НАРОДНА УКРАЇНСЬКА АКАДЕМІЯ

ПРАКТИКУМ З ПЕРЕКЛАДУ З АНГЛІЙСЬКОЇ МОВИ («НАУКОВО-ТЕХНІЧНИЙ ПЕРЕКЛАД»)

Видавництво НУА

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Навчальний посібник
для студентів II курсу факультету післядипломної освіти

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П69 **Практикум** з перекладу з англійської мови («Науково-технічний переклад») : навч. посіб. для студентів 2 курсу ф-ту після диплом. освіти / Нар. укр. акад., [каф. теорії та практики перекладу ; упоряд. М. М. Козлова]. – Харків : Вид-во НУА, 2015. – 84 с.

Дані навчально-методичні матеріали розраховані на студентів 2 курсу факультету післядипломної освіти «Референт-перекладач» і мають на меті розвинути в студентів навички та уміння перекладу з англійської мови на українську/російську та з української/російської на англійську в усній та письмовій формах професійно-орієнтованих текстів; сформувати системи умінь з усного послідовного двобічного перекладу й письмового перекладу технічних та науково-популярних текстів. Навчальні матеріали складаються з 11 розділів, присвячених оглядовому вивченню основ біології, хімії та фізики. Кожен розділ побудований на основі ілюстрованого матеріалу у вигляді першоджерельних текстів, лексичних вправ за темою заняття, роботи з понятійним апаратом розділу та безпосередньо вправ на переклад.

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ЗМІСТ

ПЕРЕДМОВА

Дані навчально-методичні матеріали розроблено згідно навчальної та робочої програм з курсу практики перекладу з англійської мови (аспект «Науково-технічний переклад») та розраховано на студентів 2 курсу факультету післядипломної освіти «Референт-перекладач». Навчальні матеріали мають своєю метою розвинути в студентів навички та уміння перекладу з англійської мови на українську/російську та з української/російської на англійську в усній та письмовій формах професійно-орієнтованих текстів; сформувати системи умінь з усного послідовного двобічного перекладу й письмового перекладу технічних та науково-популярних текстів. Навчальні матеріали складаються з 11 розділів, присвячених оглядовому вивченню основ біології, хімії та фізики, та текстів для самостійної роботи студентів:

Lesson 1. Exploring Why Matter Matters. Lesson 2. Molecules And Bonds. Lesson 3. Making Life Possible: Proteins. Lesson 4. Nucleic Acids. Lesson 5. An Overview Of Cells. Lesson 6. Reproduction: Keep On Keepin' On. Lesson 7. Biodiversity: Recognizing How Our Differences Make Us Stronger. Lesson 8. Ecosystems Bring It All Together. Lesson 9. Magnetism Vs. Gravity. Lesson 10. Electrostatics And Coulomb's Law. Lesson 11. Work: It Isn't What You Think. Тексти для самостійної роботи.

Кожен розділ побудований на основі ілюстрованого матеріалу у вигляді першоджерельних текстів, лексичних вправ за темою заняття, роботи з понятійним апаратом розділу та безпосередньо вправ на переклад. Кожний розділ супроводжується аудіо- та відеоматеріалами та вправами на опрацювання матеріалу, в них викладеному.

LESSON 1. EXPLORING WHY MATTER MATTERS

Ex. 1. Translate the following text into your native language.

Exploring Why Matter Matters

Matter is the stuff of life — literally. Every living thing is made of matter. In order to grow, living things must get more matter to build new structures. When living things die, be they plants or animals, microbes such as bacteria and fungi digest the dead matter and recycle it so that other living things can use it again. In fact, pretty much all the matter on Earth has been here since the planet formed 4.5 billion years ago; it has just been recycled since then. So, the stuff that makes up your body may once have been part of *Tyrannosaurus rex*, a butterfly, or even a bacterium.

Matter could be invisible: what looks like nothing but is really something? Air! Earth's atmosphere may seem like nothing, but it's made of gases such as nitrogen, carbon dioxide, and oxygen. These gases interact with living things in many ways. Plants, for example, take in carbon dioxide to make food and then use that food to build their structures. It's hard to believe, but the tallest tree in the redwood forest grows and grows from the result of invisible carbon dioxide gas being taken in and incorporated into the body of the tree. Obviously the redwood tree takes up space and has mass, but those invisible carbon dioxide molecules are matter too.

Ex. 2. Read the following Latin names of animals in English.

Alces alces	*Clethrionomys gapperi*
Antilocapra americana	*Eptesicus fuscus*
Arvicola richardsoni	*Erethizon dorsatum*
Canis latrans	*Eutamias amoenus*
Canis lupus	*Eutamias minimus*
Castor canadensis	*Felis concolor*
Cervus elaphus	*Felis lynx*

Felis rufus

Glaucomys sabrinus

Lepus americanus

Lontra canadensis

Marmota caligata

Martes americana

Martes pennanti

Mephitis mephitis

Microsorex hoyi

Microtus pennsylvanicus

Ex. 3. Fill the gaps with the words from the list below. Be ready to interpret the text.

Space, grams, gravity, gases, liters, solids, volume, mass, weigh, liquids.

Following are a few facts you should know about matter:

✓ Matter takes up …. Space is measured in volume, and volume is measured in liters (L).

✓ Matter has mass. … is the term for describing the amount of matter that a substance has. It's measured in … (g). Earth's … pulls on your mass, so the more mass you have, the more you ….

✓ Matter can take several forms. The most familiar forms of matter are solids, liquids, and gases. … have a definite shape and size, such as a person or a brick. … have a definite volume. They can fill a container, but they take the shape of the container that they fill. … are easy to compress and expand to fill a container.

Ex. 4. Find the definitions for the words from the list below. Be ready to interpret the definitions.

Atom, negative ions, quarks, subatomic particles, leptons, protons, mesons, electrons, positive ions, neutrons

1. The smallest particle of a chemical element that can exist.

2. A particle smaller than an atom (e.g., a neutron) or a cluster of such particles (e.g., an alpha particle).

3. A stable subatomic particle occurring in all atomic nuclei, with a positive electric charge equal in magnitude to that of an electron.

4. A subatomic particle of about the same mass as a proton but without an electric charge, present in all atomic nuclei except those of ordinary hydrogen.

5. A stable subatomic particle with a charge of negative electricity, found in all atoms and acting as the primary carrier of electricity in solids.

6. Any of a number of subatomic particles carrying a fractional electric charge, postulated as building blocks of the hadrons.

7. A subatomic particle which is intermediate in mass between an electron and a proton and transmits the strong interaction that binds nucleons together in the atomic nucleus.

8. A subatomic particle, such as an electron, meson, or neutrino, which does not take part in the strong interaction.

9. An electrically charged atom or group of atoms formed by the loss of gain of one or more electrons as a cation which is created by electron loss.

10. An electrically charged atom or group of atoms formed by the loss of gain of one or more electrons as an anion which is created by electron gain.

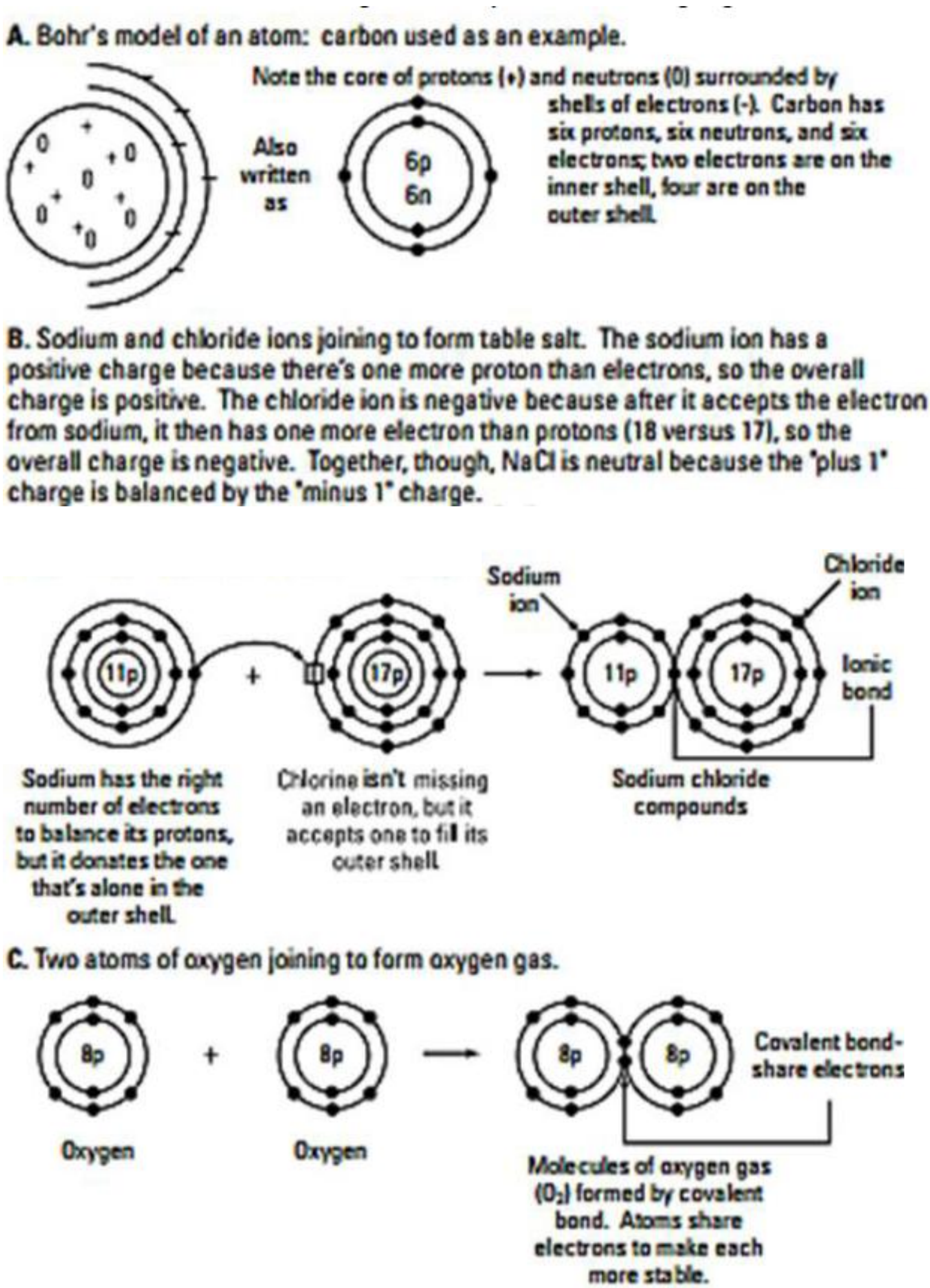
Ex. 5. Translate the following text into English.

Усі хімічні речовини складаються з частинок, класифікація яких в хімії є досить складною. Хімічні перетворення пов’язують насамперед із такими частинками як *атом, молекула, ядро, електрон, протон, нейтрон, йон.*

Вважають, що атом є найменшою хімічною частинкою речовини. *Атом* – це електронейтральна система взаємодіючих елементарних частинок, що складається з позитивно зарядженого ядра та негативно заряджених електронів. Ядро атома утворене протонами, які мають позитивний заряд, та нейтронами, які не мають заряду. Експериментально встановлено, що атом є електронейтральним, оскільки позитивний заряд усіх протонів компенсує негативний заряд усіх електронів в атомі. Отже, кількість електронів в атомі дорівнює кількості протонів у його ядрі. Величина заряду ядра атома дорівнює кількості протонів в атомі.

Наприклад, в атомі оксигену вісім протонів. Отже, величина заряду ядра його атома плюс вісім. А навколо ядра розташовано вісім електронів.

Ex. 6. Translate the following text into your native language.



Ex. 7. Read the following chemical reactions in English.

$H_2+O_2=H_2O$

$Al+S=Al_2S_3$

$AgCl+Na_2S=Ag_2S+NaCl$

$ZrCl_4=ZrCl_3+ZrCl_2+ZrCl+Cl_2$

$NaOH+Cl_2+Br_2=NaBrO_3+NaCl+H_2O$

$2As + 3Cu = Cu_3As_2$,

$2NO + 4Cu = N2 + 2Cu_2O$

$2Cu + 2H_2SO_4+ O_2= 2CuSO_4 + 2H_2O$

Ex. 8. Translate the following text into your native language.

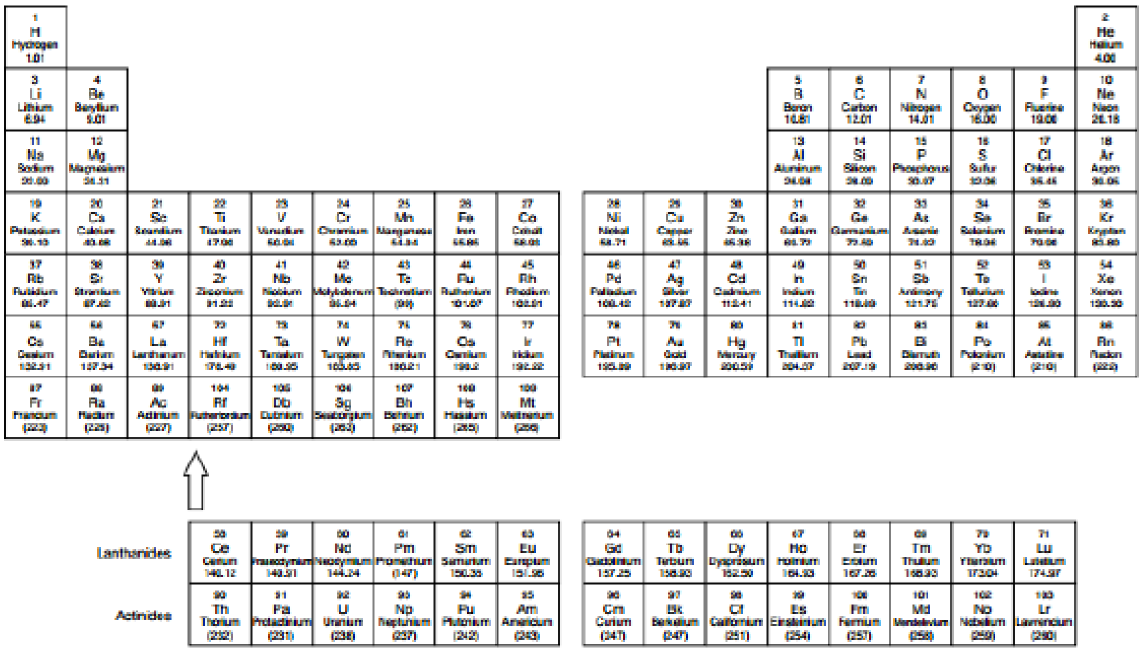


Figure 1. The Periodic Table.

Notice in Figure 1 above how each element has a number associated with it? That number is the atomic number — the number of protons in the nucleus of an atom of a particular element. For example, carbon (the letter C in the periodic table) has six protons in the nucleus of one atom, so its atomic number is 6. Periodic law states that the properties of elements are a periodic function of their atomic numbers. In other words, when elements are arranged by their atomic number, they form groups with similar properties. The number of electrons in one atom of an element is also equal to the atomic number because atoms are neutral (the positively charged particles are offset by the negatively charged particles one for one).

Of all the elements in the periodic table, living things use only a handful. The four most common elements found in living things are hydrogen, carbon, nitrogen, and oxygen, all of which are found in air, plants, and water. (Several other elements exist in smaller amounts in organisms, including sodium, magnesium, phosphorus, sulfur, chlorine, potassium, and calcium.)

Most often, the elements sodium, magnesium, chlorine, potassium, and calcium circulate in the body as electrolytes, substances that release ions when they break apart in water. For instance, when in the "water" of the body, sodium chloride (NaCl) breaks apart into the ions $Na^{+}$and Cl^{-}, which are then used either in organs such as the heart or in cellular processes.

Ex. 9. Choose the correct variant for each sentence using Video #1.

1. Today we know that it is the */billeting/layout/arrangement* of electrons inside each atom that determine its chemical *behavior/properties / features*. And similar arrangements lead to similar *properties// features/behavior*.

2. All of the elements in the table are arranged into groups based on different *meaning/values/significance* of l. Elements in a given column have their outer electrons in similarly shaped orbitals, and this means they have similar chemical properties.

3. In a given group, n increases by one for each row in the table. So the *outward/external/outer* electrons in elements directly below other elements have more energy and are less tightly *bound/attached* to the atom.

LESSON 2. MOLECULES AND BONDS

Ex. 10. Translate the following text into your native language.

Molecules and Bonds

When you start putting elements together, you get more complex forms of matter, such as molecules and compounds. Molecules are made of two or more atoms, and compounds are molecules that contain at least two different elements.

