UNIT VII

ELECTRICITY

Activity I.

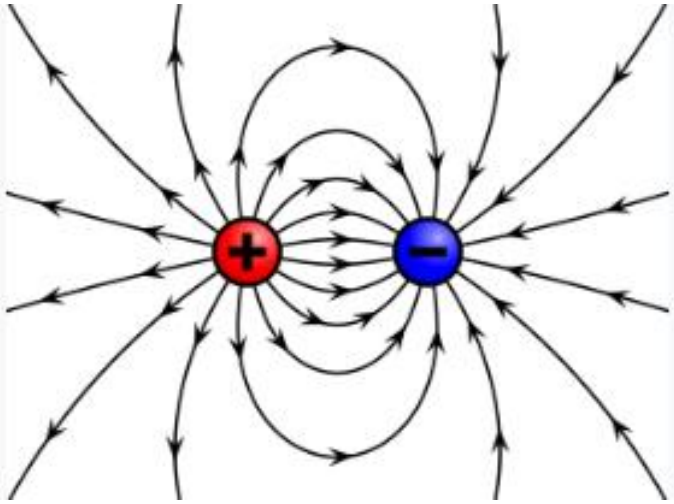
Learn the words and phrases

electric circuit – *електричне коло*	hole – *дірка*
electric plug – *штепсельна вилка*	nucleus – *атомне ядро*
a break in the path – *розрив електричного кола*	negatively charged – *негативно заряджений*
current flow – *протікання електрично-го струму*	positively charged – *позитивно заряджений*
conductor – *провідник*	resistance – *опір*
current electricity – *електричний струм*	semi- conductor – *напівпровідник*
conductivity – *електропровідність*	to attract – *притягувати*
insulator – *непровідник, ізолятор*	to repel – *відштовхувати*

Activity II.

Learn the word

Charge *(n)*	***Charge*** *(v)*
1) навантаження, завантаження 2) заряд 3) *тех.* горюча суміш 4) турбота, піклування, догляд; нагляд; 5) підопічний; опікувана особа; 6) відповідальність; керівництво 7) припис; наказ; доручення; вимога 8) ціна, плата (часто за послуги) 9) *pl* витрати 10) наступ, напад, атака	1) завантажувати; 2) заряджати (акумулятор) 3) доручати, довіряти; зобов'язувати 4) наказувати; вимагати; (підлеглому) 5) насичувати 6) призначати (певну ціну)



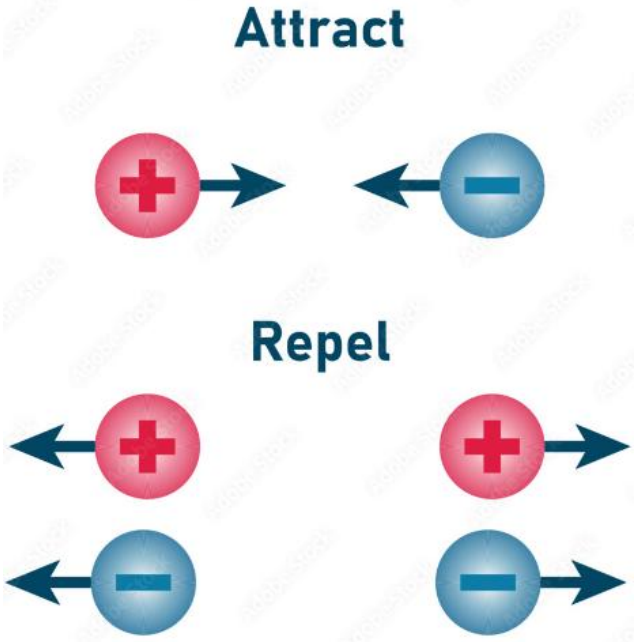
ЗАПАМЯТАЙ!

charge exchange – *перезавантаження*
electric charge – *електричний заряд*
charge carrier – *носій заряду*
fixed-charge rate – *постійна швидкість заряду*
power charge – *споживання електрики*
to build a static charge – *накопичувати статичний заряд*
free of charge – *безкоштовно*

Activity II.

Study the words and phrases. Translate the sentences paying attention to the words and phrases in bold.

