Nuclear power](https://energyeducation.ca/encyclopedia/Nuclear_power) provides the world with around 11% of its total [electricity](https://energyeducation.ca/encyclopedia/Electricity).

2. The largest producers of [nuclear power](https://energyeducation.ca/encyclopedia/Nuclear_power)  are the United States and France.

3. Aside from the source of [heat](https://energyeducation.ca/encyclopedia/Heat), nuclear power plants are very similar to [coal-fired power plants](https://energyeducation.ca/encyclopedia/Coal-fired_power_plant)

4.Nuclear power plants  get their [thermal power](https://energyeducation.ca/encyclopedia/Thermal_power) from splitting the [nuclei](https://energyeducation.ca/encyclopedia/Nuclei) of [atoms](https://energyeducation.ca/encyclopedia/Atom) in their reactor core.

5.Uranium is the dominant [nuclear fuel](https://energyeducation.ca/encyclopedia/Nuclear_fuel) used in nuclear reactors

6. The power plant encompasses not just the reactor, but also cooling towers, turbines, generators, and various safety systems.

7. These plants do not release any [carbon dioxide](https://energyeducation.ca/encyclopedia/Carbon_dioxide).

8. Many nuclear power plants simply put the waste heat into a river, lake or ocean instead of having cooling towers.

9. The [efficiency](https://energyeducation.ca/encyclopedia/Efficiency) of a nuclear power plant is determined similarly to other [heat engines](https://energyeducation.ca/encyclopedia/Heat_engine).

10. Typical nuclear power plants achieve efficiencies around 33-37%, comparable to fossil fueled power plants.

**Exercise 7.** **Fill in the gaps with the modal verbs and their equivalents: can, may, must, should, to be able to, to have to and to be to.**

1.They decided that she\_\_\_\_\_\_to leave them a message every tenth day.

2. You\_\_\_\_\_\_\_not do it if you don’t want to.

3.Where \_\_\_\_\_the meeting to take place?

4. I\_\_\_\_\_\_\_\_to help you with your work, when I finish mine.

5.The meeting \_\_\_\_\_\_\_to begin at 5p.m. Don’t be late.

6. If you want to master the language, you\_\_\_\_\_\_ read much.

7. You shouldn’t ask for help, you\_\_\_\_\_\_\_to solve this problem yourself.

8. He\_\_\_\_\_\_\_\_to read the text twice before he understood it.

9. You\_\_\_\_\_\_\_do it once over again.

10.You\_\_\_\_\_\_\_ find mistakes and correct them.

**Exercise 8.** **Change the following sentences into negative**

1.He had to sit up late with this work.

2.You will have to get up very early tomorrow.

3.These documents have to be filed.

4.She had to do it once over again.

5.I have to answer many letters.

6. They will have to speak to him about it.

7. She has to make a report at the conference.

9. Is she waiting? She is to wait for me at home. We have arranged so.

10.He was able to answer the teacher’s questions yesterday

**Exercise 9. Compose a story on one of the topics (up to 100 words):**

1. Nuclear power plants in Ukraine.
2. Nuclear Reactor
3. Cooling Towers

**References:**

**Unit 1**

<file:///C:/Users/Irina/Downloads/0321537114.pdf>

**Unit 2**

file:///C:/Users/Irina/Downloads/0321537114.pdf

**Unit 3**

[Materials Science and Engineering An Introduction by William D. Callister, Jr., David G. Rethwish (z-lib.org).pdf1.pdf](file:///C:\Users\Irina\Downloads\Materials%20Science%20and%20Engineering%20An%20Introduction%20by%20William%20D.%20Callister,%20Jr.,%20David%20G.%20Rethwish%20(z-lib.org).pdf)

file:///C:/Users/Irina/Downloads/060-Introduction-to-Materials-Science-for-Engineers-James-F.-Shackelford-Edisi-8-2015%20(1).pdf

<https://www.sciencedirect.com/journal/materials-science-and-engineering-a>

<https://mse.umd.edu/about/what-is-mse>

**Unit 4**

[Materials Science and Engineering An Introduction by William D. Callister, Jr., David G. Rethwish (z-lib.org).pdf1.pdf](file:///C:\Users\Irina\Downloads\Materials%20Science%20and%20Engineering%20An%20Introduction%20by%20William%20D.%20Callister,%20Jr.,%20David%20G.%20Rethwish%20(z-lib.org).pdf)

file:///C:/Users/Irina/Downloads/060-Introduction-to-Materials-Science-for-Engineers-James-F.-Shackelford-Edisi-8-2015%20(1).pdf

<https://www.sciencedirect.com/journal/materials-science-and-engineering-a>

<https://mse.umd.edu/about/what-is-mse>

**Unit 5**

<file:///C:/Users/Irina/Downloads/Introduction-to-Nuclear-Engineering-Lamarsh-3rd-Edition.pdf>

file:///C:/Users/Irina/Downloads/Nuclear-Engineering-Handbook.pdf

[Nuclear engineering](C:\\Users\\Julia\\Downloads\\Nuclear engineeringEncyclopedia Britannicahttps:\\www.britannica.com › ... › Civil Engineering)