So what holds the elements of molecules and compounds together? Bonds, of course. Two important types of bonds exist in living things:

✓ Ionic bonds hold ions joined together by their opposite electrical charges. Ionic reactions occur when atoms combine and lose or gain electrons. When sodium (Na) and chlorine (Cl) combine, for example, sodium loses an electron to chlorine. Sodium becomes the positively charged sodium ion (Na^+), and chlorine becomes the negatively charged chloride ion (Cl^-). These two oppositely charged ions are attracted to each other, forming an ionic bond.

✓ Covalent bonds are formed when atoms share electrons in a covalent reaction. When two oxygen atoms join together to form oxygen gas, they share two pairs of electrons with each other. Each shared pair of electrons is one covalent bond, so the two pairs of shared electrons in a molecule of oxygen gas have a double bond. Covalent bonds are extremely important in biology because they hold together the back-bones of all biological molecules.

Ex. 11. Fill the gaps with the words from the list below. Be ready to interpret the text.

Malleable metals, metalloids, metals, non-metals, ductile metals.

Elements can be metals, nonmetals, or metalloids. If you look carefully at the periodic table, you can see a line from boron (B), atomic number 5, to polonium (Po), atomic number 84. Except for germanium (Ge) and antimony (Sb), all the elements to the left of that line can be classified as .… They have properties that you normally associate with the metals you encounter in everyday life. They're solid at room temperature (with the exception of mercury, Hg, a liquid), shiny, good conductors of electricity and heat. They can be ... (they can be drawn into thin wires), and ... (they can be easily hammered into very thin sheets).

... have properties opposite those of the metals. They are brittle, aren't malleable or ductile, and are poor conductors of both heat and electricity. They tend to gain electrons in chemical reactions. Some nonmetals are liquids at room temperature. The ... or semimetals, have properties that are somewhat of a cross between metals and nonmetals.

Ex. 12. Find the definitions for the words from the list below. Be ready to interpret the definitions.

Inorganic compounds, acid, oxide, salt, base

1) a compound lacking carbon and hydrogen atoms and are synthesized by the agency of geological systems. In contrast, the synthesis of these compounds in biological systems incorporates carbohydrates into the molecular structure. Organic chemists traditionally refer to any molecule containing carbon as an organic compound and by default this means that inorganic chemistry deals with molecules lacking carbon.

2) a chemical compound that contains at least one oxygen atom and one other element in its chemical formula. Most of the Earth's crust consists of solid oxides, the result of elements being oxidized by the oxygen in air or in water. Hydrocarbon combustion affords the two principal carbon oxides: carbon monoxide and carbon dioxide.

3) a substance that can accept hydrogen ions (protons) or more generally, donate a pair of valence electrons.

4) a substance with particular chemical properties including turning litmus red, neutralizing alkalis, and dissolving some metals.

5) any chemical compound formed from the reaction of an acid with a base, with all or part of the hydrogen of the acid replaced by a metal or other cation.

Ex. 13. Define each picture from Figure 2 employing the information from the text below. Be ready to interpret the definitions.

Providing energy: Carbohydrates

Carbohydrates, as the name implies, consist of carbon, hydrogen, and oxygen. The basic formula for carbohydrates is CH_2O, meaning the core structure of a carbohydrate is one carbon atom, two hydrogen atoms, and one oxygen atom. This formula can be multiplied; for example, glucose has the formula $C_6H_{12}O_6$, which is six times the ratio, but still the same basic formula. Carbohydrates come in the following forms:

1) Monosaccharides: Simple sugars consisting of three to seven carbon atoms are monosaccharides. In living things, monosaccharides form ring-shaped structures and can join together to form longer sugars. The most common monosaccharide is glucose.

2) Disaccharides: Two monosaccharide molecules joined together form a disaccharide. Common disaccharides include sucrose (table sugar) and lactose (the sugar found in milk).

3) Oligosaccharides: More than two but just a few monosaccharides joined together are an oligosaccharide. Oligosaccharides are important markers on the outsides of your cells, such as the oligosaccharides that determine whether your blood type is A or B (people with type O blood don't have any of this particular oligosaccharide).

4) Polysaccharides: Long chains of monosaccharide molecules linked together form a polysaccharide. Some of these babies are huge, and when we say huge, we mean some of them can have thousands of monosaccharide molecules joined together. Starch and glycogen, which serve as a means of storing carbohydrates in plants and animals, respectively, are examples of polysaccharides.

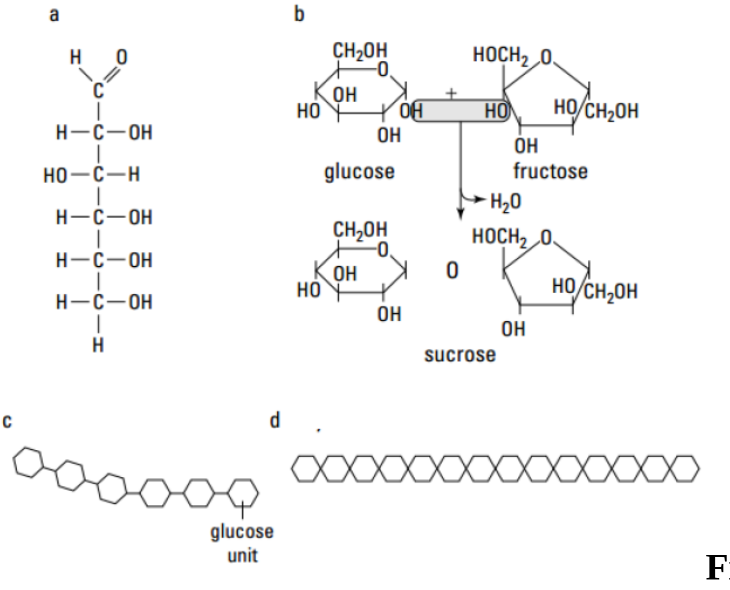


Figure 2. Carbohydrates

Ex. 14. Translate the following text into English.

Усі хімічні сполуки поділяють на неорганічні (мінеральні) і органічні. Чим вони відрізняються? До складу органічних сполук входять чотири хімічні елементи, які називають органогенними: гідроген, оксиген, нітроген і карбон. Останній з них значною мірою зумовлює хімічні властивості організмів. Як і інші органогени хімічні елементи, карбон здатний утворювати міцні ковалентні зв'язки. Атом карбону може зв'язуватись з атомами гідрогену, нітрогену, оксигену. Різні органічні сполуки містять різні функціональні групи і у зв'язку з цим мають різні хімічні й біологічні властивості.

До 90 % сухої маси клітин припадає на 4 типи органічних молекул:

1)білки,

2)ліпіди,

3)вуглеводи,

4) нуклеїнові кислоти (ДНК, РНК) і АТФ.

Окрім зазначених, у живих клітинах містяться органічні сполуки, присутні в менших кількостях, але які також відіграють важливу роль у біохімічних процесах. До них належать: органічні кислоти (піровиноградна, молочна, яблучна, лимонна, жирні кислоти — пальмітинова, стеаринова), пігменти (хлорофіл, білірубін) та ін.

Білки, нуклеїнові кислоти та деякі вуглеводи (полісахариди — крохмаль, целюлоза, хітин, глікоген) називають біополімерами або макромолекулами, оскільки вони складаються з великої кількості одиниць — мономерів. Мономерами білків є амінокислоти, мономерами нуклеїнових кислот — нуклеотиди, мономерами полісахаридів — моносахариди. Часто білки та нуклеїнові кислоти об'єднують терміном «інформаційні полімери», оскільки вони є універсальними біологічними носіями інформації.

Ex. 15. Translate the following summary into English.

Fatigue Crack Growth Characteristics of Laser-Hardened 41300 Steel

Исследованы характеристики скорости роста усталостной трещины для стали с лазерным упрочнением. Проведены испытания по определению роста усталостной трещины на образцах стали при комнатной температуре. Отмечено, что в процессе лазерного упрочнения образовывался твердый слой мартенсита с остаточными напряжениями сжатия на площади, подвергнутой лазерному воздействию. Показано, что наличие такого напряженного состояния преодолевало отрицательное влияние неотпущенного мартенсита.

LESSON 3. MAKING LIFE POSSIBLE: PROTEINS

Ex. 16. Translate the following text into your native language.

Making life possible: Proteins

Without proteins, living things wouldn't exist. Many proteins provide structure to cells; others bind to and carry important molecules throughout the body. Some proteins are involved in reactions in the body when they serve as enzymes (see Chapter 4 for more on enzymes). Still others are involved in muscle contraction or immune responses. The building blocks of proteins could be referred as follows:

Amino acids, of which there are 20, are the foundation of all proteins. Think of them as train cars that make up an entire train called a protein. Figure 3-4 shows what one amino acid looks like.

The genetic information in cells calls for amino acids to link together in a certain order, forming chains called *polypeptide chains.* Amino acids link together by dehydration synthesis, just like sugars do, and each polypeptide chain is made up of a unique number and order of amino acids.

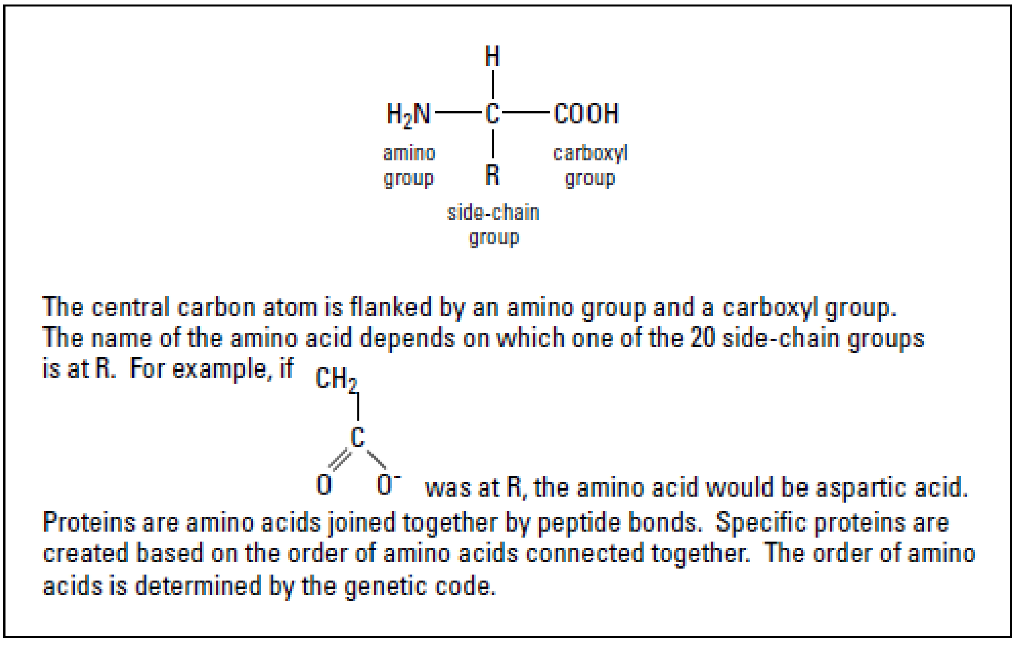


Figure 3. Amino Acid Structure

Ex. 17. Fill the gaps with the words from the list below. Be ready to interpret the text.

Proteins, heme group, enzymes, connective tissue, red blood cell, hemoglobin

One or more polypeptide chains come together to form functional ... . Once formed, each protein does a specific job or makes up a specific tissue in the body.

✓**Enzymes are proteins that speed up the rate of chemical reactions.**

Metabolic processes don't happen automatically; they require … .

✓ **Structural proteins reinforce cells and tissues.** Collagen, a structural protein found in … (the tissue that joins muscles to bones to allow movement), is the most abundant protein in animals with a backbone. Connective tissue includes ligaments, tendons, cartilage, bone tissue, and even the cornea of the eye. It provides support in the body, and it has a great capability to be flexible and resistant to stretching.

✓**Transport proteins move materials around cells and around the body.**

… is a transport protein found in red blood cells that carries oxygen around the body. A hemoglobin molecule is shaped kind of like a three-dimensional four-leaf clover without a stem. Each leaf of the clover is a separate polypeptide chain. In the center of the clover, but touching each polypeptide chain, is a … with an atom of iron at its center. When gas exchange occurs between the lungs and a blood cell, the iron atom attaches to the oxygen. Then, the iron-oxygen complex releases from the hemoglobin molecule in the … so the oxygen can cross cell membranes and get inside any cell of the body.

Ex. 18. Translate the following text into English.

Ліпіди – органічні сполуки, нерозчинні у воді (тобто гідрофобні), їх можна виділити з клітин за допомогою неполярних розчинників (ефіру, хлороформу, ацетону тощо). Ліпіди здатні утворювати складні сполуки з білками, вуглеводами, залишками фосфатної кислоти тощо. Вони є важливими компонентами вітаміну D, деяких статевих гормонів, гормонів кори надниркових залоз. Стероїдну природу мають і жовчні кислоти – важливі компоненти жовчі.

Які функції ліпідів? Одна з найважливіших функцій ліпідів у живих організмах енергетична. У разі повного окиснення 1 г жирів до вуглекислого газу і води виділяється 38,9 кДж енергії, тобто майже удвічі більше, ніж при повному розщепленні такої самої кількості вуглеводів. До того ж при окисненні 1 г жирів утворюється 1,1г води. Саме завдяки запасам жиру деякі тварини можуть відносно тривалий час обходитись без води. Наприклад, верблюди в пустелі можуть не пити по 10-12 діб, а ведмеді, бабаки та інші тварини під час зимової сплячки не споживають води понад два місяці. Необхідну для їхніх процесів життєдіяльності воду ці тварини одержують унаслідок окиснення жирів, відкладених про запас.

Ex. 19. Find the definitions for the words from the list below. Be ready to interpret the definitions.

Phospholipids, steroids, cholesterol, triglycerides, unsaturated fat, saturated fat

1. the lipids, made up of two fatty acids and a phosphate group, have an important structural function for living things because they're part of the membranes of cells.

2. The lipid compounds, consisting of four connecting carbon rings and a functional group that determines the steroid, generally create hormones.

3. A steroid molecule used to make testosterone and estrogen; it's also found in the membranes of cells.

4. These fats and oils, which are made up of three fatty acid molecules and a glycerol molecule, are important for energy storage and insulation. In people, fats form from an excess of glucose.

5. A fat or fatty acid in which there is at least one double bond within the fatty acid chain.

6. A fat that consists of triglycerides containing only saturated fatty acids. They have no double bonds between the individual carbonatoms of the fatty acid chain.

Ex. 20. Write the transcript for Video #2 ("Proteins Structure") and translate it into your native language.

LESSON 4. NUCLEIC ACIDS

Ex. 21. Translate the following text into your native language.

Nucleic acids

Nucleic acids are large molecules that carry tons of small details, specifically all the genetic information for an organism. Nucleic acids are found in every living thing — plants, animals, bacteria, and fungi. Just think about that fact for a moment. People may look different than fungi, and plants may behave differently than bacteria, but deep down all living things contain the same chemical "ingredients" making up very similar genetic material. Nucleic acids are made up of strands of nucleotides. Each nucleotide has three components of its own:

✓ A nitrogen-containing base called a nitrogenous base

✓ A sugar that contains five-carbon molecules

✓ A phosphate group

Your entire genetic composition, personality, and maybe even your intelligence hinge on molecules containing a nitrogen compound, some sugar, and a phosphate. The following sections introduce you to the two types of nucleic acids.

Ex. 22. Fill the gaps with the words from the list below. Be ready to interpret the text.

Reproduced, cytosine, deoxyribonucleic acid, deoxyribose, gene, hereditary information, thymine, genetic code

You may have heard … referred to as "the double helix." That's because DNA contains two strands of nucleotides arranged in a way that makes it look like a twisted ladder. The sides of the ladder are made up of sugar and phosphate molecules, hence the nickname "sugar-phosphate backbone." (The name of the sugar in DNA is … .) The "rungs" on the ladder of DNA are made from pairs of nitrogenous bases from the two strands.

The nitrogenous bases that DNA builds its double helix upon are adenine (A), guanine (G), cytosine (C), and thymine (T). The order of these chemical letters spells out your … . Oddly enough, the bases always pair in a certain way: Adenine always goes with … (A-T), and guanine always links up with … (G-C). These particular base pairs line up just right chemically so that hydrogen bonds can form between them.

Certain sections of nitrogenous bases along a strand of DNA form a … . A gene is a unit that contains the genetic information or codes for a particular protein and transmits … to the next generation. Whenever a new cell is made in an organism, the genetic material is … and put into the new cell. The new cell can then create proteins and also pass on the genetic information to the next new cell.

Ex. 23. Translate the following text into English.