1. A force that exists only between **charged** molecules (ions) or surfaces. 2. ***Charge*** *carriers* are particles or holes that freely move within a material and carry an electric charge. 3. He **charged** her with cleaning up all the files over the weekend. 4. Gold is dissipated by sending a powerful **charge** of electricity through it when in the form of leaf or thin wire. 5. The goods will be delivered **free of charge**. 6. The small, **positively**-charged center of an Atom, in which Protons and Neutrons are found. 7. I have fully **charged up** my laptop and phone. 8. Connect **the charger** body to a powered AC outlet. 9. It seems also that the **charge** would increase with the atomic weight of the element.10. When you call 411 on your cellphone, they **charge** you two bucks. 11. In order to do this, we need to introduce new forces with new **charge** directions. 12. My phone **ran out of charge**. 13. How much do you **charge** for a lesson? 14. Two groups of warriors **charged at** each other.



Activity III.

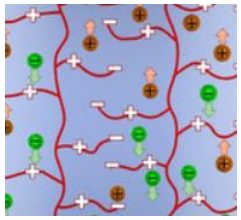
Read and translate the text:

Electricity is not just something you buy in a battery. It is one of the basic ingredients of the Universe. Everything around us is made of invisible atoms. An atom consists of protons, neutrons and electrons. Inside of the nucleus of an atom, you will find the protons and neutrons. On the other hand, electrons orbit the nucleus of an atom, like the planets orbiting the sun. The electrons are negatively charged. The neutrons do not have a charge, and the protons are positively charged. Particles with the same kind of charge repel each other, while opposite charges attract. When charges move, we get current electricity, which drives much of the modern world.

There are two types of electricity: static electricity and electrical currents. Static electricity stays in one place. Electrical current moves and flows, like the current in the wires in a lamp.

We rarely notice the electricity all around us, because positive and negative charges usually balance. However, when objects touch each other, electrons can hop between them. This may leave each object with a static charge. A comb, for example, can strip electrons from hair, making the hair positively charged.

Electrons can move more easily in some objects than in others. If you put a charge on things like glass, plastic, rubber, and wood, that charge stays where you put it. We say the charges are static, and we call this **static electricity**. Static electricity can happen on a dry winter day when you walk across a carpet. You are actually building up loads of electrons on your skin. Charges don't "want" to stay separated, however. There is always a tendency for charges to return to their original locations, and all that is needed is a pathway for charges (electrons) to use. When you touch a metal doorknob, for example, electrons can jump and give you a shock. Static charges build up on clouds until they can hold no more. At that point, lightning can occur. The study of electricity where the charges are not moving is called **electrostatics.**



Activity III.

Read and translate the text:

Static electricity depends on electrons not being able to move around easily, so that charge builds up in one place. But in some materials – mostly metals – electrons can move freely to form an electric current. An electric current is measured by the amount of charge passing a fixed point each second. There are many materials that allow charges to move easily. They are called **conductors.** Conductors have the quality of **conductivity**. Not all substances are good conductors of electricity, as a general rule metals are good conductors of electricity, whereas nonmetals are poor conductors. The poorest of conductors are commonly called insulators or nonconductors. There are a large number of substances that are neither good conductors of electricity nor good insulators. These substances are called semi- conductors.

There are two different types of current in widespread use today. They are direct current, abbreviated DC, and alternating current, abbreviated AC. An electric current which flows in the same direction through a conductor or a current which does not change its polarity is called a direct current or a continuous current. Its abbreviation is D.C. An alternating current flows first in one direction and then in the other. An electric circuit is a path through which an electric current flows. This is a complete path along which electrons can transmit their charges. An electric circuit includes a battery, generator, or magnetic means for producing current flow. Some portion of the circuit is made to do useful work. The circuit is said to be open when no charges can move due to a break in the path. The circuit is said to be closed when no break exists-when switches are closed and all connections are properly made.

Electricity is a crucial aspect of modern living and the economy. Electricity is used for lighting, heating, cooling, and refrigeration, as well as to power appliances, computers, electronics, industrial systems, and public transit systems.

Activity IV.