[Encyclopedia Britannica](C:\\Users\\Julia\\Downloads\\Nuclear engineeringEncyclopedia Britannicahttps:\\www.britannica.com › ... › Civil Engineering)

[https://www.britannica.com › ... › Civil Engineering](C:\\Users\\Julia\\Downloads\\Nuclear engineeringEncyclopedia Britannicahttps:\\www.britannica.com › ... › Civil Engineering)

**Unit 6**

http://energopostachalnyk.com/en/electricity/

**Unit 7**

**Nuclear power plant**

<https://energyeducation.ca/encyclopedia/Nuclear_power_plant>

**Keys:**

**Unit1**

**Exercise 1.**  **Look up new words and word-combinations given below in your dictionary and memorize them:**

|  |
| --- |
| ENIAC ( Electronic Numerical Integrator and Calculator) електронний цифровий інтегратор та калькулятор,  Input devices пристрій введення,  Output devices Вивідні пристрої,  Blackberries кишенькові комп'ютери,  law enforcement правоохоронні органи  Software програмне забезпечення,  Hardware апаратне забезпечення,  CPU (The central processing unit) центральний процесор,  artillery ballistic tables артилерійські балістичні таблиці,  Main memory основна пам'ять; оперативна пам'ять,  conduct business transactions проведення ділових операцій, manufacturing facilities виробничі підприємства. |

**Exercise 2.**  **Answer the questions:**

1.Where and how do people use computers?

At school, at work**,** at home. The uses of computers are almost limitless in our everyday lives.

2.Why can computers do such a wide variety of things?

Computers can do such a wide variety of things because they can be programmed.

3.What does Microsoft Word allow you to do?

Microsoft Word is a word processing program that allows you to create, edit, and print documents with your computer.

4.What does Adobe Photoshop allow you to do?

Adobe Photoshop is an image editing program that allows you to work with graphic images, such as photos taken with your digital camera.

5.Why is Software essential to a computer?

Software is essential to a computer because it controls everything the computer does.

6.What does a programmer, or software developer do?

A programmer, or software developer, is a person with the training and skills necessary to design, create, and test computer programs.

7.Where will you find programmers’ work?

Today, you will find programmers’ work used in business, medicine, government, law enforcement, agriculture, academics, entertainment, and many other fields.

8.What does the term hardware refer to?

The term hardware refers to all of the physical devices, or components, that a computer is made of.

9.What major components does a typical computer system consist of? A typical computer system consists of the following major components:

• The central processing unit (CPU)

• Main memory

• Secondary storage devices

• Input devices

• Output devices

10.When was the world’s first programmable electronic computer built?

The ENIAC (Electronic Numerical Integrator and Calculator), which is considered by many to be the world’s first programmable electronic computer, was built in 1945 to calculate artillery ballistic tables for the U.S.

**Exercise 3.**  **Match the left part with the right:**

1c;2a;3g;4b;5h;6d;7e;8f;9j;10i.

**Exercise 4. Place the words in correct order:**

1. The uses of computers are almost limitless in our everyday lives.
2. Computers are not designed to do just one job.
3. Computer programming is an exciting and rewarding career.
4. The CPU is the most important component in a computer.

**5.**Today, CPUs are small chips known as microprocessors

**Exercise 5. Fill in the blanks with appropriate words in the box.**

1.limitless;2. because;3. designed;4. a set of;5. program;6. print;7. an image;8. digital;

9. referred to

**Exercise 6.** **Open the brackets, using the verbs in Present Indefinite. Choose the correct verb forms.**

1. A program **is** a set of instructions that a computer **follows** to perform a task.

2. Software **is** essential to a computer because it controls everything the computer does.

3. The uses of computers **are** almost limitless in our everyday lives.

4. Students **have** four exams in January.

5. The CPU isthe most important component in a computer.

6. Microsoft Word **is** a word processing program that allows you to create, edit, and print documents with your computer.

7. Today, CPUs **are** small chips known as microprocessors.

8. Computer programming **is** an exciting and rewarding career.

9. There **are** laboratories, workshops and libraries in our University.

10. Every faculty has its own computer center.

11. Our library has a great number of books and magazines in all branches of science and technology.

12.We **have** industrial training in the third year.

13.The students often **have** interesting discussions after lectures.

14.There **are** a great number of goods that can be transported by air.

15.There are lights in the middle of the crossing.

**Exercise 7.** **Open the brackets, using the verbs in Present Indefinite.** **Choose the correct verb forms.**

1.This **means** that computers **are** not designed to do just one job.

2. Optical discs **hold** large amounts of data.

3.The term hardware **refers** to all of the physical devices, or components, that a computer **is** made of.

4.Like the different instruments in a symphony orchestra, each device in a computer **plays** its own part.

5.At school, students **use** computers for tasks such as writing papers, searching for articles, sending email, and participating in online classes.

6.And **don’t** forget that cell phones, iPods, Blackberries, car navigation systems, and many other devices **are** computers too.

7.A typical computer system **consists** of the following major components.