У 1953 році американський біохімік Дж. Уотсон та англійський генетик Ф. Крик запропонували модель просторової структури ДНК, яку згодом було підтверджено експериментально. Молекула ДНК складається з двох полінуклеотидних ланцюгів, сполучених між собою водневими зв'язками. Ці зв'язки виникають між двома нуклеотидами, які ніби доповнюють один одного за розмірами. Оскільки розміри А і Г дещо більші, ніж Т і Ц, то А завжди сполучається з Т (між ними виникають два водневих зв’язки), а Г — із Ц (між ними виникають три водневих зв'язки). Чітку відповідність нуклеотидів у двох ланцюгах ДНК назвали комплементарністю. Згідно із запропонованою моделлю, два полінуклеотидні ланцюги ДНК обвивають один одного, утворюючи закручену праворуч спіраль (вторинна структура ДНК). Відстань між сусідніми азотистими основами становить 0,34 нм, крок спіралі дорівнює 3,4 нм і містить десять пар основ, а її діаметр — близько 2 нм. Як вам уже відомо, одиницею спадковості є ген – ділянка молекули ДНК (у деяких вірусів – РНК). Ген містить інформацію про послідовність амінокислотних залишків поліпептидів, молекул транспортної або рибосомної РНК. Він є елементарним носієм спадкової інформації (детальніше про організацію генотипу різних організмів йтиметься далі). Таким чином, ДНК зберігає спадкову інформацію і забезпечує її передачу дочірнім клітинам під час поділу материнської.

Ex. 24. Translate the following summary into English.

Альтернативные источники синтетического топлива

Alternative sources of synthetic fuel

Рассмотрено современное состояние исследований по химической переработке твердых углеродсодержащих бытовых и промышленных отходов. Представлена новая универсальная технология переработки твердых углеродсодержащих бытовых и промышленных отходов, направленная на совершенствование процессов получения из углеродсодержащих отходов синтетических топлив, топочного и синтез-газов, а также тепловой и электроэнергий.

Ex. 25. Write the transcript for Video #2 ("DNA, RNA and Protein Synthesis") an translate it into your native language.

LESSON 5. AN OVERVIEW OF CELLS

Ex. 26. Translate the following text into your native language.

An Overview of Cells

Cells are sacs of fluid that are reinforced by proteins and surrounded by membranes. Inside the fluid float chemicals and organelles, structures inside cells that are used during metabolic processes. (Yes, an organism contains parts that are smaller than a cell, but these structures can't perform all the functions of life on their own, so they aren't considered to be alive.) A cell is the smallest part of an organism that retains characteristics of the entire organism. For example, a cell can take in fuel, convert it to energy, and eliminate wastes, just like the organism as a whole can. Because cells can per-form all the functions of life, the cell is the smallest unit of life.

Cells can be categorized in different ways, according to structure or function, or in terms of their evolutionary relationships. In terms of structure, scientists categorize cells based on their internal organization:

✓ Prokaryotes don't have a "true" nucleus in their cells. Nor do they have organelles. Bacteria and archaea are all prokaryotes.

✓ Eukaryotes have a nucleus in their cells that houses their genetic material. They also have organelles. Plants, animals, algae, and fungi are all eukaryotes.

Prokaryotes include cells you've probably heard of, such as the bacteria E. *Coli* and *Streptococcus* (which causes strep throat), the blue-green algae that occasionally cause lake closures, and the live cultures of bacteria in yogurt, as well as some cells you may never have heard of, called archaeans.

Whether you've heard of a specific prokaryote or not, you're likely well aware that bacteria have a pretty bad rap. They seem to make the papers only when they're causing problems, such as disease. Behind the scenes, though, bacteria are quietly performing many beneficial tasks for people and the rest of life on planet Earth.

Ex. 27. Translate the following text and fill the gaps in Figure 4 with the words from the list below.

Eukaryotes have the following characteristics:

✓A nucleus that stores their genetic information.

✓ A plasma membrane that encloses the cell and separates it from its environment.

✓ Internal membranes, such as the endoplasmic reticulum and the Golgi apparatus, that create specialized compartments inside the cells.

✓ A cytoskeleton made of proteins that reinforces the cells and controls cellular movements.

✓Organelles called mitochondria that combine oxygen and food to transfer the energy from food to a form that cells can use.

✓ Organelles called chloroplasts, which use energy from sunlight plus water and carbon dioxide to make food. (Chloroplasts are found only in the cells of plants and algae.)

✓ A rigid cell wall outside of their plasma membrane. (This is found only in the cells of plants, algae, and fungi; animal cells just have a plasma membrane, which is soft.)

Figure 4. Structures In A Typical Anumal Cell

Cytoplasm, cilia, mitochondrion, nucleolus, nucleus, vesicle formation, vacuole, ribosomes, rough endoplasmic reticulum, Golgi apparatus, smooth endoplasmic reticulum, lysosome, centriole, plasma membrane

Ex. 28. Find the definitions for the words from the list below. Be ready to interpret the definitions.

Cytoplasm, centriole, nucleus, ribosomes, vesicle formation, endoplasmic reticulum, mitochondrion, Golgi apparatus, lysosome, nucleolus, plasma membrane, cilia, vacuole.

1. The material or protoplasm within a living cell, excluding the nucleus.
2. A short microscopic hair-like vibrating structure found in large numbers on the surface of certain cells, either causing currents in the surrounding fluid, or, in some protozoans and other small organisms, providing propulsion.

3. An organelle found in large numbers in most cells, in which the biochemical processes of respiration and energy production occur. It has a double membrane, the inner part being folded inwards to form layers (cristae).

4. A small dense spherical structure in the nucleus of a cell during interphase.

5. A dense organelle present in most eukaryotic cells, typically a single rounded structure bounded by a double membrane, containing the genetic material.

6. A small fluid-filled bladder, sac, cyst, or vacuole within the body.

7. A space or vesicle within the cytoplasm of a cell, enclosed by a membrane and typically containing fluid.

8. A minute particle consisting of RNA and associated proteins found in large numbers in the cytoplasm of living cells. They bind messenger RNA and transfer RNA to synthesize polypeptides and proteins.

9. A complex of vesicles and folded membranes within the cytoplasm of most eukaryotic cells, involved in secretion and intracellular transport.

10. An extensive intracellular membrane system whose functions include synthesis and transport of lipids and, in regions where ribosomes are attached, of proteins.

11. An organelle in the cytoplasm of eukaryotic cells containing degradative enzymes enclosed in a membrane.

12. Each of a pair of minute cylindrical organelles near the nucleus in animal cells, involved in the development of spindle fibres in cell division.

13. A microscopic membrane of lipids and proteins which forms the external boundary of the cytoplasm of a cell or encloses a vacuole, and regulates the passage of molecules in and out of the cytoplasm.

Ex. 29. Translate the following text into English.

Клітини всіх живих організмів за структурно-функціональними особливостями можна поділити на дві великі групи: еукаріотичні та прокаріотичні. Структурними компонентами еукаріотичних клітин є плазматична мембрана, цитоплазма, клітинні органели, ядро. Прокаріотичні клітини не мають ядра і деяких органел (мітохондрій, ендоплазматичного ретикулуму, апарату Гольджі). Плазматична мембрана (плазмалема) оточує клітину, визначає її розміри, форму та виконує такі функції: бар’єрна (захисна) — забезпечує асиметричний розподіл речовин між внутрішньоклітинним і позаклітинним середовищами; транспортна — визначає вибіркове надходження молекул до клітини і з клітини; рецепторна — уловлює і підсилює сигнали, закодовані в хімічній структурі гормонів, медіаторів; комунікативна — здійснює контакт сусідніх клітин між собою і з позаклітинною речовиною.

Звичайно клітинний центр знаходиться поблизу ядра тваринних клітин. Він складається з двох розташованих під прямим кутом один до одного центріолей. Кожна центріоль — це циліндр завдовжки 0,3 мкм і діаметром 0,1 мкм, стінка якого утворена дев’ятьма групами білкових мікротрубочок. Центріолі оточені аморфним простором (хмарою) з білків, вуглеводів і невеликої кількості ліпідів, що відіграє важливу роль у прикріпленні ниточок веретена поділу. Важливою особливістю центріолей є їх здатність до автономного розмноження, яке не залежить від поділу клітини.

Ex. 30. Immediate translation. Work in pairs and interpret the following words and combinations.

протоплазма	protoplasm
цитоплазматические отсеки	cytoplasm chambers
препарат	mount
промежуточный	intermediate

гликокаликс	glycocalyx
проникновение веществ	flux
изгиб	curve
вырост	apophysis
ворсинка	fibre

Ex. 31. Read the following transcript of the Video #5 and translate the words and words combinations in italics.

Both animals and plants are made up of cells. Their cells have many features in common, but *существует ряд существенных различий*. Let's look inside a leaf to take a closer look at a *растительную клетку*.

First, we encounter a protective cell wall outside the plasma membrane. The cell wall is made from strong *целлюлозных волокон*.

Once inside the plant cell, we see the large *центральную вакуоль*, which regulates the composition of the cytoplasm, creates the *внутреннее давление* that is characteristic of plant cells, and stores *различные соединения* produced by the cell.

Plants make their own food *посредством фотосинтеза, происходящего в хлоропластах.* Light passes through the two membranes of the chloroplast and strikes these green disks, where *энергия света* is converted to *химическую энергию*.

The sugar molecules produced by photosynthesis can be made into other molecules or broken down for energy.

All plant cells have *митохондрии также, как и животные*. Sugars produced by photosynthesis are broken down and converted to *АТФ в митохондриях*. Most organelles, like mitochondria, are found in both plant cells and animal cells.

Так что, когда вам на глаза снова попадется растение, помните, что у нас с ними больше общего, чем кажется на первый взгляд.

LESSON 6. REPRODUCTION: KEEP ON KEEPIN' ON

Ex. 32. Translate the following text into your native language.

Reproduction: Keep On Keepin' On

When cells replicate, they make copies of all of their parts, including their DNA, and then divide themselves to make new cells. If a cell makes an exact copy of itself, it's engaging in asexual reproduction. Single-celled prokaryotes, such as bacteria, reproduce asexually by binary fission; they're able to divide quickly and reproduce themselves in as little as 10 to 20 minutes. Some single-celled eukaryotes and individual cells within a multicellular eukaryote also reproduce asexually. However, they use a process called mitosis (which we explain in the later "Mitosis: One for you, and one for you" section) to produce new generations. If a cell produces a new cell that contains only half of its genetic information, that cell has engaged in sexual reproduction. A special type of cell division known as meiosis (which we explain in the later "Meiosis: It's all about sex, baby" section) is responsible for all sexual reproduction. Cells divide for the following important reasons:

✓ To make copies of cells for growth: You started out as a single cell after mom's egg met dad's sperm, but today you have about 10 trillion cells in your body. All of those cells were produced from that first cell and its descendents by mitosis. When you watch plants grow taller or baby animals grow into adults, you're seeing mitosis at work.

✓ To make copies of cells for repair: It's a fact of life that cells wear out and need to be replaced. For instance, you constantly shed skin cells from your surface. If your body couldn't replace these cells, you'd run out of skin. And if an organism gets injured, its body uses mitosis to pro-duce the cells necessary to repair the injury.

✓ To carry on the species: During asexual reproduction, organisms make exact copies of themselves for the purpose of creating offspring. During sexual reproduction, gametes (cells, specifically eggs and sperm, containing half the genetic information of their parent cells) get together to make new individuals. When the genetic information of the gametes joins together, the new individual has the correct total amount of DNA.

Ex. 33. Fill the gaps with the words from the list below. Be ready to interpret the text.

Interphase, cell division, meiosis, cell cycle, mitosis, gonads, spores, eggs, gametes

… is the process by which new cells are formed to replace dead ones, repair damaged tissue, or allow organisms to grow and reproduce. Cells that can divide spend some of their time functioning and some of their time dividing. This alternation between not dividing and dividing is known as the … , and it has specific parts:

✓ The nondividing part of the cell cycle is called… . During inter-phase, cells are going about their regular business. If the cell is a single-celled organism, it's probably busy finding food and growing. If the cell is part of a multicellular organism, like a human, it's busy doing its job. Maybe it's a skin cell protecting you from bacteria or a fat cell storing energy for later.

✓ Cells that receive a signal to divide enter a division process, which is either mitosis or meiosis.

• Cells that reproduce asexually, like a skin cell that needs to replace some of your lost skin, divide by … , a process that produces cells that are identical to the parent cell.

• Cells that reproduce sexually enter a special process called … that produces special cells called … (in animals) and … (in plants, fungi, and protists) that have half the genetic information of the parent cell. In you, the only cells that reproduce by meiosis are cells in your gonads. Depending on your gender, your … are your testes or your ovaries. Cells in testes produce gametes called sperm, and cells in ovaries produce gametes called … .

Ex. 34. Translate the following text and arrange the mitosis phases in the correct order.

The process of mitosis occurs in four phases, with the fourth phase initiating a final process called cytokinesis. Although the cell cycle is a continuous process, with one stage flowing into another, scientists divide the events of mitosis into four phases based on the major events in each stage. The four phases of mitosis are

Telophase: The cell gets ready to divide into two by forming new nuclear membranes around the separated sets of chromosomes. The two daughter nuclei each have a copy of every chromosome that was in the parent cell. The events of telophase are essentially the reverse of prophase.

• New nuclear membranes form around the two sets of chromosomes.

• The chromosomes uncoil and spread throughout the nucleus.

• The mitotic spindle breaks down.

• The nucleoli reform and become visible again.

Prophase: The chromosomes of the cell get ready to be moved around by coiling themselves up into tight little packages. (During interphase, the DNA is spread throughout the nucleus of the cell in long thin strands that would be pretty hard to sort out.) As the chromosomes coil up, or condense, they become visible to the eye when viewed through a micro-scope. During prophase:

• The chromosomes coil up and become visible.

• The nuclear membrane breaks down.

• The mitotic spindle forms and attaches to the chromosomes.

• The nucleoli break down and become invisible.

Anaphase: The replicated chromosomes separate so that the two sister chromatids (identical halves) from each replicated chromosome go to opposite sides. This way each new cell has one copy of each DNA molecule from the parent cell when cell division is over.

Metaphase: The chromosomes are tugged by the mitotic spindle until they're all lined up in the middle of the cell.

Ex. 35. Use the words from the table above to translate the text from Video #6.

prior to	до, перед, раньше
central plate of the cell	центральная клеточная пластинка
second division sequence	второе деление
single division sequence	однократное деление

Ex. 36. Answer the following questions using the information from the Video #6.

1. The number of cells produced by meiosis is ________ the number of cells produced by mitosis.

a) one-fourth
b) half
c) equal to
d) twice
e) four times.

2. The number of chromosomes in daughter cells produced by meiosis is ________ the number of chromosomes in daughter cells produced by mitosis.

a) one-fourth
b) half
c) equal to
d) twice
e) four times.

3. Which of the following is unique to meiosis?

a) nuclear membrane breaks down
b) DNA organizes into chromosomes
c) crossing-over

d) chromosomes align along the central plate of the cell

e) none of the above.

4. Daughter cells produced in meiosis are identical.

a) True

b) False

5. Chromosome duplication occurs prior to both mitosis and meiosis.

a) True

b) False.

LESSON 7.
BIODIVERSITY: RECOGNIZING HOW OUR DIFFERENCES MAKE US STRONGER

Ex. 37. Translate the following text into your native language.

Biodiversity: Recognizing How Our Differences Make Us Stronger

The diversity of living things on Earth is referred to as biodiversity. Almost everywhere biologists have looked on this planet — from the deepest, darkest caves to the lush Amazonian rain forests to the depths of the oceans — they've found life. In the deepest, darkest caves where no light ever enters, bacteria obtain energy from the metals in the rocks. In the Amazonian rain forest, plants grow attached to the tops of trees, collecting water and forming little ponds in the sky that become home to insects and tree frogs. In the deep oceans, blind fish and other animals live on the debris that drifts down to them like snow from the lit world far above. Each of these environments presents a unique set of resources and challenges, and life on Earth is incredibly diverse due to the ways in which organisms have responded to these challenges over time.

Ex. 38. Fill the gaps with the words from the list below. Be ready to interpret the text.

classes, domains, kingdoms, families, orders, phyla, species, genera

Being able to categorize the three largest, and most distantly related, groups of living things on Earth into domains (as explained in the preceding section) is great, but biologists need smaller groups to work with in order to determine how similar different types of organisms are. Hence the creation of the taxonomic hierarchy, a naming system that ranks organisms by their evolutionary relationships. Within this hierarchy, living things are organized into the largest, most-inclusive group down to the smallest, least-inclusive group.

The taxonomic hierarchy is as follows, from largest to smallest. (Note that organisms are placed into each category based on similarities within that particular group of organisms. Whatever characteristics are used to define a category must be shared by all organisms placed into that category.)