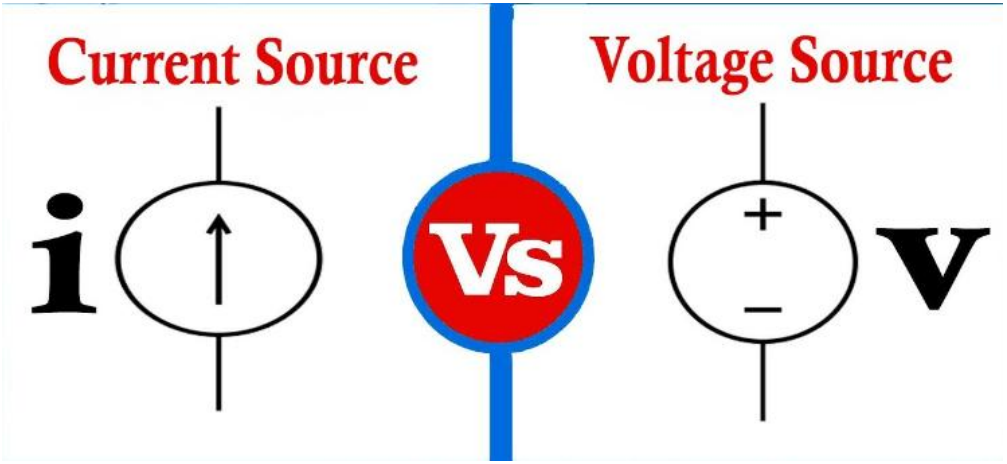
Answer the questions:

1. What are the forces of electrostatic attraction and repulsion between charged objects caused by?
2. What is **static electricity?** How can it be produced?
3. How can charges be transferred from one material to another?
4. What is **conductivity**?
5. Can solids, liquids and gases conduct electric current?
6. How are the poorest of conductors commonly called?
7. What is the difference between an alternating current and a direct current?
8. What is an electric circuit?
9. What is the open circuit?
10. Does an ordinary pencil usually conduct electricity?

Activity V.

Decide whether each of the following statements is 'true' or 'false'

1. The conductor is the object that allows charge to flow.
2. Materials like glass and plastic are called semi-conductors.
3. When an electric charge is at rest it is spoken of as an electric current.
4. That kind of electricity created by batteries is called alternating current.
5. Electrons carry a positive charge while protons carry negative charge.
6. Particles with the same kind of charge repel each other.
7. You can find the protons and neutrons inside of the nucleus of an atom.
8. There are some conductors that are not metals.
9. Electrons can't be removed from atoms.
10. Liquids and gases can't conduct electric current even if there are enough free electrons.



Activity VI.

Insert the words into the following sentences:

1. …. depends on electrons not being able to move around easily, so that charge builds up in one place. 2. The poorest of conductors are commonly called … . 3. An … is measured by the amount of charge passing a fixed point each second. 4. In most currents, the … move more slowly than a snail. 5. …. have free electrons, but not as many as conductors, and they are not as easy to get moving. 6. Current in semiconductors consists of the motion of holes in the … direction and electrons in the … direction. 7. Current is the flow of … through a conducting medium, such as a wire. 8. A material that is a good conductor doesn't give ... to the flow of charge. 9. A good conductor has high … . 10. An … is a path through which an electric current flows.

Activity VII.

Match the definitions with words:

1.	electric circuit	a)	the stable, positively charged nucleon
2.	particle	b)	a stable elementary particle having a negative electric charge
3.	electron	c)	a substance that has an electrical conductivity that increases with temperature and is intermediate between that of a metal and an insulator
4.	semiconductor	d)	the quantity of unbalanced electricity in a body
5.	proton	e)	the movement of electrically charged particles, or ions, through solids, liquids, gases, or free space
6.	charge	f)	an extremely small piece of matter;
7.	wire	g)	a metal conductor that carries electricity over a distance
8.	electric current	h)	a (usually closed) path along which electricity can flow