8. Most computers **have** a disk drive mounted inside their case.

9.A floppy disk drive **records** data onto a small floppy disk, which can be removed from the drive.

10.A disk drive **stores** data by magnetically encoding it onto a circular disk.

**Unit2**

**Exercise 1.**  **Read and memorize using a dictionary:**

|  |
| --- |
| RAM (random-access memory) оперативна пам'ять,  volatile нестабільний,  secondary storage вторинне сховище,  payroll data дані про фонд оплати праці,  inventory records інвентаризаційний облік,  disk drive дисковод,  backup copies резервні копії,  floppy disk drives дисководи для гнучких дисків,  USB (universal serial bus) drives приводи універсальної послідовної шини ),  flash memory флеш пам'ять,  DVD (digital versatile disc) цифровий універсальний диск,  retrieve відновити,  fit into- вписатися в  . |

**Exercise 2.**  **Answer the questions:**

1.How is main memory commonly known?

Main memory is commonly known as random-access memory, or RAM.

2.What is a type of memory that can hold data for long periods of time?

Secondary Storageis a type of memory that can hold data for long periods of time, even when there is no power to the computer.

3.Where is important data, such as word processing documents, payroll data, and inventory records, saved?

Important data, such as word processing documents, payroll data, and inventory records, is saved to secondary storage as well.

4.What is the most common type of secondary storage device?

The most common type of secondary storage device is the disk drive.

5. What can external disk drives be used for? External disk drives can be used to create backup copies of important data or to move data to another computer.

6. What disadvantages do floppy disks have? Floppy disks have many disadvantages, however. They hold only a small amount of data, they are slow to access data, and they can be unreliable

7.Where do drives store data? They store data in a special type of memory known as flash memory.

8. What do CD and DVD drives use to detect the pits and thus read the encoded data? CD and DVD drives use a laser to detect the pits and thus read the encoded data.

9. How is the component that collects the data and sends it to the computer called?

The component that collects the data and sends it to the computer is called an input device.

10Why can Disk drives and Optical drives also be considered input devices?

Disk drives and optical drives can also be considered input devices because programs and data are retrieved from them and loaded into the computer’s memory.

11Why can Disk drives and CD recorders also be considered output devices?

Disk drives and CD recorders can also be considered output devices because the system sends data to them in order to be saved.

12. What does the operating system do?

The operating system controls the internal operations of the computer’s hardware, manages all of the devices connected to the computer, allows data to be saved to and retrieved from storage devices, and allows other programs to run on the computer.

**Exercise 3.**  **Match English words and word-groups with their definitions.**

**1e;2d;3a;4h;5b;6g;7c;8f;10i; 9j.**

**Exercise 4. Put a tick (✓) if the sentence is right and a cross (×) if it is wrong. Correct the mistake.**

1. Main memory is commonly known as random-access memory, or **RAM. (✓)**
2. When the computer is turned off, the contents of RAM are stored. **(×)**
3. Secondary Storage is a type of memory that can hold data for long periods of time. **(✓)**
4. Programs are normally stored in main memory and loaded into secondary memory as needed. **(×)**
5. The most common type of secondary storage device is the disk drive. **(✓)**
6. External disk drives cannot be used to create backup copies of important data or to move data to another computer.  **(×)**
7. USB drives are big devices that plug into the computer’s USB (universal serial bus) port, and appear to the system as a disk drive. **(×)**
8. CD and DVD drives use a laser to detect the pits and thus read the encoded data.  **(✓)**
9. Input is any data the computer collects for people and for other devices. (×)

Input is any data the computer collects from people and from other devices.

1. Outputis any data the computer produces for people or for other devices.  **(✓)**

**Exercise 5. Fill in the blanks with appropriate words in the box.**

**(1. collects; 2. sends; 3. devices; 4. microphone; 5. optical drives; 6. retrieved)**

**Input** is any data the computer **collects** from people and from other devices. The component that collects the data and **sends** it to the computer is called an input device. Common input **devices** are the keyboard, mouse, scanner, **microphone**, and digital camera. Disk drives and **optical drives** can also be considered input devices because programs and data are **retrieved** from them and loaded into the computer’s memory.

**Exercise 6. Open brackets choosing the right words:**

Outputis any data the (**computer** | calculator) produces for people or for other **(devices|** appliances)**.** It might be a **(sales report/** defect report), a list of names, or a graphic image. The data is sent to an (**output|** input) device, which formats and presents it. Common output devices are video displays and printers. Disk drives and CD recorders can also be (**considered|** discussed) output devices because the system (**sends |** transmits) data to them in order to be saved.

**Exercise 7. Give the words that have similar meanings (synonyms).**

|  |
| --- |
| detect; discover; display; show, control; govern; order; book, save; preserve  memory; storage; main; principal; device; appliance; people; population; collect; gather. |

Exercise 8. Open the brackets, using the **Present Continuous Tense**. Choose the correct verb forms.