✓ … group organisms by fundamental characteristics such as cell structure and chemistry. For example, organisms in domain Eukarya are separated from those in the Bacteria and Archaea domains based on whether their cells have a nucleus, the types of molecules found in the cell wall and membrane, and how they go about protein synthesis.

✓ … group organisms based on developmental characteristics and nutritional strategy. For example, organisms in the animal kingdom (Animalia) are separated from those in the plant kingdom (Plantae) because of differences in the early development of these organisms and the fact that plants make their own food by photosynthesis whereas animals ingest their food. (Kingdoms are most useful in domain Eukarya because they're not well defined for the prokaryotic domains.)

✓ … separate organisms based on key characteristics that define the major groups within the kingdom. For example, within kingdom Plantae, flowering plants (Angiophyta) are in a different phylum than cone-bearing plants (Coniferophyta).

✓ … separate organisms based on key characteristics that define the major groups within the phylum. For example, within phylum Angiophyta, plants that have two seed leaves (dicots, class Magnoliopsida) are in a separate class than plants with one seed leaf (monocots, class Liliopsida).

✓ … separate organisms based on key characteristics that define the major groups within the class. For example, within class Magnoliopsida, nutmeg plants (Magnoliales) are put in a different order than black pepper plants (Piperales) due to differences in their flower and pollen structure.

✓ … separate organisms based on key characteristics that define the major groups within the order. For example, within order Magnoliales, buttercups (Ranunculaceae) are in a different family than roses (Rosaceae) due to differences in their flower structure.

✓ … separate organisms based on key characteristics that define the major groups within the family. For example, within family Rosaceae, roses (Rosa) are in a different genus than cherries (Prunus) thanks to differences in their flower structure.

✓... separate eukaryotic organisms based on whether they can successfully reproduce with each other. You can walk through a rose garden and see many different colors of China roses (Rosa chinensis) that are all considered one species because they can reproduce with each other.

Ex. 39. Find the definitions for the words from the list below. Be ready to interpret the definitions.

More recently, taxonomists divided Monera into Bacteria and Archaea, based on RNA studies. Meanwhile, Fungi was reclassified as a kingdom separate from Plantae (indeed, many experts describe fungal organisms as closer to animals).

Protista, Animalia, Bacteria, Fungi, Archaea, Plantae

1. This kingdom includes multicellular organisms that consume other organisms or organic matter for energy. They also can move independently for at least part of their life cycle, and have thin cell membranes. The kingdom includes, among other species, mammals, birds, insects, reptiles and arthropods.
2. The organisms of this kingdom have chlorophylls a and b and produce energy from sunlight and carbon dioxide. In addition, members of the kingdom have rigid cell walls containing cellulose, and do not move

independently. This kingdom include trees, bushes, grasses, ferns and green algae.

3. The organisms of this kingdom, like plants, have rigid cell walls and do not move independently; and like ferns, they reproduce via spores. However, taxonomists eventually distinguished fungi from plants. Like animals, these organisms consume external organic matter for energy, and unlike plants, they have no chlorophyll and no cellulose. Mushrooms, yeasts and molds are members of this kingdom.

4. This kingdom includes organisms of only one cell, or cell colonies that do not form differentiated tissues and whose cells contain distinct nuclei and organelles. Protozoa, red algae, slime molds and water molds belong to this kingdom.

5. Some taxonomists use the name Eubacteria for this kingdom. Others occasionally give this kingdom the old Monera label. This kingdom is composed of single-celled organisms that do not contain distinct nuclei and rarely contain organelles. Bacterial organisms are ubiquitous on Earth, found everywhere from deep-sea hot springs to the human gut.

6. Sometimes called Archaebacteria, ths kingdom comprises single-celled organisms that contain no distinct nuclei or organelles. Although very similar in appearance to bacteria, these organisms have different genetic structures and metabolic processes. The representatives of this kingdom, initially thought to inhabit only extreme environments like sulfur springs, have been found all over the planet and are particularly abundant in plankton.

Ex. 40. Translate the following text into English.

Існує декілька систем організмів. Наведемо приклад однієї з них.

У біології розрізняють **неклітинні** та **клітинні** організми. Неклітинні мають лише одне царство —**Віруси.** (Царство є найвищою одиницею класифікації). Клітинні організми нараховують два**надцарства: прокаріоти, або доядерні, та еукаріоти (ядерні).**До прокаріотів належить одне царство **Дроб’янки** (три підцарства: бактерії, архебактерії та ціанобактерії, або синьо-зелені водорості). Друге об’єднує три царства: **Тварини** (два підцарства: найпростіші, або одноклітинні, та багатоклітинні), **Рослини** (три підцарства: справжні водорості, багрянкові та вищі рослини) і**Гриби** (два підцарства: нижчі та вищі гриби).

Увесь світ живого сучасними систематиками найчастіше поділяється на п’ять царств: Віруси, Дроб’янки, Рослини, Гриби, Тварини. Головними таксономічними категоріями є царство, відділ (у тварин — тип), клас, порядок, родина (у тварин — ряд), рід і вид.

LESSON 8. ECOSYSTEMS BRING IT ALL TOGETHER

Ex. 41. Translate the following text into your native language.

Ecosystems Bring It All Together

Life thrives in every environment on Earth, and each of those environments is its own ecosystem, a group of living and nonliving things that interact with each other in a particular environment. An ecosystem is essentially a little machine made up of living and nonliving parts. The living parts, called biotic factors, are all the organisms that live in the area. The nonliving parts, called abiotic factors, are the nonliving things in the area (think air, sunlight, and soil).

Ecosystems exist in the world’s oceans, rivers, forests — they even exist in your backyard and local park. They can be as huge as the Amazon rain forest or as small as a rotting log. The catch is that the larger an ecosystem is, the greater the number of smaller ecosystems existing within it. For example, the ecosystem of the Amazon rain forest also consists of the soil ecosystem and the cloud forest ecosystem (found at the tops of the trees).

A particular branch of science called ecology is devoted to the study of eco-systems, specifically how organisms interact with each other and their environment. Scientists who work in this branch are called ecologists, and they look at the interactions between living things and their environment on many different scales, from large to small.

The sections that follow explain how ecologists classify Earth's various ecosystems and how they describe the interactions between the planet's many species. Before you check them out, take a look at Figure 11-1 to get an idea of how living things are organized.

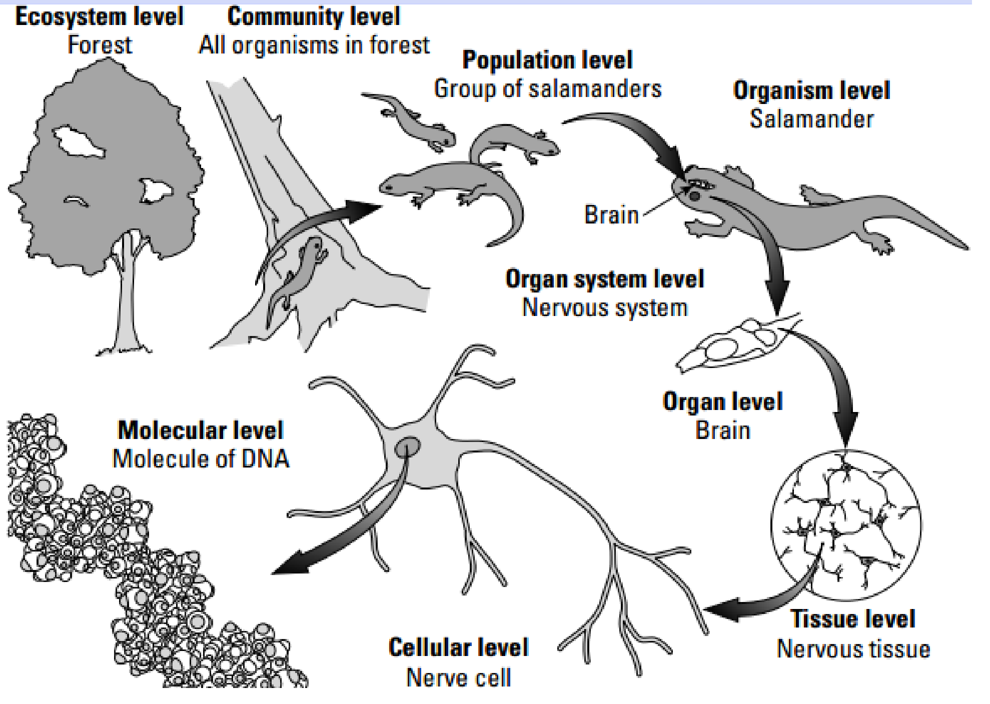


Figure 5. The Organization Of Living Things.

Ex. 42. Fill the gaps with the words from the list below. Be ready to interpret the text.

Community, tundra biomes, biomes, forest biomes, freshwater biomes, marine biomes, grassland biomes, desert biomes

All the living things together in an ecosystem form a … . For example, a forest community may contain trees, shrubs, wildflowers, squirrels, birds, bats, insects, mushrooms, bacteria, and much more. The different types of communities found on Earth are called … . Six major types of biomes exist:

✓ … include ponds, rivers, streams, lakes, and wetlands. Only about 3 percent of the Earth's surface is made up of freshwater, but freshwater biomes are home to many different species, including plants, algae, fish, and insects.

✓ … contain saltwater and include the oceans, coral reefs, and estuaries. They cover 75 percent of the Earth's surface and are very important to the planet's oxygen and food supply — more than half the photosynthesis that occurs on Earth occurs in the ocean.

✓ … receive minimal amounts of rainfall and cover approximately 20 percent of the Earth's surface. Plants and animals that live in deserts have special adaptations, such as the ability to store water or only grow during the rainy season, to help them survive in the low-water environment. Some familiar desert inhabitants are cacti, reptiles, birds, camels, rabbits, and dingoes.

✓ … contain many trees or other woody vegetation; cover about 30 percent of the Earth's surface; and are home to many different plants and animals, including trees, skunks, squirrels, wolves, bears, birds, and wildcats. They're important for global carbon balance because they pull carbon dioxide out of the atmosphere through the process of photosynthesis.

✓ … are dominated by grasses, but they're also home to many other species, such as birds, zebras, giraffes, lions, buffaloes, termites, and hyenas. Grasslands cover about 30 percent of the Earth's surface and are typically flat, have few trees, and possess rich soil. Because of these features, people converted many natural grasslands for agricultural purposes.

✓ … are very cold and have very little liquid water. Tundras cover about 15 percent of the planet's surface and are found at the poles of the Earth as well as at high elevations. Arctic tundras are home to organisms such as arctic foxes, caribou, and polar bears, whereas mountain tundras are home to mountain goats, elk, and birds. In both types of tundra, nutrients are typically scarce, and the growing seasons are quite short.

Ex. 43. Translate the following text into your native language. Find the synonyms for the words in italics among the terms from the list below.

Autotrophs, herbivores, carnivores, carnivores

One of the most fundamental ways that organisms interact with each other is eating each other. In fact, all the various organisms in an ecosystem can be divided into four categories called trophic levels based on how they get their food:

✓ *Producers* make their own food. Plants, algae, and green bacteria are all producers that use energy from the Sun to combine carbon dioxide and water and form carbohydrates via photosynthesis.

✓ Primary consumers eat producers. Because producers are mainly plants, primary consumers are also called *plant-eating animals*.

✓ Secondary consumers eat primary consumers. Because primary consumers are animals, secondary consumers are also called *meat-eating animals*.

✓ Tertiary consumers eat secondary consumers, so they're also considered *meat-eating animals*.

Organisms in the different trophic levels are linked together in a food chain, a sequence of organisms in a community in which each organism feeds on the one below it in the chain. Figure 6 shows a depiction of a simple food chain.

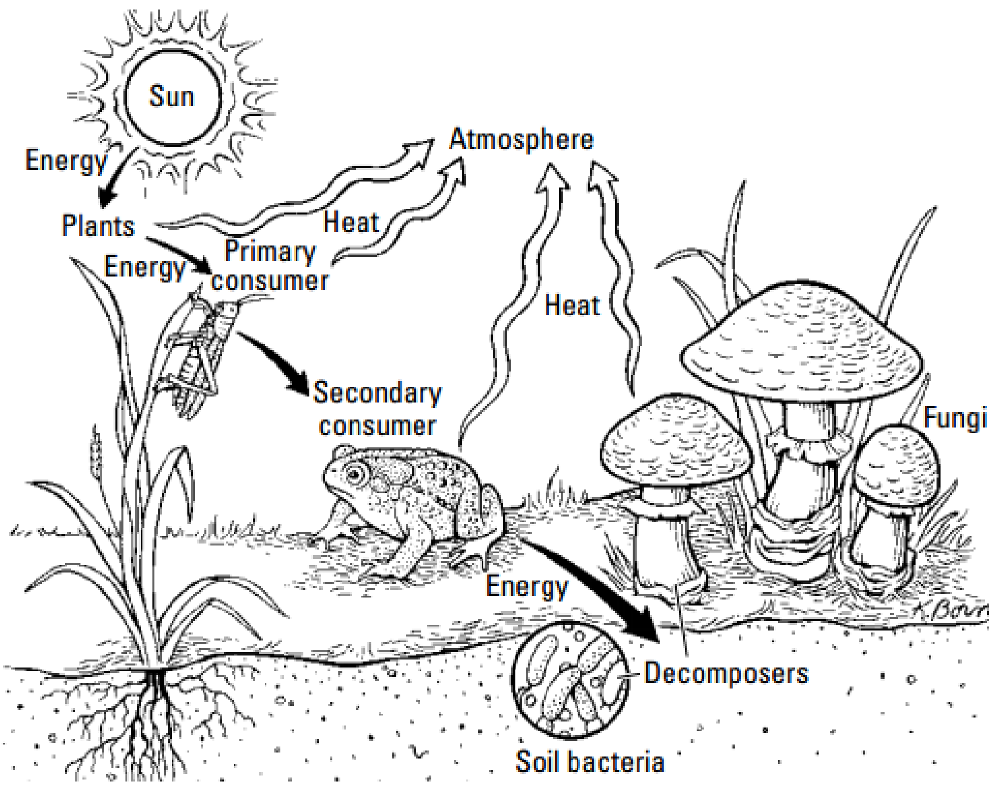


Figure 6. The Energy Flow In Ecosystems

Ex. 44. Translate the following text into English.

При вивченні біотичної структури екосистем стає очевидним, що одними з найважливіших взаємовідносин між організмами є харчові, або трофічні, зв'язки.

Термін "ланцюг живлення" запропонував Ч. Елтон у 1934 р. Ланцюги живлення, або трофічні ланцюги, – це шляхи перенесення енергії їжі від її джерела (зеленої рослини) через ряд організмів на більш високі трофічні рівні.

Крім трофічних ланцюгів, в екології є поняття харчових (трофічних) сіток. Вони утворюються тому, що практично будь-який член будь-якого харчового ланцюга одночасно є ланкою і в іншому трофічному ланцюзі, тобто він споживає і його споживають декілька видів інших організмів. Наприклад, лучний вовк-койот може харчуватися до 14 тис. видами тварин і рослин. Можливо, таку саму кількість видів можуть споживати і ті організми, які беруть участь у поїданні, розкладанні та деструкції речовин трупу цього вовка.

LESSON 9. MAGNETISM VS. GRAVITY

Ex. 45. Translate the following text into your native language.

Magnetism Vs. Gravity

Gravity and magnetism are two fundamental forces that affect almost every phenomenon in nature. While we owe it to gravity, to keep our feet firmly grounded on Earth, it is due to magnetism that devices like electric generators, motors, fans, hard drives and countless other electronic gadgets help make our life comfortable. Both magnetism (as one aspect of the electromagnetic force) and gravity are two fundamental forces of nature, which mold matter at the microscopic and macroscopic scales. Gravity is the force which determines the large-scale structure of space time by clumping together matter from planetary scales to galactic clusters, determining the ultimate fate of the universe. On the other hand, at microscopic scales, electromagnetic force determines atomic structure, determining the properties of materials. While the force of gravity felt by a particle is purely dependent on mass, electromagnetic forces are mediated by charge.

Ex. 46. Fill the gaps with the words from the list below. Be ready to interpret the text.

Maglev, magnetism, diamagnetic, atom, ferromagnetic, electric current, angular momentum, conductors, magnetic field, paramagnetic.

… is the tendency of any material to react to any applied … with attraction or repulsion. For example, when a magnet is passed over iron nails, they stick to it due to attraction. All substances are either … (repulsed by applied magnetic field), … (weakly attracted by applied magnetic field) or … (strongly attracted to applied magnetic field) in nature.