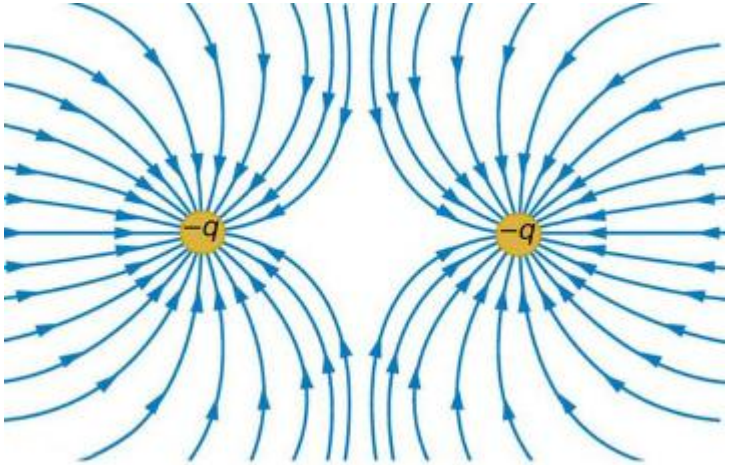
ACTIVITY VIII.

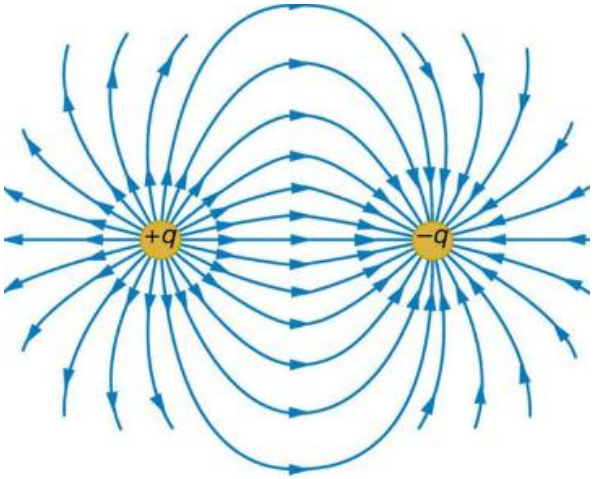
PAY ATTENTION TO THE FOLLOWING FACTS:

1. Electricity travels at the speed of light, which is 186,000 miles per second.
2. When lightning strikes, it flows from the cloud to the ground, but the part we see is the charge going from the ground back up into the cloud.
3. The first and only country that relies only on renewable sources for electricity is Iceland. Iceland is the country that uses the most electricity annually. Their consumption is about 23% more than the U.S.
4. Electricity is present in our bodies – our nerve cells use it to pass signals to our muscles.
5. Together, the power generated by all 86 billion neurons in the brain would be enough to power a low-wattage light bulb.
6. Electric fields work in a similar way to gravity. Whereas gravity always attracts, electric fields can either attract or repulse.
7. 10% of the energy in a light bulb is used to create the light it produces. 90% of the energy creates heat.
8. Thomas Edison invented almost everything we use for electricity in our homes. That includes meters, fuses, sockets and switches.
9. It's not always safe to touch metal objects like train tracks or fences while standing next to electric lines due to the risk of being electrocuted.
10. When you get shocked from touching live wires, electrons jump between atoms inside your finger causing pain.

Activity IX. ***Put questions to the following sentences.***

1. There are two types of particles known as positive charges and negative charges. (Disjunctive)
2. Electrons can be removed from atoms. (General)
3. The magnitude of the force between two charges depends on their size, distance apart, and the substance they are in. (What…?)
4. All substances are made up of atoms, which consist of a nucleus and orbiting electrons. (Disjunctive)
5. The positive and negative charges cancel each other to a large extent. (General)
6. This results from a phenomenon called electrostatic induction. (Alternative)
7. Electrons and positively charged ions move in opposite directions through the material. (Alternative)
8. The forces of electrostatic attraction and repulsion between charged objects are caused by the electric fields associated with them. (What…?)





Activity X.

Find English equivalents

електричне поле _____

притягання різнойменних зарядів_____

відштовхування однойменних зарядів_____

напівпровідник_____

діелектрик _____

ізолятор _____

позитивні і негативні іони_____

дірки і електрони _____

вільні електрони _____

заряджена частинка _____

носій струму _____

електричне коло _____

напруга _____

електроліз в електролітах _____

Activity XI.

Find Ukrainian equivalents:

a current-carrying wire _____
direct current _____
to push the electrons back and forth _____
lectric resistance _____
high voltage _____
to reduce the voltage _____
to carry a charge _____
the amount of the charge _____
to be trapped inside the nucleus _____
to escape the nucleus _____
to repulse each other _____
current intensity _____

Activity XII.