1. When a computer (is | are) performing the tasks that a program tells it to do, we say that the computer (is| are) running or executing the program. (is performing), (computer is running)
2. This is where the computer stores a program while the program **is running**, as well as the data that the program **is working with.**
3. RAM is usually a volatile type of memory that is used only for temporary storage while a program **is running.**
4. The more civilization (to develop), the greater the ecological problems (to become).

**(is developing; are becoming)**

1. I (not to write) an article now. I (to listen) to the music. **(I′m not writing; I′m listening)**
2. Look at the sky: the clouds (to move) slowly, the sun (to appear) from behind the clouds, it (to get) warmer. (are **moving; the sun is appearing; it is getting warmer)**
3. At present scientists in industrially developed countries (to work) on the theory of interaction of all the atmospheric and oceanic global processes that determine the climate and weather of the world. **(are working)**
4. What you (to do) here now? – We (to listen) to tape-recordings. **(Are you doing; we′re listening)**
5. We (to translate) a technical text now. **(we are translating)**
6. Water and air (is |are) becoming more and more polluted**. (is becoming)**
7. **There are government** and public organizations that **are analyzing** data on land, forest and air.
8. You (to have) a break? **Are you having a break?**
9. What language you (to study)? **are you studying?**
10. Science {is | are) becoming a leading factor in the progress of mankind. **(is becoming)**
11. At present mankind (is | are) making considerable investments to eliminate air pollution **(is making)**
12. Today the changes in the global climate and water balance **are bringing** about serious changes in the environment.
13. Many scientists **are constantly carrying out** experimental work to solve the problem of environment protection.
14. The company **is making** plans for the future.
15. It is evident that research **is becoming** more specialized now.
16. It is industrialization that **is making** ecological problems very serious.

**Unit 3**

**After text activity**

**Exercise 1.**  **Look up new words and word-combinations given below in your dictionary and memorize them:**

|  |
| --- |
| Furnishings предмети обстановки, nutritious - поживний,forerunner- передвісник, superior -покращений; вищих; alter- змінювати; approximately приблизно, empower уповноважують, accessibility- доступність, sophisticated -складний, predetermine зумовити, nebulous неясний, aggregate сукупний, intimately безпосередньо, pottery кераміка ;гончарні вироби |

**Exercise 2. Match the left part with the right:**

**1e; 4a;2d;3f;5j;6i;7b;10g;8c;9h**

**Exercise 3.**   **Give the words that have opposite meanings (antonyms).**

|  |
| --- |
| a few, many, modern, outmoded; involve; exclude; ancestor, descendant, microstructure,   1. macrostructure, individual, common, develop, decrease, expensive, cheap, create, destroy, comparable, incomparable. |

**Exercise 4. Answer the questions:**

1.What does Materials Science and Engineering (MSE) combine? Materials Science and Engineering (MSE) combines engineering, physics and chemistry principles to solve real-world problems associated with nanotechnology, biotechnology, information technology, energy, manufacturing and other major engineering disciplines.

2. How have in fact, early civilizations been designated? In fact, early civilizations have been designated by the level of their materials development (Stone Age, Bronze Age, Iron Age).

3. What materials did earliest humans have access to? The earliest humans had access to only a very limited number of materials, those that occur naturally: stone, wood, clay, skins, and so on.

4. When did they discover techniques for producing materials? Later, they discovered techniques for producing materials that had properties superior to those of the natural ones; these new materials included pottery and various metals.

5. When did scientists come to understand the relationships between the structural elements of materials and their properties.? It was not until relatively recent times that scientists came to understand the relationships between the structural elements of materials and their properties.

6. What has the development of many technologies that makes our existence so comfortable been intimately associated with? The development of many technologies that makes our existence so comfortable has been intimately associated with the accessibility of suitable materials.

7. What does materials science involve? Strictly speaking, materials science involves investigating the relationships that exist between the structures and properties of materials.

8. What is the role of a materials scientist from a functional perspective? From a functional perspective, the role of a materials scientist is to develop or synthesize new materials,

9. What is the role of a materials engineer? A materials engineer is called upon to create new products or systems using existing materials and/or to develop techniques for processing materials.

10.What does the structure of a material usually relate to? In brief, the structure of a material usually relates to the arrangement of its internal components.

11. How may structural elements be classified? Structural elements may be classified on the basis of size and in this regard there are several levels:

**Exercise 5. Fill in the blanks with appropriate words in the box.**

(1. a few; 2. like;3. modern; 4. cell phones; 5. refrigerators;6. lives; 7. advancement; 8. designated)

Please take \_\_\_\_\_1\_\_\_\_\_moments and reflect on what your life would be \_\_2\_\_\_\_\_\_\_ without all of the materials that exist in our \_\_\_\_3**\_\_\_\_\_** world. Believe it or not, without these materials we wouldn’t have automobiles, \_\_\_\_\_4\_\_\_\_\_\_\_\_, the internet, airplanes, nice homes and their furnishings, stylish clothes, nutritious (also “junk”) food, \_\_\_\_\_5\_\_\_\_\_\_\_\_, televisions, computers. Virtually every segment of our everyday \_\_\_\_6\_\_\_\_\_\_ is influenced to one degree or another by materials. Without them our existence would be much like that of our Stone Age ancestors. Historically, the development and \_\_\_\_\_\_7\_\_\_\_\_\_\_ of societies have been intimately tied to the members’ ability to produce and manipulate materials to fill their needs. In fact, early civilizations have been \_\_\_\_\_\_\_8\_\_\_\_\_ by the level of their materials development (Stone Age, Bronze Age, Iron Age).