Every magnetized object has two *poles*, which are labeled as north and south poles (as they are attracted to the north and south poles of the Earth's magnetic field). Like poles of magnetic objects repel each other, while unlike poles attract. The Earth itself behaves like a large magnet, with the magnetic north and south poles directing compass needles towards them. The magnetic property of a substance arises due to the orbital motion of electrons around the atomic nucleus and intrinsic spin … .

In fact, wherever there's an... , there is a magnetic field. The degree to which magnetism is expressed in a material is largely dependent on the electronic configuration of its constituent atoms. More the number of unpaired electrons in an … , more is the probability of the atom showing magnetism. Every atom of the material is a small magnet. In most materials, these small magnets are aligned in such a way, that they cancel each other out. In some ferromagnetic materials like iron, these small atomic magnets tend to be well aligned in the same direction, giving rise to pronounced tendency to be magnetized.

All … with an electric current flowing through them, have a magnetic field around them, making them 'electromagnets'. Magnets are used in countless electronic gadgets like audio speakers, doorbells, computer hard drives and in the construction of 'Magnetic Levitation (…) trains'. Most importantly, electric power generation is made possible by the giant magnets placed inside power plant dynamos.

Ex. 47. Find the definitions for the words from the list below. Be ready to interpret the definitions.

Heisenberg's Uncertainty Principle, Newton's laws of motion, general theory of relativity, Archimedes' Buoyancy Principle, Laws of Thermodynamics, Newton's law of universal gravitation, theory of natural selection,

1. The three laws proposed by Sir Isaac Newton to define the concept of a force and describe motion, used as the basis of classical mechanics.
2. The principle that two particles attract each other with forces directly proportional to the product of their masses divided by the square of the distance between them.
3. A geometrical theory of gravity developed by Albert Einstein in which gravity's effects are a consequence of the curvature of four-dimensional space-time.
4. The four laws which define fundamental physical quantities (temperature, energy, and entropy) that characterize thermodynamic systems.
5. The law that states that a body immersed in a fluid is buoyed up by a force equal to the weight of the displaced fluid.
6. The principle which says that random genetic changes that are beneficial to survival are 'selected' and passed to descendants.
7. The scientific principle stating that it is impossible to determine with perfect accuracy both the position and momentum of a particle at any given point in time.

Ex. 48. Fill the gaps with the words from the list below. Be ready to interpret the text.

Mass, universal law of gravitation, pulls, force, inversely, pull back, gravity, gravitational constant.

One of the most important scientific breakthroughs of all times is Sir Isaac Newton's … , all thanks to the falling apple. … is an invisible force that pulls all matter together. Sir Isaac Newton studied the reason behind the falling apple and defined it as the law of universal gravitation, "Each particle of matter attracts every other particle with a … which is directly proportional to the product of their masses and …proportional to the square of the distance between them."

Gravity is the reason behind, things staying on the Earth's surface as also for the formation and movement of all the planets and other heavenly bodies.

Standard Formula of Gravity is **Gravitational force = (G * m_1 * m_2) / (d_2)** where G is the … , m_1 and m_2 are the masses of the two objects for which force has to calculated, and d is the distance between the centers of gravity of the two masses.

Let's consider the two objects; the Earth and us. As we move around the Earth's surface, it … us and we … . Mass is the amount of matter in any object, since the Earth's mass is more compared to us, we get pulled towards the Earth. Besides the amount of… , gravity also depends on how far you are from a particular object. This is probably the reason why we don't get pulled towards the Sun, which has more gravity than the Earth.

Ex. 49. Translate the following text into English.

На відміну від короткодіючих сильних і слабких взаємодій, електромагнітні і гравітаційні взаємодії мають властивість дальньої дії: їх дія виявляється на дуже великих відстанях. Усі механічні явища в макроскопічному світі визначаються виключно гравітаційними й електромагнітними силами. Між фізичними тілами діє сила взаємного притягання. Такі явища, як падіння тіл на Землю, рух Місяця навколо Землі, планет навколо Сонця і інші, відбуваються під дією сил всесвітнього притягання, які називають гравітаційними. Аналізуючи закони Кеплера і закони вільного падіння тіл на Землі, Ньютон дійшов до висновку, що сили притягання мають існувати не лише на Землі, а й у космосі. Закон, який характеризує сили притягання, уперше сформулював Ньютон в 1687 року під час вивчення руху Місяця навколо Землі. Цезакон всесвітнього тяжіння: будь-які дві матеріальні точки притягуються одна до одної із силою, прямо пропорційною добутку їх мас і обернено пропорційною квадрату відстані між ними.

LESSON 10. ELECTROSTATICS AND COULOMB'S LAW

Ex. 50. Translate the following text into your native language.

Electrostatics and Coulomb's Law

Even though they didn't fully understand it, ancient people knew about electricity. Thales of Miletus, a Greek philosopher known as one of the legendary Seven Wise Men, may have been the first human to study electricity, circa 600 B.C. By rubbing amber – fossilized tree resin – with fur, it was able to attract dust, feathers and other lightweight objects. These were the first experiments with electrostatics, the study of stationary electric charges or static electricity.

By the later 1700s, the scientific community was beginning to get a clearer picture of how electricity worked. Benjamin Franklin ran his famous kite experiment in 1752, proving that lightning was electrical in nature. He also presented the idea that electricity had positive and negative elements and that the flow was from positive to negative. Approximately 30 years later, a French scientist by the name of Charles Augustin de Coulomb conducted several experiments to determine the variables affecting an electrical force. His work resulted in Coulomb's law, which states that like charges repel and opposite charges attract, with a force proportional to the product of the charges and inversely proportional to the square of the distance between them.

Coulomb's law made it possible to calculate the electrostatic force between any two charged objects, but it didn't reveal the fundamental nature of those charges. What was the source of the positive and negative charges? As we'll see in the next section, scientists were able to answer that question in the 1800s.

Ex. 51. Fill the gaps with the words from the list below. Be ready to interpret the text.

magnetic field, electrons, magnetism, steam engines, nuclear fission, generator, "pressure", current, rotations, amp

The … responsible for lining up all those little bits of metal into a proper Mohawk haircut is due to the movement of… . If you allow electrons to move through a metal wire, a magnetic field will form around the wire.

We can see that there's a definite link between the phenomena of electricity and… . A generator is simply a device that moves a magnet near a wire to create a steady flow of electrons. The action that forces this movement varies greatly, ranging from … to… , but the principle remains the same.

One simple way to think about a … is to imagine it acting like a pump pushing water through a pipe. Only instead of pushing water, a generator uses a magnet to push electrons along. This is a slight oversimplification, but it paints a helpful picture of the properties at work in a generator. A water pump moves a certain number of water molecules and applies a certain amount of pressure to them. In the same way, the magnet in a generator pushes a certain number of electrons along and applies a certain amount of … to the electrons.

In an electrical circuit, the number of electrons in motion is called the amperage or … , and it's measured in amps. The "pressure" pushing the electrons along is called the voltage and is measured in volts. For instance, a generator spinning at 1,000 … per minute might produce 1 amp at 6 volts. The 1 amp is the number of electrons moving (1 … physically means that 6.24 x 1018 electrons move through a wire every second), and the voltage is the amount of pressure behind those electrons.

Ex. 52. Find the definitions for the words from the list below. Be ready to interpret the definitions.

alternating current, circuit breaker, coulomb, cycles-per-second, diode, electrolyte, frequency, Joule's law, Ohm's Law, reactive power, three-phase

1. an electrical current which reverses direction repeatedly due to a change in voltage which occurs at the same frequency. Often abbreviated AC or ac.

2. a device which can stop the flow of electricity around a circuit by switching itself off if anything goes wrong.

3. a unit of electric charge, equal to the quantity of electricity conveyed in one second by a current of one ampere.

4. a measure of the frequency in an ac electric system. Abbreviated cps or cycles. Now replaced with the unit Hertz.

5. an electronic semiconductor device that predominantly allows current to flow in only one direction.

6. a nonmetallic conductor of electricity usually consisting of a liquid or paste in which the flow of electricity is by ions.

7. the number of complete alternations or cycles per second of an alternating current. It is measured in Hertz. The standard frequency in the US is 60 Hz. However, in some other countries the standard is 50 Hz.

8. the law which defines the relationship between current in a wire and the thermal energy produced. In 1841an English physicist James P. Joule experimentally showed that W = I2 x R x t where I is the current in the wire in amperes, R is the resistance of the wire in Ohms, t is the length of time that the current flows in seconds, and W is the energy produced in Joules.

9. the law which defines the relationship between voltage, resistance, and current. In 1828 the German physicist George Simon Ohm showed by experiment that the current in a conductor is equal to the difference of potential between any two points divided by the resistance between them. This may be written as I = E / R where E is the potential difference in volts, R is the resistance in Ohms, and I is the current in amperes.

10. the mathematical product of voltage and current consumed by reactive loads. Examples of reactive loads include capacitors and inductors. These types of loads when connected to an ac voltage source will draw current, but since the current is 90o out of phase with the applied voltage they actually consume no real power in the ideal sense.

11. an ac electric system or load consisting of three conductors energized by alternating voltages that are out of phase by one third of a cycle. This type of system has advantages over single-phase including the ability to deliver greater power using the same ampacity conductors and the fact that it provides a constant power throughout each cycle rather than a pulsating power, as in single-phase. Large power installations are three-phase.

Ex. 53. Fill the gaps with the words from the list below. Be ready to interpret the text.

"pressure", wall outlet, wattage, resistance, ohms, Ohm's law, equation, alternating

As mentioned earlier, the number of electrons in motion in a circuit is called the current, and it's measured in amps. The … pushing the electrons along is called the voltage and is measured in volts. If you know the amps and volts involved, you can determine the amount of electricity consumed, which we typically measure in watt-hours or kilowatt-hours. Imagine that you plug a space heater into a wall outlet. You measure the amount of current flowing from the … to the heater, and it comes out to 10 amps. That means that it is a 1,200-watt heater. If you multiply the volts by the amps, you get the … . In this case, 120 volts multiplied by 10 amps equals 1,200 watts. This holds true for any electrical appliance. If you plug in a light and it draws half an amp, it's a 60-watt light bulb.

Now let's add one more factor to current and voltage: … , which is measured in … . We can extend the water analogy to understand resistance, too. The voltage is equivalent to the water pressure, the current is equivalent to the flow rate and the resistance is like the pipe size.

A basic electrical engineering equation called … spells out how the three terms relate. Current is equal to the voltage divided by the resistance. It's written like this:

$I = V/R$

where **I** stands for current (measured in amps), **V** is voltage (measured in volts) and **R** symbolizes resistance (measured in ohms).

Let's say you have a 120-watt light bulb plugged into a wall socket. The voltage is 120 volts, and a 120-watt bulb has 1 amp flowing through it. You can calculate the resistance of the filament by rearranging the… :

R = V/I

So the resistance is 120 ohms.

Beyond these core electrical concepts, there is a practical distinction between the two varieties of current. Some current is direct, and some current is … – and this is a very important distinction.

Ex. 54. Translate the following text into English.

Закон Ома – це основний закон електротехніки, який застосовується для розрахунку таких величин, як: струм, напруга і опір в електричному ланцюзі.

Електричний струм, тобто потік електронів, виникає в ланцюзі між двома крапками з різними потенціалами. Тоді слід вважати, що чим більше різниця потенціалів, тим більша кількість електронів переміщаэться з крапки з низьким потенціалом (Б) в крапку з високим потенціалом (А). Кількісно струм виражається сумою зарядів, який проходить через задану крапку і збільшення різниці потенціалів, тобто прикладеної напруги до резистора R, приведе до збільшення струму через резистор.

За допомогою закону Ома для ділянки ланцюга можна обчислити прикладену напругу до ділянки ланцюга, або напруга на вхідних затисках ланцюга.

LESSON 11. WORK: IT ISN'T WHAT YOU THINK

Ex. 55. Translate the following text into your native language.

Work: It Isn't What You Think

Work is defined as an applied force over a certain distance. In physics jargon, you do work by applying a constant force, F, over a distance, s, where the angle between F and s is θ and is equal to Fs cos θ. In layman's terms, if you push a 1,000-pound hockey puck for some distance, physics says that the work you do is the component of the force you apply in the direction of travel multiplied by the distance you go.

To get a picture of the full work spectrum, you need to look across different systems of measurement. After you have the measurement units down, you can look at practical working examples, such as pushing and dragging.

Work is a scalar, not a vector. Because work is force times distance, Fs cos θ, it has the units Newton-meter in the meters-kilograms-seconds (MKS) system. Newton-meters are awkward to work with, so they have a special name — Joules. For conversion purposes, 1 Newton multiplied by 1 meter = 1 Joule, or 1J.

In the centimeter-gram-second (CGS) system, Fs cos θ has the units dyne-centimeter, which is also called the erg (a great name for a unit of work because it sounds like what you would say when pushing a heavy weight). For conversion purposes, 1 erg = 1 dyne-centimeter. What about the foot-pound-second system? In this system, work has the units foot-pound.

Ex. 56. Fill the gaps with the words from the list below. Be ready to interpret the text.

Motion, ingot, kinetic, friction, magnitude, angle, Calorie

Holding heavy objects — like, say, a set of exercise weights — up in the air seems to take a lot of work. In physics terms, however, that isn't true. Even though holding up weights may take a lot of biological work, no physics work takes place if the weights aren't moving. Plenty of chemistry happens as your body supplies energy to your muscles, and you may feel a strain, but if you don't move anything, you don't do work in physics terms.

… is a requirement of work. For example, say that you're pushing a huge gold ingot home after you explore a cave down the street, as shown in Figure 8-1. How much work do you have to do to get it home? First, you need to find out how much force pushing the …requires.

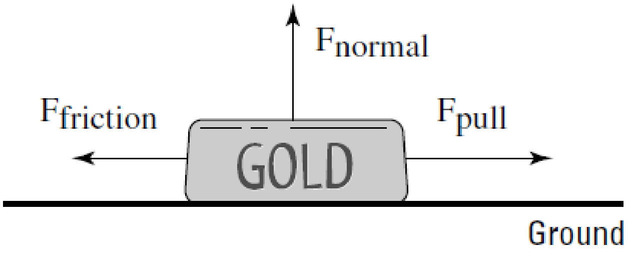


Figure 7. Pushing Requires Plenty Of Work In Physics Terms When The Object Is In Motion

The … coefficient of… , μ_k, between the ingot and the ground is 0.25, and the ingot has a mass of 1,000 kg. What's the force you have to exert to keep the ingot moving without accelerating it?

$F_F = \mu_k F_N$

Assuming that the road is flat, the … of the normal force, F_N, is just mg (mass times gravity). That means that

$F_F = \mu_k F_N = \mu_k mg$

where m is the mass of the ingot and g is the acceleration due to gravity on the surface of the Earth. Plugging in the numbers gives you

$F_F = \mu_k F_N = \mu_k mg = (0.25)(1{,}000 \text{ kg})(9.8 \text{ meters per second}^2) = 2{,}450N$

You have to apply a force of 2,450 Newtons to keep the ingot moving without accelerating. Say that your house is 3 kilometers away, or 3,000 meters. To get the ingot home, you have to do this much work:

$W = Fs \cos \theta$

Because you're pushing the ingot, the … between F and s is 0°, and cos θ = 1, so plugging in the numbers gives you

$W = Fs \cos \theta = (2{,}450)(3{,}000)(1) = 7.35 \times 10^6 J$

You need to do 7.35×10^6J of work to move your ingot home. Want some perspective?

Well, to push 1 kilogram 1 meter, you have to supply a force of 9.8N (about 2.2 pounds) over that distance, which takes 9.8J of work. To get your ingot home, you need 750,000 times that. Put another way, 1 kilocalorie equals 4,186J. A kilocalorie is commonly called a … (capital C) in nutrition, which you see on candy bar labels, so to move the ingot home, you need to expend about 1,755 calories.

Ex. 57. Translate the following text into English.

Силы, работа которых не зависит от формы траектории, а определяется начальным и конечным положением тела, называются потенциальными. Очевидно, что работа потенциальных сил на замкнутой траектории равна нулю.

Все силы, работа которых зависит от формы траектории, называются непотенциальными. Непотенциальными силами являются силы трения, сопротивления.

Для системы тел, в которой действуют потенциальные силы взаимодействия, можно ввести понятие потенциальной энергии.

Потенциальная энергия – некоторая функция, описывающая взаимное расположение тел в системе, изменение которой взятое с обратным знаком, равно работе потенциальных сил, действующих между телами системы $-\Delta E_p = A$ или же это энергия взаимного действия, взаимного расположения тел относительно друг друга:

Ex. 58. Fill the gaps with the words from the list below. Be ready to interpret the text.

Pulling, constant force, gravity, kinetic energy, at rest, potential energy, total energy, the principle of conservation of mechanical energy, friction

When you start pushing or … an object with a… , it starts to move if the force you exert is greater than the net forces resisting you (such as friction and…). And if the object starts to move at some speed, it will acquire kinetic energy. Kinetic energy is the energy an object has because of its motion. Energy is the ability to do work.