Translate into English

1.Електричним струмом називається впорядкований рух заряджених частинок. 2. Носіями струму в різних середовищах можуть бути різні частинки: в металах - електрони, в напівпровідниках - електрони і дірки, в електролітах - іони. 3. Речовини, що проводять елек-тричний струм, називають провідниками. 4. Носіями струму в металах є вільні електрони. 5. Напівпровідники поділяють на два види залежно від переважаючого типу носіїв електричного заряду, що створюють електричний струм. 6. Електропровідність речовин характеризується наявністю великої кількості вільних зарядів та їх рухливістю. 7. При нагріванні діелектриків з'являється незначна кількість вільних зарядів, тому провідність трохи покращується. 8.Якщо напівпровідник нагріти, то електрони почнуть відриватись від своїх атомів, а на їх місці виникне дірка (фактично позитивний іон), якій приписують позитивний заряд. 9. Атом складається з позитивно зарядженого ядра та електронів, які обертаються навколо ядра на певних відстанях (орбітах). 10. Електричний опір металів зумовлений ударами рухомих вільних електронів об вузли кристалічної гратки металу. 11. Сила струму на однорідній ділянці кола прямо пропорційна прикладеній напрузі та обернено пропорційна опору цієї ділянки. 12. Для проходження електричного струму по провідниках електричне коло має бути обов'язково замкненим. 13. Напівпровідники – це речовини, в яких електропровідність займає проміжне місце між провідниками і діелектриками

WORD STUDY

1W. Choose the correct item.

1. The idea behind biofuels is simple: any carbon relising/released when they burn should be balancing/balanced by the carbon absorbing/absorbed during the growth of the plants that are their raw material, making/made them carbon neutral.
2. Turning/turned food crops into fuel creates financial competition between rich consumers wanting/wanted fuel and poor consumers wanting/wanted food, for both the crops themselves and the land using/used to grow them.
3. Creating/created palm oil plantations destroys land with some of the highest biodiversity in the world and contributes to the loss of habitat of many animals including/included the orangutan, which is threatening/threatened with extinction, as it loses habitat and is also killing/killed as a pest of the young oil palms.
4. Much research has been done and is ongoing to overcome these problems: avoiding/avoided dependency on food crops and increasing/increased the efficiency of fuel production to reduce the amount of land requiring/required.
5. This contributes to their improving/improved efficiency – for example, a 50% reduction in emissions is achieved using/used ethanol producing/produced from grasses growing/grown on the American prairies comparing/compared to 20% from corn.

WORD STUDY

2W. Match the common prefixes with the correct meaning.

1. over	a. too much
2. mis	b. better/more than
3. out	c. badly
4. co	d. extremely
5. re	e. former
6. ultra	f. opposite
7. ex	g. with
8. de	h. too little
9. under	i. again

3W. Underline the odd one out in each group.

1. under	a. Perform /rate /charge / require
2. co	b. Worker /author / student / user
3. re	c. New / place / generate / decide
4. over	d. Consumption / come / increase / supply
5. mis	e. Understand / look/ estimate / adjust
6. out	f. Class / require / do / drive
7. ultra	g. Modern /big/ efficient / high
8. ex	h. President / director / year / boss
9. de	i. Regulate / activate / motivate / process

WORD STUDY

4W. Underline the most appropriate word in each sentence.

1. The hair-drier is fitted with a three point cable/pjug/socket.
2. Don't touch that wire! It's live/lively/living.
3. This small vacuum cleaner is motivate/powered/run by batteries.
4. The set wouldn't work because there was a faulty connection/joint/link.
5. I can't use my drill here. The lead/plug/wire isn't long enough.
6. Turn off the mains first in case you get a/an impact/jolt/shock.
7. Oh dear the lights have gone off! The cable/fuse/safety must have gone.
8. The appliance is powered by a small electric engine/machine/motor.
9. Jim has just started work as an electrical/electricity/electrician engineer.
10. I can't undo this nut. I need a larger bolt/screwdriver/spanner.