Please take **a few** moments and reflect on what your life would be **like** without all of the materials that exist in our **modern** world. Believe it or not, without these materials we wouldn’t have automobiles, **cell phones**, the internet, airplanes, nice homes and their furnishings, stylish clothes, nutritious (also “junk”) food, **refrigerators,** televisions, computers. Virtually every segment of our everyday **lives** is influenced to one degree or another by materials. Without them our existence would be much like that of our Stone Age ancestors. Historically, the development and **advancement** of societies have been intimately tied to the members’ ability to produce and manipulate materials to fill their needs. In fact, early civilizations have been **designated** by the level of their materials development (Stone Age, Bronze Age, Iron Age).

**Exercise 6.**    **Pick out all international words from the text.**

**Exercise** **7.** **Open the brackets, using the Present Perfect Tense.**

1. That the problem of pollution and ecology (to become) the most important one for mankind is evident to all. **(has become)**

2. He (not to translate) the article yet**. (hasn′t translated)**

3. Distance learning (to develop) over years from satellite video courses to modern video conferencing through personal computers**. (has developed)**

4.The rain (to stop) but a cold wind is still blowing**. (has stopped)**

5. I never (to be) to London**. (have never been to)**

6. You (to make) any spelling mistakes in your dictation**? (Have you made)**

7. I (not to see) my cousin since last year. **(haven′t seen)**

8. Why you (to put) these things in the wrong place? **(Why have you put)**

9. “We (not to meet) for such a long time!” said my friend. “Yes, indeed”, I answered, “and we both (to grow)”. **(haven′t seen, have grown)**

10. Water pollution (to become) a serious problem in many British rivers. (**has become)**

11. We just (to talk) about it. **(have just talked)**

12. He (to tell) us nothing about it. **(has told)**

13. She (not to speak) yet **(has not spoken.)**

14. Who (to write) this article? **(has written)**

15. We already (to learn) a lot of English words. (**have already learned)**

16. He just (to do) something for us. (**has just done)**

17. We already (to solve) the problem**. (have already solved)**

18. I (not to see) him since 1987. (**have not seen)**

19. My father knows so much because he (to travel) a lot. (**has travelled)**

20.But industrial pollution (to make) many sources of water undrinkable. (**has made)**

**Unit 4.**

**After text activity**

**Exercise 1.**  **Read and memorize using a dictionary:**

|  |
| --- |
| Elaboration доопрацювання, evoke викликати, specimen зразок, provoking провокувати, gradients градієнти, heat capacity теплоємність, susceptibility схильність, refraction рефракції, reflectivity рефлективність, stiff жорсткий, ductile пластичний, fracture руйнування, attributable які відносяться, lustrous блискучий, porcelain фарфор, deteriorative погіршуватися, malleable ковкий, fusible. легкоплавкий |

**Exercise 2.**  **Answer the questions:**

1. How may virtually all important properties of solid materials be grouped? Virtually all important properties of solid materials may be grouped into six different categories: mechanical, electrical, thermal, magnetic, optical, and deteriorative.

2.What two other important components are involved in the science and engineering

of materials? In addition to structure and properties, two other important components are involved in the science and engineering of materials-namely, processing and performance.

3.What does the structure of a material depend on with regard to the relationships of these four components? With regard to the relationships of these four components, the structure of a material depends on how it is processed. Furthermore, a material’s performance is a function of its properties.

4.What is a material’s performance? Furthermore, a material’s performance is a function of its properties.

5. What three basic categories have solid materials been conveniently grouped into? Solid materials have been conveniently grouped into three basic categories: metals, ceramics, and polymers, a scheme based primarily on chemical makeup and atomic structure.

6. Where are advanced materials used? Another category is advanced materials—those used in high-technology applications, such as semiconductors, biomaterials, smart materials, and nanoengineered materials.

7. What are metals composed of? Metals are composed of one or more metallic elements (e.g., iron, aluminum, copper, titanium, gold, nickel), and often also nonmetallic elements (e.g., carbon, nitrogen, oxygen) in relatively small amounts.

8. How are atoms in metals and their alloys arranged? Atoms in metals and their alloys are arranged in a very orderly manner and are relatively dense in comparison to the ceramics and polymers.

9.What are ceramics?Ceramics are compounds between metallic and nonmetallic elements; they are most frequently oxides, nitrides, and carbides.

10. What do common ceramic materials include? For example, common ceramic materials include aluminum oxide, silicon dioxide, silicon carbide, silicon nitride.