For example, say you come to a particularly difficult hole of miniature golf, where you have to hit the ball through a loop. The golf ball enters the loop with a particular speed; in physics terms, it has a certain amount of kinetic energy. Assume that when it gets to the top of the loop, it stops dead. This means it no longer has any … at all. However, now that it's at the top of the loop, it sits higher than it was before, and when it drops back down — assuming it stays on the track and there was no friction — it will have the same speed when it gets to the bottom of the track as it had when it first entered the track.

If the golf ball has 20J of kinetic energy at the bottom of the loop, the energy is due to its motion. At the top of the loop, it had no motion, so it had no kinetic energy. However, it took some work to get the golf ball to the top, and that work was 20J, so the golf ball … has 20J of what's called potential energy. The golf ball has … because if it falls, that 20J of energy will be available; if it falls and stays on the track, that 20J of potential energy, which it had because of its height, will become 20J of kinetic energy again.

At the bottom of the loop, the golf ball has 20J of kinetic energy and is moving; at the top of the loop, it has 20J of potential energy and isn't moving; and when it comes back down, it has 20J of kinetic energy again, as shown in Figure 8-3. The golf ball's … stays the same — 20J at the bottom of the loop, 20J at the top of the loop. The energy takes different forms — kinetic when it's moving and potential when it isn't moving but is higher up — but it's the same. In fact, the golf ball's energy is the same at any point around the loop, and physicists who've measured this kind of phenomenon call this … .

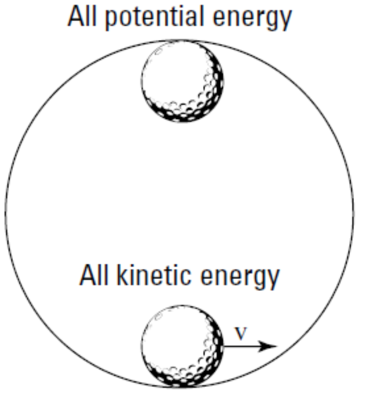


Figure 8. An Object Circling A Loop Withot Friction Has The Same Energy Throughout; It Just Takes Different Forms

Where does the kinetic energy go when … is involved? If a block is sliding along a horizontal surface and there's friction, the block goes more and more slowly until it comes to a stop. The kinetic energy goes away, and you see no increase in potential energy. What happened? The block's kinetic energy dissipated as heat. Friction heated both the block and the surface.

Ex. 59. Translate the following text into English.

Закон збереження енергії – фундаментальний закон природи, встановлений емпірично і полягає в тому, що для ізольованою фізичної системи може бути введена скалярна фізична величина, що є функцією параметрів системи і звана енергією, яка зберігається з плином часу. Оскільки закон збереження енергії відноситься не до конкретних величин і явищ, а відображає загальну, застосовну скрізь і завжди, закономірність, то його можна іменувати не законом, апринципом збереження енергії.

З фундаментальної точки зору, згідно теоремі Нетер, закон збереження енергії є наслідком однорідності часу, тобто незалежністю законів фізики від моменту часу, у який розглядається система. У цьому сенсі закон збереження енергії є універсальним, тобто властивим системам самої різної фізичної природи. При цьому виконання цього закону збереження в кожній конкретно узятій системі обгрунтовується підпорядкуванням цієї системи своїм специфічним законам динаміки, взагалі кажучи розрізняються для різних систем.

У різних розділах фізики з історичних причин закон збереження енергії формулювався незалежно, у зв'язку з чим були введені різні види енергії. Кажуть, що можливий перехід енергії одного типу в інший, але повна енергія системи, яка дорівнює сумі окремих видів енергій, зберігається. Зважаючи умовності поділу енергії на різні види, такий розподіл не завжди може бути вироблено однозначно.

ТЕКСТИ ДЛЯ САМОСТІЙНОЇ РОБОТИ

Ex. 60. Translate the following text into Ukrainian.

The quality of life emerges on the level of the cell. Just as an atom is the smallest unit of an element, so too the cell is the smallest unit of life. The difference between a living cell and a conglomeration of chemicals illustrates some of the emergent properties of life.

Fundamentally, all cells contain genes, units of heredity that provide the information needed to control the life of the cell; subcellular structures called organelles, these being miniature chemical factories that use the information in the genes and keep the cell alive; and a plasma membrane, a thin sheet surrounding the cell that both encloses a watery medium (the cytoplasm) that contains the organelles and separates the cell from the outside world. Some life-forms, mostly microscopic, consist of just one cell, but larger life-forms are composed of many cells whose functions are differentiated. In these multicellular life-forms, cells of similar type are combined into tissues, each performing a particular function. Various tissue types combine to make up a structural unit called an organ. Several organs that collectively perform a single function are called an organ system, and all the organ systems functioning cooperatively make up an individual living thing, the organism.

Ex. 61. Translate the following text into Ukrainian.

Organisms can be grouped into three major categories, called domains: (1) Bacteria, (2) Archaea [a:ˈkɪ(:)ə], and (3) Eukarya [juˈkærɪə]. This classification is based on fundamental differences among the cell types that comprise these organisms. Members of both the Bacteria and the Archaea normally consist of single, simple cells. Members of the Eukarya have bodies composed of one or more highly complex cells and are subdivided into four kingdoms: Protista, Fungi [ˈfΛndʒɪ], Plantae, and Animalia. There are exceptions to any simple set of criteria used to characterize the domains and kingdoms, but three characteristics are particularly useful: cell type, the number of cells in each organism, and the mode of nutrition – that is, energy acquisition.

Ex. 62. Translate the following text into Ukrainian.

There are two fundamentally different types of cells: (1) prokaryotic and (2) eukaryotic. *Kariotic* refers to the nucleus of a cell; *eu* means “true” in Greek; eukaryotic cells possess a “true”, membrane-enclosed nucleus. Eukaryotic cells are larger than prokaryotic cells and contain a variety of other organelles, many surrounded by membranes. Prokaryotic cells do not have a nucleus; their genetic material resides in their cytoplasm. They are small – only 1 or 2 micrometers long – and lack membrane-bound organelles. *Pro* means “before” in Greek; prokaryotic cells almost certainly evolved before eukaryotic cells (and eukaryotic cells probably evolved from prokaryotic cells). Bacteria and Archaea consist of prokaryotic cells; the cells of the four kingdoms of Eukarya are eukaryotic.

Ex. 63. Translate the following text into Ukrainian.

All organisms need energy to live. Photosynthetic organisms capture energy from sunlight and store it in molecules such as sugars and fats. These organisms, including plants, some bacteria, and some protists, are therefore called autotrophs, meaning “self-feeders”. Organisms that cannot photosynthesize must acquire energy prepackaged in the molecules of the bodies of other organisms; hence, these organisms are called heterotrophs, meaning “other-feeders”. Many archaeans, bacteria, and protists and all fungi and animals are heterotrophs. Heterotrophs differ in the size of the food they eat. Some, such as bacteria and fungi, absorb individual food molecules; others, including most animals, eat whole chunks of food and break them down to molecules in their digestive tracts (ingestion).

Ex. 64. Translate the following text into Ukrainian.

Monosaccharides, especially glucose and its relatives have a short life span in a cell. Most are either broken down to free their chemical energy for use in various cellular activities or are linked by dehydration synthesis to form disaccharides or polysaccharides. Disaccharides are often used for short-term energy storage, especially in plants. Common disaccharides include sucrose (glucose plus fructose), which you stir into your breakfast coffee; lactose (milk sugar: glucose plus galactose), found in the milk you pour in your coffee; and maltose (glucose plus glucose, which will form in your digestive tract as you break down the starch in the pancakes you may have for breakfast). When energy is required, the disaccharides are broken apart into their monosaccharide subunits by hydrolysis.

Ex. 65. Translate the following text into Ukrainian.

Although all atoms of a particular element have the same number of protons, the number of neutrons may vary. Neutrons do not affect the chemical reactivity of an atom very much, but they do make their presence felt in other ways. First, neutrons add to the atom’s mass, which can be detected by sophisticated instruments such as mass spectrometers. Second, nuclei with “too many” neutrons break apart spontaneously, or decay, often emitting radioactive participles in the process. Those particles can also be detected – for instance, with Geiger [‘gaɪgə] counters. The process in which a radioactive isotope spontaneously breads apart is called radioactive decay.

A particularly fascinating and medically important application of radioactive isotopes is positron emission tomography, more commonly know as PET scans. In a common application of PET scans, a subject is given the sugar glucose that has been labeled with (that is, attached to) a harmless radioactive isotope of fluorine. When the nucleus of fluorine decays, it emits two bursts of energy that travel in opposite directions along the same line. Energy detectors are arranged in a ring around the subject. They record the nearly simultaneous arrival of the two energy bursts. A powerful computer then calculates the location within the subject at which the decay must have occurred and generates a map of the frequency of fluorine decays. As the fluorine is attached to glucose molecules, this map reflects the glucose concentration within the subject's brain. The brain uses prodigious amounts of this sugar for energy; the more active a brain cell is, the more glucose is uses. How can this information be used in biological research?

Let us suppose that a neuroscientist is trying to locate the areas of the brain that are involved in memory. The researcher might give fluorine-labeled glucose to a few volunteer subjects and then ask them to memorize a word list, which is read aloud. Because brain regions that are active during this process would need more energy and would take more fluorine-glucose molecules than they would be taken by inactive regions, the active regions would have more fluorine decays. The PET scans would be taken during the memorization and then pinpoint brain regions active in storing memories of words.

Physicians also use PET scans in the diagnosis of brain disorders. For example, brain regions in which epileptic seizures originate generally have excessively high glucose utilization and show up in PET scans as "hot spots". Many brain tumors also light up in PET scans. Abnormal metabolism of certain brain regions may also be detected in patients with some mental disorders, such as schizophrenia [skıtsəu'fri:njə].

Ex. 66. Translate the following text into Ukrainian.

Within the past few years, the technologies of recombinant DNA have mushroomed. We will follow a typical sequence of procedures that might be used to solve a particular problem or to produce a specific product.

The first task in recombinant DNA technology is to produce a DNA library – a readily accessible, easily duplicable assemblage of all the DNA of a particular organism. The entire set of genes carried by a member of any given species is called a genome. Why build a DNA library of a species' genome? A DNA library organizes the DNA in a way that researchers can use it. restriction enzymes, plasmids, and bacteria are the most commonly used tools in assembling a DNA library.

Many bacteria produce restriction enzymes, which sever DNA at particular nucleotide sequences. In nature, restriction enzymes defend bacteria against viral infections by cutting apart the viral DNA. (The bacteria protect their own DNA, probably by attaching methyl groups to some of the DNA nucleotides.) Researchers have isolated restriction enzymes and use them to break DNA into shorter strands at specific sites.

Most restriction enzymes recognize and sever palindromic sections of DNA, in which the nucleotide order is the same n one direction on one strand as in the reverse direction on other strand. (A palindrome is a word that reads the same forward and backward, such as "madam".) These single-stranded cut pieces of the DNA fragment are called 'sticky ends', because they will stick to (form hydrogen bonds with) other single-stranded cut pieces of DNA with the complementary series of bases. If the appropriate DNA repair enzyme (called DNA ligase) is added, DNA from different sources cut by the same restriction enzyme can be joined as if the DNA had occurred naturally. Segments of DNA from fundamentally different types of organisms, such as bacteria and humans, can be joined if they have complementary sticky ends.

Many different restriction enzymes have been isolated from various species of bacteria. Each cuts DNA apart at different but specific palindromic nucleotide sequences. The variety of restriction enzymes has enabled molecular geneticists to identify and isolate specific segments of DNA from many organisms, including humans.

Suppose now that human DNA is isolated from white blood cells and is cut apart into many small fragments with a restriction enzyme. The same restriction enzyme is then used to sever the DNA of bacterial plasmids. Now both human and plasmid DNA have complementary sticky ends that, when mixed, form hydrogen bonds. When DNA ligase is added, it bonds the sugar-phosphate backbones together, inserting segments of human DNA into plasmids.

The new rings of plasmid-human DNA (recombinant DNA) are mixed with bacteria, which take up the recombinant DNA. Millions or billions of plasmids collectively could incorporate DNA from the entire human genome. Usually, 100 to 1000 times more bacteria than plasmids are used, so that no individual bacterium ends up with more than one recombinant DNA molecule. The resulting population of bacteria containing recombinant plasmid-human DNA constitutes a human DNA library.

Ex. 67. Translate the following text into Ukrainian.

A gene's specific physical location on a chromosome is called a locus (plural, 'loci'). Homologous chromosomes carry the same genes, located at the same loci. Although the nucleotide sequence at a given gene locus is always similar on homologous chromosomes, it may not be identical. These differences allow different nucleotide sequences at the same gene locus on two homologous chromosomes to produce alternate forms of the gene, called alleles. Human A, B, and O blood types, for example, are produced by three alleles of the same gene.

If both homologous chromosomes in an organism have the same allele at a given gene locus, the organism is said to be homozygous at that gene locus. ("Homozygous" comes from Greek words meaning "same pair".) If two homologous chromosomes have different alleles at a given gene locus the organism is heterozygous ("different pair") at that locus and is called a hybrid. During meiosis, homologous chromosomes are separated, so each gamete receives one member of each pair of homologous chromosomes. Therefore, all the gametes produced by an organism that is homozygous at a particular gene locus will contain the same allele.

Gametes produced by an organism that is heterozygous at the same gene locus are of two kinds: half of the gametes contain one allele, and half contain the other. (…)

Mendel's choice of the edible pea as an experimental subject was critical to the success of his experiments. In plants, a male gamete, which for simplicity we'll call the sperm, is contained in each pollen grain. The structure of the pea flower normally prevents another flower's pollen from entering. Instead, each pea flower normally supplies its own pollen, so the egg cells in each flower are fertilized by sperm from the pollen of the same flower. This process is called self-fertilization. Even in Mendel's time, commercial seed dealers sold many types of peas that were true-breeding. In true-breeding plants, all the offspring produced through self-fertilization are homozygous for a given trait and are essentially identical to the parent plant.

Although peas normally self-fertilize, plant breeders can also mate plants by hand, a process called cross-fertilization. Breeders pull apart the petals and remove the stamens, preventing self-fertilization. By dusting the carpels with pollen they have selected, breeders can control cross-fertilization. In this way, two true-breeding plants can be mated to see what types of offspring they produce.

In contrast to earlier scientists, Mendel chose to study traits – heritable characteristics – that are unmistakably different forms, such as white flowers versus purple flowers, and he worked with one trait at a time. These factors allowed Mendel to see through to the underlying principles of inheritance. Equally important was the fact that Mendel counted the numbers of offspring with each type of trait and analyzed the numbers. The use of statistics as a tool to verify the validity of results has since become an extremely important practice in biology.

Ex. 68. Translate the following text into Ukrainian.

Although nearly 100,000 species of modern fungi have been described, biologists have only begun to comprehend the diversity of these organisms – at least 1000 additional species are described each year. Like plants, fungi are grouped into divisions, which are comparable to animal phyla. The major divisions of fungi are the Zygomicota (zygote fungi), Ascomycota (sac fungi), Basidiomycota (club fungi), and Deuteromycota (imperfect fungi) (Table 1).

The zygomycetes, also called the zygote fungi, include about 600 species. Familiar – and annoying – zygomycetes are those of the genus Rhizopus, which cause soft fruit and black bread mold. The haploid hyphae of zygomycetes appear identical but are actually two different mating types. The two types “mate sexually”, fusing their nuclei to produce diploid zygospores. These resistant structures are dispersed through the air and can remain dormant until conditions are favorable for growth. Zygospores then undergo meiosis and germinate into structures that bear haploid spores. The spores then give rise to new hyphae. These hyphae may reproduce asexually, by forming haploid spores in black spore cases called sporangia, or sexually, by fusing to produce more zygospores.

The 30,000 species of ascomycetes, also called sac fungi, are named after the saclike case, or ascus (plural, asci), in which their spores form during sexual reproduction. Some ascomycetes live in decaying forest vegetation and form beautiful cup-shaped reproductive structures or corrugated, mushroomlike fruiting bodies called morels. This division also includes many of the colorful molds that attack stored food and destroy fruit and grain crops and other plants. Some ascomycetes secrete the enzymes cellulase and protease, which can cause significant damage to cotton and wool textiles, especially in warm, humid climates where molds flourish. Ascomycetes cause both Dutch elm disease and chestnut blight, but other ascomycetes are a boon to plants, forming mutually beneficial associations with plant roots. A gastronomic delicacy, the truffle, is also a member of this diverse division.