5W. Decide how many of the words from the box will go into each sentence.

extensively considerably	broadly widely	largely literally	practically effectively	invariably relatively

1. The music from the four loudspeakers was … deafening.
2. The factory is … now given over to the manufacture of spare parts.
3. It has been … rumored that Mr. Murrell is about to be arrested.
4. The weather … changes for the worse whenever we go on holiday.
5. … speaking, I would agree with Jane Bowling, though not entirely.
6. The decorating is … finished, and we should have everything ready soon.
7. We thought that this year's exam paper was … easy.
8. Her career … ended after her injury, although she did play again.
9. The government will be … encouraged by these latest figures.
10. The theatre was … damaged in the explosion and will have to close.

WORD STUDY

6W. Match each problem (a-j) with a solution (1-10).

1. The door squeaks.	a) It needs servicing.
2. The battery is dead	b) It needs tightening.
3. The pencil is blunt	c) It needs painting.
4. The screw is coming loose	d) It needs oiling.
5. My watch has stopped	e) It needs re-programming.
6. The car seat is too far back	f) It needs recharging.
7. The light bulb is flickering	g) It needs sharpening.
8. The car's got a few things wrong with it	h) It needs winding up.
9. The wall looks very bare	i) It needs replacing.

7W. Match the antonyms.

Verbs		Nouns	
1. increase	a. keep	1. wholesale	a. vendor
2. push	b. sell	2. shrinkage	b. retail
3. buy	c. go up	3. customer	c. likeness
4. drop	d. decrease	4. subscriber	d. growth
		5. distinction	e. publisher

ADDITIONAL READING PASSAGE

Text 1

Atomic energy

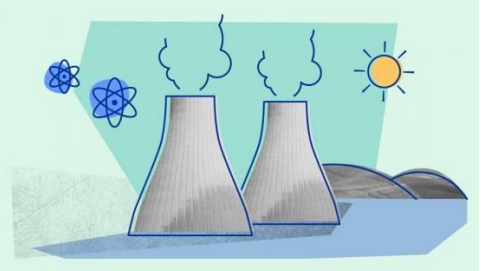
A man trying to see a single atom is like a man trying to see a single drop of water in the sea while he is flying high above it. He will see the sea made up of a great many drops of water but he certainly will not be able to see a single drop. By the way, there are so many atoms in the drop of water that if one could count one atom a second, day and night, it would take one hundred milliard years. But that is certainly impossible.

Man has, however, learned the secret of the atom. He has learned to split atoms in order to get great quantities of energy. At present, coal is one of the most important fuels and our basic source of energy. It is quite possible that some day coal and other fuel may be replaced by atom-ic energy. Atomic energy replacing the present sources of energy, the latter will find various new applications.

The nuclear reactor is one of the most reliable "furnaces" producing atomic energy. Being used to produce energy, the reactor produces it in the form of heat. In other words, atoms splitting in the reactor, heat is developed. Gas, water, melted metals, and some other liquids circulating through the reactor carry that heat away. The heat may be carried to pipes of the steam generator containing water. The resulting steam drives a turbine, the turbine in its turn driving an electric generator. So we see that a nuclear power-station is like any other power-station but the familiar coal-burning furnace is replaced by a nuclear one, that is the reactor supplies energy to the turbines. By the way, a ton of uranium (nuclear fuel) can give us as much energy as 2.5 to 3 million tons of coal.

We might mention here another important achieve-ment, that is, the first nuclear installation where thermal energy generated in the reactor is transformed directly into electrical energy.

The importance of atomic energy will grow still more when fast neutron reactors are used on a large scale. These reactors can produce much more secondary nuclear fuel than the fuel they consume.



UNIT VIII

MAGNETISM

Activity I.

Learn the words and phrases

alloy – *сплав*	susceptibility – *чутливість*
atomic dipoles – *атомний диполь*	to align – *випрямляти*
field lines – *лінії поля, силові лінії*	to overwhelm – *поглинати, охоплювати*
inducing field – *індуктивне поле*	ferromagnetic – *феромагнітний*
magnetic field – *магнітне поле*	paramagnetic – *парамагнітний*
pole – *полюс*	unspecified – *точно не визначений*

Activity II.