**Exercise 3.**  **Match English words and word-groups with their definitions:**

**1b;2d;3a;4c;5j;6e;7i;8f;9g;10h.**

**Exercise 4. Group the synonyms according to their similarity.**

|  |
| --- |
| Light; illumination; radiation; emission, alter; change; field; branch; refer; relate; frequently; often; force, power; concept; notion; characteristic; property; react;respond, |

**Exercise 5.**    **Pick out all international words from the text.**

**Exercise 6. Fill in the gap with an appropriate word.**

**(1. metallic, 2. nonmetallic, 3. arranged,4. dense, 5 stiff,6. fracture,7. properties,8. good;**

**9. lustrous; 10. magnetic.)**

Metals are composed of one or more\_\_\_\_\_1\_\_\_\_\_\_\_\_ elements (e.g., iron, aluminum, copper, titanium, gold, nickel), and often also \_\_\_\_\_2\_\_\_\_\_\_ elements (e.g., carbon, nitrogen, oxygen) in relatively small amounts. Atoms in metals and their alloys are \_\_\_\_3\_\_\_\_\_\_ in a very orderly manner and are relatively\_\_\_\_\_\_4\_\_\_\_\_\_\_ in comparison to the ceramics and polymers. With regard to mechanical characteristics, these materials are relatively \_\_\_\_5\_\_\_\_\_\_\_ and strong, yet are ductile, and are resistant to\_\_\_\_\_6\_\_\_\_\_\_, which accounts for their widespread use in structural applications. Many \_\_\_\_\_7\_\_\_\_\_\_ of metals are directly attributable to these electrons. For example, metals are extremely\_\_\_\_\_\_8\_\_\_\_\_\_\_ conductors of electricity and heat, and are not transparent to visible light; a polished metal surface has a **\_\_\_\_\_**9**\_\_\_\_\_\_** appearance. In addition, some of the metals (i.e., Fe, Co, and Ni) have desirable\_\_\_\_\_\_10\_\_\_\_\_\_\_\_ properties.

Metals are composed of one or more **metallic** elements (e.g., iron, aluminum, copper, titanium, gold, nickel), and often also **nonmetallic** elements (e.g., carbon, nitrogen, oxygen) in relatively small amounts. Atoms in metals and their alloys are **arranged** in a very orderly manner and are relatively **dense** in comparison to the ceramics and polymers. With regard to mechanical characteristics, these materials are relatively **stiff** and strong, yet are ductile, and are resistant to **fracture,** which accounts for their widespread use in structural applications. Many **properties** of metals are directly attributable to these electrons. For example, metals are extremely **good** conductors of electricity and heat, and are not transparent to visible light; a polished metal surface has a **lustrous** appearance. In addition, some of the metals (i.e., Fe, Co, and Ni) have desirable magnetic properties.

**Exercise 7. Open the brackets, using the Future or Past (Simple, Continuous, Perfect)**

1.We (not to rest) yesterday. (didn′t rest)

**2.** You (to come) home at six o’clock yesterday? (Did you come)

3. Who (to ring) you up an hour ago? (rang you up)

4. He (to enter) the Aviation Institute last year. (entered)

5.The third-year students (to have) industrial training next summer. (will have)

6.Specialized study and courses (to help) students to become specialists and prepare them for their future work. (will help)

7.In July they (to take) their exams for the whole month. (will be taking)

8.What you (to do) in the laboratory tomorrow morning? We (to watch) the operation of a new device. (**Will you be doing; we′ll be watching).**

9.John (to prepare) report all day yesterday**. (was preparing)**

10.We (to discuss) the first industrial revolution, the one that (to take) place some centuries ago

**(discussed; took place)**

11.The World Health Organization (WHO) (to study) air pollution around the world for over eight years. **(studied).**

12.By the beginning of the lecture the laboratory assistant (to bring) all the necessary diagrams.

**(had brought).**

13.They (not to pass) their exams by the time you return. **(will not have passed**)

14.She (to finish) her test when we (to come). (**had finished; came)**

15. It is evident that electricity (to be) the energy of the future. **(will be)**

16.The practical use of electricity on a larger scale (to become) possible after developing electromagnetic machines, generators and transformers. (**became)**

17.My friend (to take) the course in English next semester. **(will take)**

18.I still (to study) English in two years′ time. (**I′ll still be studying)**

19.Soon millions of turbines (to turn) wind into electricity. **(will be turning)**