Claviceps purpurea, an ascomycete that attacks rye plants, produce structures called ergots that release several toxins, one of which is the active ingredient in the drug LSD. If infected rye is made into flour and consumed, the toxins can lead to ergot poisoning – convulsions, hallucinations, and ultimately death. This happened frequently in northern Europe in the Middle Ages, but modern agricultural techniques have essentially eliminated the disease. Another Claviceps toxin has medicinal effects if administered in low doses; that toxin is currently used in drugs that induce labor and control hemorrhaging after childbirth.

Among the ascomycetes we also find the yeasts, some of the few unicellular fungi. The yeasts include both the parasitic yeast that is a common cause of vaginal infections and the baker's and brewer's yeasts that make possible the proverbial loaf of bread and jug of wine. Some yeasts form hyphae when nutrients are scarce; the hyphae can elongate and reach distant food sources.

Basidiomycetes are called the club fungi because they produce club-shaped reproductive structures. The division Basidiomycetes consists of about 25,000 species, including the familiar mushrooms, puffballs, and shelf fungi, sometimes called monkey-stools. Although several mushrooms species are considered delicacies, mushrooms can be deadly. Some members of the genus Amanita contain potent toxins that are among the most deadly poisons ever found. Basidiomycetes can also be dangerous to plants; they include some devastating plant pests descriptively called rusts and smuts, which cause billions of dollars worth of damage to grain crops annually. Some members of this group, however, enter into mutually beneficial relationship with plants.

Basidiomycetes typically reproduce sexually. Mushrooms and puffballs are actually reproductive structures: dense aggregations of hyphae that emerge under proper conditions from a massive underground mycelium. On the undersides of mushrooms are leaflike gills that produce specialized club-shaped diploid cells called basidia. Basidia give rise to haploid reproductive basidiospores by meiosis. These are released by the billions from the gills of mushrooms or the inner surface of puffballs and are dispersed by wind and water.

Falling on fertile ground, a mushroom basidiospore may germinate and form haploid hyphae of two different mating types. When the two types meet, some of the cells fuse and produce an underground mycelium. These hyphae grow outward from the original spore in a roughly circular pattern as the older hyphae in the center die. The subterranean body periodically sends up numerous mushrooms, which emerge in a ringlike pattern called a fairy ring. The diameter of the fairy ring can reveal the approximate age of the fungus – the wider the ring diameter, the older the mushrooms, and their average rate of growth is known. Some fairy rings are estimated to be 700 years old.

Deuteromycetes are called the imperfect fungi because none have been observed to form sexual reproductive structures. In some species the sexual stage has been lost during evolution; in others it may exist but has not yet been observed. This large division includes about 25,000 described species of great diversity and considerable importance to humans. It was a member of this division that contaminated and killed the bacterial cultures of the microbiologist Alexander Fleming by accident. His keen observations led to the isolation of penicillin, the first antibiotic, from the fungus Penicillium. We also owe to deuteromycetes the indescribable flavor and aroma of Roquefort and Camembert cheeses. Other imperfect fungi are human parasites, causing diseases such as ringworm and athlete's foot. Some are not content to live on dead organisms or even to parasitize live ones – they act as predators, laying deadly traps for unsuspecting roundworms.

Ex. 69. Translate the following text into Ukrainian.

The immune system is a strange "system". Unlike the nervous system, for example, it is not composed of physically attached structures. Instead, as befits its mission of patrolling the entire body for microbial invaders, the immune system consists of an army of separate cells. Nevertheless, the army is highly coordinated. This coordination requires complex communications involving antigens, antibodies, hormones, receptors, and cells. For example, when a virus invades the body (step 1), it sets off a cascade of events that can be loosely divided into three components.

One component of the immune response begins when macrophages ingest the virus (step 2) and digest it. Antigens that have been "chewed off" the virus become attached to certain proteins of the macrophage's major histocompatibility complex (MHC) and are displayed, or presented, on the surface of the macrophage. These antigen-MHC complexes are recognized by virgin helper T cells (step 3). Next, receptors on helper T cells release a hormone called interleukin-2 (step 4). This hormone stimulates cell division and differentiation (step 5) in both the releasing cell and in any other T cells that have bound to an antigen-MHC complex. Some of the resulting daughter helper T cells become memory cells that provide future immunity (step 6); other daughter cells become mature T cells that assist in activating – that is, stimulating the immune response of – cytotoxic T cells and B cells (step 7).

Meanwhile, other copies of the virus are infecting ordinary body cells, such as those lining the respiratory tract (step 8). Infected body cells display viral antigens on their surfaces, bound to another set of MHC molecules. Virgin cytotoxic T cells bind to the antigen-MHC complex on the body cells (step 9) and are simultaneously activated by interleukin-2 released by the activated helper T cells. This combination of binding and stimulation causes the cytotoxic T cells to multiply and become activated (step 10). When activated cytotoxic T cells then encounter infected cells presenting the antigen-MHC complex, the T cells release toxic proteins that kill the infected cell by lysis (step 11).

Some B cells bear antibodies on their surfaces that bind antigens on the surface of free viruses that have not yet invaded a body cell (step 12). This antigen-antibody binding stimulates some B cell division and maturation, but full activation of B cells requires a boost from helper T cells. This boost is provided when B cells that have bound antigen ingest that antigen (by receptor-mediated endocytosis), attach the antigen to MHC molecules, and present the antigen-MHC complex on their surfaces. The antigen-MHC complex is recognized by activated helper T cells (step 13), which then release several types of interleukin hormones that stimulate the division and differentiation of antigen-binding B cells (step 14). Some of the progeny become memory cells (step 15); other become plasma cells that secrete antibodies into the bloodstream (step 16).

As you can see, helper T cells are essential in turning on both phases of the immune response. A loss of helper T cells, such as that caused by the virus that causes AIDS, virtually eliminates the immune response to many diseases.

Ex. 70. Translate the following text into Ukrainian.

The field of chemistry is now a very large one. There are more than 30 different branches of chemistry. Some of the better known fields are inorganic chemistry, organic chemistry, physical chemistry, analytical chemistry, biological chemistry, pharmaceutical chemistry, nuclear chemistry, industrial chemistry, colloidal chemistry, and electrochemistry.

Inorganic chemistry. It is originally considered that the field of inorganic chemistry consists of the study of materials not derived from living organisms|. However it now includes all substances other than the hydrocarbons and their derivatives.

Organic chemistry. At one time it was thought that all substances found in plants and animals could be made only by using part of a living plant or animal. The study of these substances, most of which contain carbon was therefore called organic chemistry. It is now known that this idea is quite wrong, for in 1828 F. Wohler made an "organic" substance using a simple laboratory process.

Organic chemistry now merely means the chemistry of carbon compounds.

Physical chemistry is concerned with those parts of chemistry which are closely linked with physics as, for in stance, the behaviour of substances when a current of electricity is passed through them.

Electrochemistry is concerned with the relation between electrical energy and chemical change. Electrolysis is the process whereby electrical energy causes a chemical change in the conducting medium, which usually is a solution or a molten substance. The process is generally used as a method of deposition metals from a solution.

Magnetochemistry is the study of behaviour of a chemical substance in the presence of a magnetic field. A paramagnetic substance, i.e. one having unpaired electrons is drawn into a magnetic field. Diamagnetic substances, i.e. those having no unpaired electrons, are repelled by a magnetic field.

Biochemistry. Just as the physical chemist works on the boundaries between physics and chemistry, so the biochemist works on the boundaries between biology and chemistry. Much of the work of the biochemist is concerned with foodstuffs and, medicines. The medicines known as antibiotics, of which penicillin is an early example, were prepared by biochemists.

Ex. 71. Translate the following text into Ukrainian.

Simple diatomic molecules of a single element are designated by the symbol for the element with a subscript 2, indicating that it contains 2 atoms. Thus the hydrogen molecule is H_2; the nitrogen molecule, N_2; and the oxygen molecule, O_2. Polyatomic molecules of a single element are designated by the symbol for the element with a numerical subscript corresponding to the number of atoms in the molecule. Examples are the phosphorus molecule, P_4, and the sulphur molecule, S_8.

Diatomic covalent molecules, containing unlike elements are given similar designation. The formula for hydrogen chloride is HCl. The more electropositive element is always designated first in the formula.

For polyatomic covalent molecules containing unlike elements, numerical subscriptions are used to designate number of atoms of each element present in the molecule, for example, water, H_2O. Again, as in diatomic molecules, more electropositive element is placed first in the formula.

Ex. 72. Translate the following text into Ukrainian.

One of the cornerstones of modern chemical theory is the Periodic Law. It can be simply stated as follows: The properties of the elements are a periodic function of the nuclear charges of their atoms.

In 1869 Mendeleyev arrived at the conclusion that by the arrangement of the elements in order of increasing atomic weight the similarity and periodicity of properties of various, valence groups of the elements were clearly delineated.

There were several vacant spaces in Mendeleyev's table which led him to predict the existence of six undiscovered elements, (scandium, gallium, germanium, polonium etc). His confidence in the new classification was clearly expressed in the predictions which he made of the chemical properties of these missing elements. And within fifteen years gallium, scandium and germanium were discovered.

Although this table has been modified hundreds of times, it has withstood the onslaught of all new facts. Isotopes, rare gases, atomic numbers, and electron configurations have only strengthened the idea of the periodicity of the properties of the elements.

Ex. 73. Translate the following text into Ukrainian.

Chlorine is an element with atomic number 17, atomic weight 35.5 (thirty-five point five). It is a gas at ordinary temperatures and is never found free in nature. It is found in nature combined with other elements. At normal temperatures, chlorine is a diatomic gas ($C1_2$), greenish-yellow in colour and about 2 1/2 (two and a half) times as heavy as air. It liquefies at atmospheric pressure at —34. 1° C (minus thirty-four point one degrees Centigrade) to a yellowish liquid approximately 11/2 (one and a half) times as heavy as water. The liquid freezes at —100.98° C (minus one hundred point nine eight degrees Centigrade). Chlorine is soluble in water and indirectly exerts bleaching and bactericidal action by reacting with water to form hypochlorous acid.

$$Cl_2 + H_2O \leftrightarrow HCl + HClO \rightarrow HCl + (O)$$

Chlorine Water Hydrochloric acid Hypochloric acid

The hypochlorous acid is unstable, giving up oxygen to form more HC1. The oxygen attacks and destroys bacteria; it also oxidizes coloured organic substances, forming colourless or less-coloured components.

As one of the most active elements, chlorine ranks in reactivity about with oxygen. It combines directly and readily with hydrogen and most non-metals except nitrogen, carbon and oxygen; it also unites with all the familiar metals except gold and platinum.

Participating in a number of important organic reactions, in some cases chlorine appears in the final product, as in insecticides (DDT) or in the plastic, polyvinil chloride.

Chlorine is generally produced by electrolysis of water solutions of sodium chloride in electrolytic cells. When sodium chloride or potassium chloride solutions are subjected to electrolysis, there are three products; caustic soda or caustic potash, chlorine and hydrogen. If fused sodium chloride is used, there are two products: chlorine, and metallic sodium.

Ex. 74. Translate the following text into Ukrainian.

The analysis of a complex material usually involves four steps, sampling, dissolving the sample, separating mutually interfering substances, and determining the constituents of interest. The first step, sampling can be a significant problem, particularly in industrial applications.

Sampling is complete when the subdivision is small enough to permit analysis.

The second step is the dissolving of a sample. If we know the nature of the sample we use a suitable reagent.

Gravimetric methods involve a weighing operation as the final measurement.

Gravimetric analysis have been developed for almost everything from A(luminium) to Z(irconium).

Gravimetric procedures may be done in various ways: by precipitating, by dissolving, by removing as a volatile compound.

Volumetric methods involve measurement of that volume of a solution of known concentration which reacts with a known amount of the sample. Such a solution is called a standard solution.

Volumetric techniques are now applicable to most of the elements and to many specific inorganic and organic compounds. They are widely used in all phases of chemistry, in medicine, and in many allied sciences.

Physico-chemical methods depend upon the measurement of physical properties other than mass and volume. Such methods are important when the simpler methods of analysis are inadequate.

Ex. 75. Translate the following text into Ukrainian.

Methods of separating a solid and a liquid are built around two processes, filtration and centrifugation.

Filtration is the process of passing the suspension of solid and liquified through a porous barrier which will trap the solid. The barrier may be filter paper, sintered glass, asbestos matting, glass wool and others.

Centrifugation is mechanized setting (or floating) and depends upon the difference between the densities of the solid and the solution. Gravitational setting is usually inadequate. A centrifuge can be used to enhance the gravitational force moving the particles. Most centrifuges operate at hundreds of revolutions per minute. Extremely difficult separations require speeds of tens of thousands of revolutions per minute.

Ex. 76. Translate the following text into Ukrainian.

Chromatography is a method of chemical analysis based upon the selective absorption and partial fractionation of various substances by certain suitable materials. The method is simple and requires a minimum of special equipment. The technique consists of pouring a solution through a column containing a suitable adsorbing material. A selective developing agent is then passed through the column and the different substances in the solution are spread down the column into layers visibly separated from one another, provided the substances are colored. In the case of colorless substances, the layers of the different substances may be located by the use of ultra-violet light or by chemical tests.

This method was first described by the Russian botanist Tswett, in 1906. Tswett was engaged in the extraction and purifictaion of plant pigments.

Methods of chromatography have been applied to the separation of the rare earths and a number of procedures, based on chromatography techniques, have been developed for the separation of the inorganic cations and anions.

Ex. 77. Translate the following text into Ukrainian.

The relative proportions of various components of gas mixtures can be determined by merely measuring some physical constants of the mixture: the density, the viscosity, the thermal conductivity, heat of combustion, ionization potential.

Condensation methods are often applicable in the separation of complex mixtures of gases. This method has been applied to the gases of the argon group and of natural gas mixtures.

The application of the methods of mass spectrometry to gas analysis has been extensive. The use of a mass spectrometer in analysis enables one to determine the components of mixtures of hydrocarbons, fuel gases, rare gases, etc.

Thermal conductivity applied to gas analysis is rapid, simple to carry out and adaptable to continuous operation .and process control.

Some attempts to apply the methods of emission and absorption spectroscopy to gas analysis have been made.

Other miscellaneous methods include magnetic susceptibility, micro-wave analysis, acoustical method based on the principle that the velocity of sound in a gas is a function of the molecular weight of the gas, inferometric methods, diffusion methods and others.

Ex. 78. Translate the following text into Ukrainian.

Liquid-liquid phase separations are possible when a metal forms a compound soluble in two immiscible liquids. The distribution of the compound between the two liquids can be considered to be a solubility contest. Practical considerations dictate that one of the liquids must be water. Among the liquids other contestants are: carbon tetrachloride, chloroform, carbon disulfide, ethers, paraffin hydrocarbons, and aromatic hydrocarbons. Alcohols cannot be added to this list.

Most inorganic compounds just are not interested in the organic solvents which are immiscible with water. Sometimes, however, a complexing agent can be found which will coach an inorganic substance into an organic solution. Cupric, lead, zinc, silver, mercuric, and cadmium salts, for example, will dissolve, in either chloroform or carbon tetrachloride if it contains some dithizone.

Ex. 79. Translate the following text into Ukrainian.

Alfred Bernard Nobel, a Swedish chemist, invented dynamite and founded the Nobel Prizes. As a young man, Nobel experimented with nitroglycerin in his father's factory. He hoped to make this dangerous substance into a safe and useful explosive. He prepared a nitroglycerin explosive, but so many accidents occurred when it was put on the market that for a number of years many people considered Nobel almost a public enemy.

Finally in 1867 Nobel combined niter with an absorbent substance. This explosive could be handled and shipped safely. Nobel named it dynamite. Within a few years he became one of the world's richest men. He set up factories throughout the world and bought the large Bofors armament plant in Sweden. He worked on synthetic rubber, artificial silk and many other products.

Nobel was never in good health. In later years he became increasingly ill and nervous. He suffered from a feeling of guilt at having created a substance that caused so much death and injury. He hated the thought that dynamite could be used in war when he had invented it for peace. Nobel set up a fund of about 9 million U.S. dollars. The interest from the fund was to be used to award annual prizes, one of which was for the most effective work in promoting international peace.

Alfred Nobel was born on October, 21, 1833 in Stockholm. He was the son of an inventor. He was educated in St. Petersburg, Russia, and later studied engineering in the United States.

Ex. 80. Translate the following text into Ukrainian.

Flip a switch and a light goes on. It's simple, right? Wrong! Every time you flip a light switch, you make billions of little electrons go to work for you. Uncountable hours of work have gone into providing you with the electricity you need to turn that light on. Without electricity you wouldn't have telephones, television, video games, and many other things you use every day.