Study the words and phrases. Translate the sentences paying attention the words and phrases in bold.

Field (*n*)	***Field*** (*adj*)
1. поле, луг; великий простір 2) майданчик, площадка 3) *геол.* родовище 4) поле бою, битва 5) галузь, сфера діяльності 6) *спец.* поле, область 7) текстове поле	1) фоновий 2) периферійний

галузь, сфера діяльності

спец. поле, область

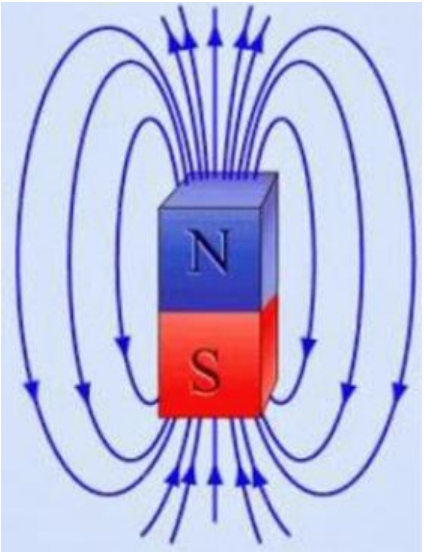
ЗАПАМ'ЯТАЙ!

1) active field – *активне поле*
2) attribute field – *поле атрибута*
3) calculated field – *обчислюване поле*
4) category field – *поле категорії*
5) constrained field – *поле з обмеженням*
6) field magnet – *індуктор*

Activity II.

Study the words and phrases. Translate the sentences paying attention the words and phrases in bold.

1. The office park used to be a ***soccer field***. 2. The farmers were scattering seed on the **fields**. 3. That's not my **field** but I'm not sure if anyone is producing serious study. 4. The pace of advancement in the **field** of robotics and nanotechnology roughly doubles every couple of years. 5. After growing wildly for years, the **field** of computing appears to be reaching its infancy. 6. Your question is shown on the top left. Type your answer in the edit **field**. 7. In the darkness these electric fish hunt by detecting distortions in the electric **field** they create around their bodies. 8. When two objects have different charges a **field** exists between them. 9. It is possible to use a **magnetic field** inside the heating coil to stir fluids with a **magnetic** stirrer. 10. The *results of the* ***field*** and laboratory work confirmed the existence of radiological contamination at two locations only 11. We welcome the increased budget for fighting disease and for medical support in that ***field.***



Activity III.

Read and translate the text:

In studying the electric current, the following relation between magnetism and the electric current can be observed; on the one hand magnetism is produced by the current and on the other hand the current is produced from magnetism.

It has been known for centuries that certain black, heavy stones have the property of attracting iron, this property being called magnetism. A body that exhibits magnetism is called a magnet. The two parts of a magnet that show the strongest magnetism are called the North pole and the South pole.

Magnets not only affect ordinary iron, but they affect one another. When a pole of one magnet is brought toward a pole of the second magnet, they will repel if both are north poles or both are south poles, but they will attract if one is a north pole and the other a south pole. Magnets can do this because they are surrounded by a magnetic field. It is the magnetic field that creates the force (a push or a pull) on other magnets or magnetic materials in the field. The magnetic field gets weaker as you get farther and farther away from a magnet; so magnets can be very strong up close, but they do not have much of an effect on objects that are very far away.

Magnetic fields are invisible; you cannot see them with your eyes. So, how do we know they are there, or what they look like? Scientists represent the invisible magnetic field by drawing magnetic field lines. These are lines that point *from* the north pole *to* the south pole outside of the magnet (*inside* the magnet they point from the south pole to the north pole). The magnetic field is strongest where these lines are bunched closely together, and weakest where they are spaced farther apart.

Magnetic fields are different from electric fields. Although both types of fields are interconnected, they do different things. The idea of magnetic field lines and magnetic fields was first examined by Michael Faraday and later by James Clerk Maxwell**.** Both of these English scientists made great discoveries in the field of electromagnetism**.**

Activity III.

Read and translate the text:

Magnetism is one of the fundamental properties of matter. All substances – even those such as glass, plastics, and wood, for example – exhibit magnetic properties to some extent, although most materials do so to such a minute degree that they are generally regarded as nonmagnetic. Only the metallic elements iron, nickel, and cobalt, and certain of their alloys (such as steel) are strongly magnetic; such substances are described as being ferromagnetic.