20.Irrigation technology (to become) more efficient **(will become)**

**Unit 5**

Read the text: **Materials for Nuclear Engineering**

**After text activity**

**Exercise 1. Read and memorize using a dictionary:**

|  |
| --- |
| [Nuclear fission](http://nuclear-power.com/nuclear-power/fission/)-ядерний поділ, [nuclear fusion](http://nuclear-power.com/nuclear-power/nuclear-fusion/)- ядерний синтез, [nuclear power plants](http://nuclear-power.com/nuclear-power-plant/)- атомні електростанції, naval propulsion systems -морські силові установки, alloys of[low neutron capture cross-sections](http://nuclear-power.com/nuclear-power/reactor-physics/nuclear-engineering-fundamentals/neutron-nuclear-reactions/neutron-capture-radiative-capture/neutron-capture-cross-section/)- сплави з малим перерізом захоплення нейтронів ; neutron absorber- поглинач нейтронів; [boric acid](http://nuclear-power.com/glossary/boron-10/boric-acid-chemical-shim/) -борна кислота, boron carbide- карбід бору, [control rods](http://nuclear-power.com/nuclear-power-plant/control-rods/)- стрижні керування, quality- якість, reliability- надійність, [enriched uranium](http://nuclear-power.com/nuclear-power-plant/nuclear-fuel/uranium/enriched-uranium/)-збагачений уран, fuel, uranium dioxide -діоксид урану, matrices plural form of matrix, [moderator](http://nuclear-power.com/neutron-moderator/), slow down, roughly- приблизно,burnable-горючий, dispersed -розсіяний, uniformly- рівномірно,additives -добавки, excess -надлишок, heat exchange теплообмін , barriers of lead- бар'єри свинцю, radiation shielding -захист від радіації, [depleted uranium](http://nuclear-power.com/nuclear-power-plant/nuclear-fuel/uranium/depleted-uranium/)-збіднений уран, inappropriate- невідповідний, originate -зародитися. |

**Exercise 2.**  Match the left part with the right:

**1b;2a;3j;4c;5d;6e;7i;8f;9g;10h**

**Exercise 3. Answer the following questions:**

1.What does nuclear engineering deal with in general, In general, nuclear engineering deals with applying [nuclear energy](http://nuclear-power.com/nuclear-power/nuclear-energy/) in various branches.

2. How many basic types of materials are used in nuclear power plants? In general, there are two basic types of materials that are used in nuclear power plants.

3.What does this class ofmaterials with specific nuclear properties correspond to? This class corresponds to the nuclear fuels, neutron-absorbing materials, or alloys of[low neutron capture cross-sections](http://nuclear-power.com/nuclear-power/reactor-physics/nuclear-engineering-fundamentals/neutron-nuclear-reactions/neutron-capture-radiative-capture/neutron-capture-cross-section/).

4.What does this class with standard engineering materials correspond to? This class corresponds, for example, to alloys, such as structural steels, stainless steels, aluminum alloys, etc.

5.How can materials essential for designing nuclear power plantsbe divided into? Materials essential for designing nuclear power plants can be divided into the following groups:Nuclear Fuels, Neutron Moderators, Neutron Absorbers.

6. Where are the materials that absorb neutrons used? The materials that absorb neutrons are used in the reactor core.

7. Where are water and steam used forheat exchange in the primary circuit?

In a nuclear power plant, water and steam are common fluids used forheat exchange in the primary circuit

8. What does radiation shielding usually consist of? Radiation shielding usually consists of barriers of lead, concrete, or water.

9. What materials can be used for radiation shielding? Many materials can be used for radiation shielding.

**Exercise 4. Are these sentences True or False?**

**1.**Nuclear engineering is the branch of engineering concerned with applying [nuclear fission](http://nuclear-power.com/nuclear-power/fission/) and [nuclear fusion](http://nuclear-power.com/nuclear-power/nuclear-fusion/). **True**

**2.** In general, there are three basic types of materials that are used in nuclear power plants. **False** In general, there are two basic types of materials that are used in nuclear power plants.

3.These materials have specific nuclear properties. and mustn′t fulfill very specificrequirements that originate, especially in interactions of atomic nuclei. **False**

These materials must fulfill very specific requirements that originate, especially in interactions of atomic nuclei. должны отвечать очень специфическим требованиям, которые возникают, особенно в взаимодействиях атомных ядер.

4.Standard engineering materials differ from the material used in other engineering branches. **False.** Standard engineering materials do not differ from the material used in other engineering branches.

5. A few specific alloys have been developed for particular applications, such as Zr alloys in water reactors, which also belong to materials with specific nuclear properties. **True**

6. Common nuclear reactors use [enriched uranium](http://nuclear-power.com/nuclear-power-plant/nuclear-fuel/uranium/enriched-uranium/) and [plutonium](http://nuclear-power.com/nuclear-power-plant/nuclear-fuel/plutonium/) as fuel. **True**

**Exercise 5. Put the words into the right order. Check your answers with the text**

1.In power reactors, carbon dioxide, heavy water, helium, or liquid metals can be used.

2.Many materials can be used for radiation shielding.

3.For example, even [depleted uranium](http://nuclear-power.com/nuclear-power-plant/nuclear-fuel/uranium/depleted-uranium/) can be used as good protection from gamma radiation.