Have you ever gotten a shock when you touched a doorknob, or seen sparks fly when you combed your hair? That's electricity. Electricity is a type of energy that gives things the power to work. This energy comes from electrons. Scientists have learned how to use electrons to produce electricity.

It takes billions of electrons to make electricity operate. Electrons move through an electric wire in much the same way water moves through a garden hose. Turning on the faucet pushes the water through the hose. Pushing electrons makes electricity move through the wire. The machine that pushes the electrons through the wire is called a generator. The wire from the generator goes to your home and into a control center, which is either a fuse box or a circuit breaker.

The fuse box controls how much electricity you use. If you try to use too much, you will "blow a fuse," and the electricity from that fuse will be cut off. A circuit breaker works differently from a fuse box. A circuit breaker does not let you use too much electricity. It cuts off the flow before there's an overload. If you did not have a fuse box or circuit breaker, your electric wires could overheat and start a fire! From the fuse box or circuit breaker, the wires go inside your walls to light switches and sockets. Turning on the light switch lets the electricity flow to the light, and the light goes on. When you put a plug into-a socket, electricity comes to the socket. But it doesn't flow into the lamp until the switch is turned on.

Besides turning on lights, we can use electricity to carry sound. Sound is made by vibrations called sound waves. The electricity in a telephone picks up the sound waves from the speaker on one end and carries them to the receiver on the other end. The electricity moves so fast that you can hardly notice the time it takes to travel from one place to another. When you turn on your TV, you get both light and sound, Again, it is electricity that makes this possible, allowing you to see and hear your favorite shows!

Ex. 81. Translate the following text into Ukrainian.

Sugar, rubber, glass, silver, milk, wood and modelling clay are all common substances. They are easy to tell apart and each one is useful in its own way. No one would think of trying to make an ink-pot out of milk, or a candle out of sugar. No one would make a bracelet of modeling clay, a dinner plate of silk. No one would try to drink wood or build a fire with water, no one would make a baseball bat of glass, or a baseball of silver. Every substance has, what scientists call, properties of its own. Yet all substances are alike in one way. They all weigh something, and they all take up room.

When scientists want to lump all substances together and talk about them, they use the word "matter". Every substance is a kind of matter. The science of physics is partly a study of matter. It explains how water can evaporate and become a gas as well as how it can freeze and become a solid. It explains why some substances are solids, some liquids, and some gases. It explains why butter melts more easily than iron and where a lump of sugar goes when it is put into hot coffee. It explains why a tire is more likely to blow out on a hot day than on a cold one. It explains many of the changes that go on around us.

But physics is also a study of energy – of light, heat, sound, electricity, magnetism, of the energy of moving bodies, and of atomic energy. One of the commonest of all questions is, "How does it work?" Many, many times we must go to the science of physics to get the answer. And most of the answers have something to do with energy.

How does television work? How fast does sound travel? How can a camera take a picture? What are cosmic rays? What are the problems in travelling through outer space? How does an airplane fly? These are a few questions that the science of physics answers.

Ex. 82. Translate the following text into Ukrainian.

1. A force is a push or pull which affects the motion of matter. Like energy, force cannot be weighed and does not take up space. However, force acts on matter to produce or prevent motion in a given direction. Although we cannot actually see force, we know it is present by the way it affects the movement of matter.

2. Does force always produce motion? In trying to lift a heavy object, it is possible to exert a great deal of force without moving the object. Thus all motion is caused by force, but not all forces produce motion.

3. When you pick up a book or throw a ball, you are using force to put the objects in motion. You may already know that energy is needed to produce motion in matter. Therefore, the force you exert in moving an object is actually produced by your muscles. When you ride in an automobile, you know that force is needed to move the car.

4. Force is also needed to slow down or stop the motion of an object. When you catch a ball, you use force to stop the motion of the ball. When you use the brake on a bicycle, you are using force to slow it down. To affect motion, force always requires some form of energy, such as mechanical, heat, electrical, chemical, or nuclear.

5. We know that gravity attracts all matter toward the centre of the Earth. Since a falling object is in motion, the attraction of gravity is a force that produces this motion in matter. We also know that the pull of gravity, commonly measured as the weight of an object, is greater on objects having more mass than on less massive objects. Does this difference in the pull of gravity affect the rate of speed with which an object falls?

6. Careful experiments have shown that the speed with which a n object falls from a given height is the same regardless of mass. That is, a heavy object falls at the same rate of speed as a light object. Of course, if you drop a feather and a coin 'from the same height, the coin strikes the ground first. The feather falls slower only because it has a larger surface area. It is held back by the amount of air that must be pushed aside to let it fall. This air friction opposes the motion of the feather. If a feather and a coin are placed in a tube and all the air is pumped out, you would discover that both objects fall at the same rate of speed.

7. There are forces which can overcome the force of gravity. An airplane rises above the ground because the forces acting on its wings lift it off the ground. A helicopter can come to a stop in the air because it is supported by the forces acting on its rotating wing. Rockets and spaceships can escape the Earth's gravitational pull when upward forces are produced that overcome their weights.

8. Scientists know that gravity is responsible for the holding together of our solar system and the entire Universe. Isaac Newton realized that every object on Earth and in space exerts a force of attraction on every other object, regardless of mass. This force of attraction is known as the law of universal gravitation.

Ex. 83. Translate the following text into Ukrainian.

Electricity has been known since the days of the ancient Greeks. The word "electricity" comes from the Greek word for amber. The Greeks discovered that, if a piece of amber was rubbed with fur, it would pick up bits of straw or other light-weight materials. Later scientists discovered that other materials would act like amber. They could be given charges of electricity. Charges of this kind are called charges of frictional, or static, electricity. They are not very useful.

2. In 1800 an Italian scientist named Volta found a way of getting an electric current. He invented an electric cell. But electricity became truly useful after Michael Faraday invented a machine to push electrons on their way. A machine which furnishes a current of electricity is called a genarator. Today we use both cells and generators.

3. A battery is made up of two or more electric cells joined together. We use batteries in such things as portable radios, flashlights, electric games, and automobiles. The current which comes to our houses, stores and offices and lights our streets comes from generators.

4. In buying and using electrical appliances there are some terms everyone needs to know. "Volt" is one. "Ampere" is another. "Watt" is a third. The push that forces a current through a circuit is measured in volts. A volt is a measure of electrical force. Most household appliances are built for a voltage of either 127 or 220.

5. An ampere is a measure of the strength of a current. Electric lamp bulbs are marked in watts. A watt is a measure of electrical power. A kilowatt is 1,000 watts.

Ex. 84. Translate the following text into Ukrainian.

1. All the millions of substances in the world are built of only about a hundred simple substances. We call these simple substances elements. The very smallest bit of an element is an atom. Iron, for instance, is one of the elements. The very smallest bit of iron is an atom of iron.

2. Atoms are so tiny that it is hard to imagine how tiny they are. In a thimbleful of air there are more atoms than you could count if you lived to be a million years old. Of course, atoms are too small to be seen even with powerful microscopes. We know about them only from the way they act.

3. There can be millions of different substances because atoms of different kinds can join together in different ways. Atoms of oxygen and atoms of hydrogen, for instance, can join to form water. They can join in different proportions to form hydrogen peroxide.

4. Atoms are so small that it is almost unbelievable that anything could be smaller. But atoms are made up of even smaller particles. Every atom has a centre, or nucleus. The nucleus of an atom always has in it one or more particles called protons. In the case of every element except hydrogen it has particles called neutrons in it, too. Travelling around the nucleus there are one or more tiny particles called electrons.

5. The atoms of a few rare elements gradually break down by themselves. They shoot out some of the particles they are made of. As they do, they give off energy, mostly in the form of heat and light. These elements, we say, are radioactive. Radium is one of them. Uranium is another.

6. About 30 years ago scientists found a way of splitting atoms artificially and making them give off energy. They used machines called atomsmashers to hurl parts of atoms against the nucleus of an atom with so much force that it would split the nucleus. The splitting of atoms is called atomic fission.

7. After they found out how an atom can be split, scientists found out how to use the splitting of one atom to set off the splitting of other atoms. They discovered, in other words, how to bring about a chain reaction. 8. In atomic fission it is the nucleus that is split. For this reason, atomic energy is often called nuclear energy. Now scientists have found how to control the splitting of atoms. They have worked

out ways of making atomic fission supply a steady amount of energy and serve mankind. Some power stations are already using atomic energy to generate electricity for peaceful aims.

Ex. 85. Translate the following text into Ukrainian.

For many years, men used light and heat energy from the Sun and from fires, but they did not understand the nature of light and heat until quite recently. Near the end of the 19th century, scientists began to think of light as waves travelling through space, somewhat the way that waves move over water.

As the problem was explored, it seemed that there should be other forms of energy which travel in the same way that light does. This study led to the discovery of radio waves which are somewhat like light waves. They both travel at the same speed and go out in all directions, or radiate, from one sport. They have been called radiant energy.

Radiant energy waves, though often explained by comparing them with water waves, or sound waves, are unlike anything else in the Universe. Water waves occur in water. Sound waves occur in the air, or other material. But radiant energy waves need no material to carry them from place to place. This seemed so unbelievable to scientists that for years they pretended that space was filled with a substance called ether, through which light, radio and other waves of radiant energy travelled.

The number of waves which are passing a given point in a second is the frequency. In sound, we know that the greater the frequency, the higher the pitch that we hear. Experiment shows that the short, high-frequency light waves are seen as violet in colour, while the longer, low-frequency waves are seen as red in colour. Some radiant energy waves, such as X-rays, are so short and have so high a frequency that they cannot be seen at all. Others, such as radio waves, are so long and have so low a frequency that you do not know they are present. Scientists learn about them only by experimenting and using sensitive instruments.

It is known that a current in a wire produces a magnetic field about it. If the current goes back and forth, or oscillates, a wave is set up which moves through space with the speed of light. These are radio waves. They have all the properties of other waves of radiant energy.

Radio broadcasting stations, television studios, radar sets, and signals from satellites all depend upon radiant energy waves for their operation.

Ex. 86. Translate the following text into Ukrainian.

As its name suggests, nuclear physics is the study of the central cores (nuclei) of atoms. An atomic nucleus is a tightly knit group of particles called protons and neutrons. Since protons are positively charged and neutrons are uncharged, the nucleus as a whole carries a positive charge. Virtually the whole weight of an atom is concentrated in its nucleus. Any atom of any one chemical element contains the same number of protons. This is its atomic number. But atoms of the same element may contain different numbers of neutrons. An element may therefore have more than one atomic weight. Hydrogen has just one proton in its nucleus (and so it is element number 1 in the periodic table). But deuterium, or heavy hydrogen, has a neutron as well as a proton in its nucleus. Its atomic weight is therefore 1 + 1=2. Elements like hydrogen and deuterium, that have the same atomic number but different atomic weights, are called isotopes. Nearly all the elements occurring in nature are stable but many isotopes are radioactive, i.e. their nuclei break up, throwing out rays and particles. The nuclear physicist can make radioactive isotopes by bombarding elements with atomic particles in an atom-smasher, or particle- accelerator. This may be one of several types, such as cyclotrons, synchrotrons or linear accelerators. But the most fruitful source of radioactive isotopes for use as "tracers" in a wide variety of applications is the nuclear reactor. A reactor is used for controlling the type of nuclear disintegration called a chain reaction, when the products are able to trigger off the break-up of further atoms.

Ex. 87. Translate the following text into Ukrainian.

In 1916, Albert Einstein published his General Theory of Relativity; this was to do for the 20th century what Newton's work had done for the 17th.

In 1907, at the age of twenty-eight, Einstein began digging at the roots of Newtonian mechanics. This re-examination of the fundamental premises of classical physics was prompted by Einstein's earlier work. Nearly two years before, while a clerk in a Swiss patent office, he had established an international reputation with the publication of a brief Special Theory of Relativity. This revolutionary theory, which was to lead ultimately to the liberation of atomic energy, introduced several profound ideas which differed greatly from those proposed by Newton.

Einstein showed that the Newtonian view was only an approximation of reality. But as it turns out, it proves to be a remarkably close approximation and so continues to be of fundamental importance to the world of science.

In the service of scientists, Newton's mechanics still explains the motion of planets, the Moon, artificial satellites, interplanetary space vehicles, tides, airplanes, automobiles – in fact for any kind of motion in which the relativistic increases in mass do not become important. They become important, as Einstein showed in his Special Theory of Relativity, when the speed of light is approached. And even when the speed of light is approached, suitable corrections can easily be made in Newton's laws to compensate for relativity effects.

As for the applications of Einstein's theory, it provides us with guidance in the field of cosmology, which deals with the large-scale 49 features of the Universe and with its history. But perhaps most important of all, general relativity has added to our understanding and our appreciation of the Universe.

Ex. 88. Translate the following text into Ukrainian.

The Universe contains many millions of stars in space. Vast collections of stars, known as galaxies, stretch out into space far beyond the visibility of the most powerful telescopes.

Galaxies exist in various shapes and sizes. The majority may be classed according to their shape as spiral, elliptical or irregular galaxies. The Milky Way, the galaxy in which our own solar system occurs, is of the spiral type. Seen in the night sky as a haze of white light stretching from the horizon, it is in fact a collection of perhaps 100,000 million stars. Our own Sun is not in the centre of it, but near the edge. The Milky Way is also known to astronomers as the Galaxy.

Some of the patches of light which can be seen in the sky are not so much galaxies as patches of incandescent (glowing) gas which may in time become stars. The origin of the Universe and its galaxies is not known. Some astronomers believe that matter is being continually created, though others believe that the Universe started by the explosion of concentrated matter. Both theories are difficult to prove.

Asteroids. An asteroid is a small or minor planet which circles the Sun. The distance from the Sun of such an asteroid varies greatly as it moves in its path around the Sun. There are many thousands of asteroids moving round the Sun between the orbits of Mars and Jupiter.

Most asteroids are very small, less than 20 miles in diameter. The largest is Ceres, which measures some 480 miles across. It is thought by some scientists that the origin of these minor planets is to be found in the breaking-up of a much larger body many thousands of 50 years ago. A characteristic feature of many of the asteroids is that their orbits are elongated ellipses.

Ex. 89. Translate the following text into Ukrainian.

Of all the planets in the solar system the planet Mars is probably the one which stimulates the greatest interest and which poses some interesting problems to the observers. In one curious way this planet differs from all the others. Each and every one of these planets presents itself in a suitable position for study every year, or at intervals of approximately every 12 months.

This is not the case with the planet Mars, for this planet presents itself for study at intervals of about 2 years and 2 months (780 days). A "day" on Mars is about 24 ½ hours. The Martian year is 687 days: it takes 687 of our days for Mars to complete one revolution about the Sun. However, because Mars travels more slowly than the Earth, it takes 780 days before the two bodies come into line. When the Earth and the planet Mars are in a line with the Sun, and on the same side of it, then Mars is in opposition and so at its best position for study.

Mars is a little over half the size of the Earth and it has a diameter of about 4,200 miles. As this planet is rather small, it can be 51 observed easily only around the times of opposition, when it is near the Earth. These oppositions occur about every 2 years and 2 months. Mars has a very elliptical orbit and opposition distances ca n vary from 62 million to 35 million miles. A favourable opposition, when Mars is as close to the Earth as it can be, takes place every 15 or 17 years.

Man's knowledge of Mars comes not only from the use of powerful telescopes but also from the use of unmanned spacecraft. Since 1962 Soviet and American spacecrafts have been travelling great distances in space to photograph and collect data about Mars and other planets. The pictures and the information are then sent back to Earth by means of radio and television signals.

Ex. 90. Translate the following text into Ukrainian.

Everyone has seen the Moon shining brightly in the sky on a clear night. The Moon is our natural satellite because it revolves in an orbit around the Earth. On the average, it is about 240,000 miles away. This is a short distance when we think of the vast distances between planets. The Moon is a rather large satellite with a diameter of a little more than 2,000 miles.

We have learned that there is no water on the Moon, and it has no atmosphere. The surface of the Moon has steep mountains and deep valleys. There are also large flat plains, which early astronomers thought were "seas", and large circular craters scattered on the surface. The surface of the Moon remains rugged and forbidding because there is no atmosphere. As a result, there is no weather to wear down the rocks. As the Moon revolves around the Earth, sunlight strikes its surface, and we see its reflected light in the Earth.

Since the Moon revolves around the Earth in our month, it takes a little over a week for the Moon to move one-quarter the distance around in its orbit. The Moon rotates on its axis and revolves around the Earth once each 27 1/3 days. However, since the Earth and the Moon are both moving around the Sun, it takes the Moon a little over two more days to catch up with the new position of the Earth. Hence, for an observer on the Earth, it is 29 ½ days between the one new Moon and the next.

Automatic stations, space laboratories, the Soviet "Lunokhod" and the flight of the American astronauts to the Moon have begun a new period in exploration of the Moon.

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