4. Few specific alloys have been developed for particular applications,

**Exercise 6. Fill in the blanks with appropriate words in the box.**

**(1. requirements;2. nuclei; 3. corresponds; 4.a priority; 5. selected;6. solution)**

These materials must fulfill very specific \_\_\_\_\_\_1\_\_\_\_\_\_\_\_\_ that originate, especially in interactions of atomic \_\_\_\_\_2\_\_\_\_\_\_\_\_. This class \_\_\_\_\_\_\_\_3\_\_\_\_\_\_\_\_\_to the nuclear fuels, neutron-absorbing materials, or alloys of[low neutron capture cross-sections](http://nuclear-power.com/nuclear-power/reactor-physics/nuclear-engineering-fundamentals/neutron-nuclear-reactions/neutron-capture-radiative-capture/neutron-capture-cross-section/). Proper nuclear properties are \_\_\_\_\_\_\_\_4\_\_\_\_\_\_\_\_\_ for these materials, and the best chemical state (atomic properties) could be \_\_\_\_\_\_5\_\_\_\_\_\_\_\_\_(e.g.,, [boron as a neutron absorber](http://nuclear-power.com/glossary/boron-10/) can be used in water \_\_\_\_\_\_\_\_6\_\_\_\_\_\_\_\_ as [boric acid](http://nuclear-power.com/glossary/boron-10/boric-acid-chemical-shim/) or as boron carbide –  B4C in [control rods](http://nuclear-power.com/nuclear-power-plant/control-rods/)).

**Exercise** **7. Open the brackets using the verbs in Present, Past, Future Simple Passive:**

1.All materials (to expose) to external stimuli that evoke some types of responses. (are exposed)

2.A composite (to compose) of two or more individual materials that come from the categories previously discussed- metals, ceramics, and polymers. (is composed)

3. A large number of composite types (to represent) by different combinations of metals, ceramics, and polymers. (is represented)

4. At the last competition the first prize (to win) by our team (was won)

5.That problem (to discuss) at out meeting. (was discussed)

6.The exams (to take) in January. (will be taken)

7.We (to give) a new task tomorrow. (shall| will be given)

8.In summer you (to send) to a big plant for your industrial training. (will be sent)

9.The development of science closely (to connect) with the development of higher education. (is closely connected)

10.The scientific and technological progress of a country (to determine) by the qualification of specialists. (is determined)

**Exercise** **8. Open the brackets using the verbs in Present, Past Continuous Passive and Present, Past, Future Perfect Passive:**

1.What grammar (to explain) when you came in? (was being explained)

2.Numerous questions (to discuss) by the commission now. (are being discussed)

3.New methods of research (to use) in our lab nowadays.(are being used)

4.Computers and lasers widely (to introduce) at plants and factories this year. (are being widely introduced)

5.The air in many cities (to pollute) by traffic and industry by the next year. (will have been polluted)

6.Today′s global economy (to form) by market, not by the principals of ecology. (has been formed) Сегодня мировая экономика сформирована рынком, а не принципами экологии.

7.A new deep-level tunnel (to complete) in London this week. (is being completed)

8.The new apparatus already (to install) when the delegation arrived. (had already been installed)

9.The temperature (to maintain) at the point of 20 degrees since the beginning of the experiment. (has been maintained)

10.A new research (to carry out) successfully by our team. (is being carried out)

**Unit 6**

Ex.2

1 d, 2 – e, 3-a 4 c- , 5- b

Ex. 4

1,2, 3,6 -T, 4,5 - F

Ex.5

1 – e, 2- c, 3 – a, 4- b, 5- d

Ex.7.

1. to consume - consumption, consumer, to produce - producer, production, to act- action, actor, to classify - classification, to depend - dependence, to extract - extraction, to dispose - disposition, to express – expression, to precipitate - precipitation, to circulate – circulation.
2. globe - global, agriculture - agricultural, significance – significant, value - valuable, hazar - hazardous, destruction - destructive, catastrophe - catastrophic, explosion – explosive, advantage - advantageous, harm - harmful

Ex. 8

1.can, 2. mustn’t,3. can,4. must,5. can,6. must 7. must, 8. must, 9.may

Ex.9.

1. \_should, 2. should, mustn’t, 3. should, 4. should, 5. could, couldn’t,

6. mustn’t.,7. should, 8. must,9. may.

**Unit 7**

Ex. 3

1 F, 2-T, 3- T ,4 – F, 5- F, 6 – F, 7- T, 8- T, 9-F,

Ex.4

1-e, 2-d, 3-a,4-d, 5- c

Ex.5

1-source, 2- similar,3- require, 4- measures, 5-  fuel, 6-  fossil, 7- splitting,8-core 9 potential, 10. production,

Ex.6

1. What percent of total electricity does nuclear power provide?

2. What countries are the largest producers of nuclear power?

3. What plants are nuclear power plants very similar to aside from the source of heat?

4. How do nuclear power plants get their thermal power?

5. What is the dominant nuclear fuel used in nuclear reactors?

6. What does a power plant encompass?

7. What plants do not release any carbon dioxide?

8. Where do many nuclear power plants simply put the waste heat?

9. How is the efficiency of a nuclear power plant determined

10. What efficiencies do typical nuclear power plants achieve comparable to fossil fueled power plants?

Ex. 7

1. is to, 2. don’t have, 3.is....to, 4. will be able, 5. is to, 6. should, 7. are able to, 8. had to, 9. should 10. should ( will have to)

Ex8.

1.didn’t have, 2.won’t have to, 3.don’t have to, 4. didn’t have to, 5. don’t have to, 6.won’t have to, 7.doesn’t have to, 8.isn’t to, 9.wasn’t able to.