In general all materials can be classed as diamagnetic, paramagnetic, or ferromagnetic. Each behaves in a characteristic way when placed inside a current-carrying solenoid (that is, in a uniform magnetic field), depending on the electronic structure of the atoms and the arrangement of the atoms themselves within the material.

In a piece of diamagnetic material (such as bismuth or copper), the electrons in each atom are arranged so that their magnetic effects cancel out each other; hence a diamagnetic substance has no overall magnetic field associated with it. If a bar of the material is placed in an inducing field, however, the electron paths are slightly distorted. As a result, the substance becomes very weakly magnetized, but in the opposite direction to that of the inducing field. Hence the susceptibility (the ratio of the induced to the inducing magnetic field) of diamagnetic materials is very small and negative (typically about -10^{-5}). If a bar of diamagnetic material is freely suspended in a strong uniform magnetic field, it aligns itself across the field.

In a paramagnetic material (such as platinum or aluminum) the magnetic effects of the electrons do not cancel completely and each atom acts like a minute, weak bar magnet. Under normal circumstances, these atomic dipoles are oriented at random and there is no overall magnetic effect. Under the influence of an inducing field, however, the dipoles tend to align with the field. As a result, the magnetic field induced in the substance is in the same direction as that of the inducing field, and a freely-suspended bar of paramagnetic material therefore aligns itself with the inducing field. But the dipole alignment is not complete and so the induced magnetism tends to be weak, although it is still strong enough to overwhelm the diamagnetic effect. The susceptibility of paramagnetic substances is small and positive (in the order of $+10^{-3}$).

Many substances are paramagnetic, but very few exhibit the third and most important form of magnetism – ferromagnetism. Ferromagnetic materials, such as iron and cobalt, display paramagnetic behavior, but much more strongly than most paramagnetic substances because many more atomic dipoles align when in an inducing field. Thus ferromagnetic materials have large, positive susceptibilities (often greater that $+10^{3}$).

Activity IV.

Answer the questions:

1. What is magnetism?
2. What is a magnet? What types of magnets do you know?
3. Do all substances exhibit magnetic properties?
4. What happens when a pole of one magnet is brought toward a pole of the second magnet?
5. What substances are generally regarded as nonmagnetic ones?
6. What types of magnetism can you name?
7. What influences the behavior of a material when placed inside a current-carrying solenoid?
8. What materials are called diamagnetic?
9. What is the most important form of magnetism?
10. How do atomic dipoles in a ferromagnetic material act when in an inducing field?
11. What happens to the compass needle as the compass moves around the wire carrying electrical current?

Activity V.

Decide whether each of the following statements is 'true' or 'false'

1. All magnetic effects are caused by movements of electric charges.
2. It is the electric current that creates the force on other magnets or magnetic materials in the field.
3. Not all substances exhibit magnetic properties.
4. The metallic elements such as iron, cobalt, bismuth are regarded to be ferromagnetic.
5. Solenoid can be described as a uniform magnetic field.
6. The behavior of a definite material placed inside a current-carrying solenoid depends only on the electronic structure of the atoms within the material.
7. A diamagnetic substance has no overall magnetic field associated with it.
8. The ratio of the induced to the inducing magnetic field is called the susceptibility of a material.
9. Only diamagnetic materials possess negative susceptibilities.
10. Only the metallic elements are strongly magnetic.

Activity VI.

Match the definitions with words:

1.	magnet	a)	force by which two bodies are pulled toward each other; opposite poles attract each other.
2.	field line	b)	area around the magnet where magnetic forces represented by lines of force are exerted, resulting in electron movement.
3.	south pole	c)	line separating the north and south lines of the magnet and exhibiting no magnetic phenomena.
4.	neutral line	d)	end of the magnet to which the field lines are directed and around which the exterior magnetic action is intense.
5.	attraction	e)	imaginary line representing the direction of the magnetic forces between the north and south poles.
6.	repulsion	f)	body producing an exterior magnetic field; it attracts iron, nickel and cobalt as well as their alloys.
7.	north pole	g)	end of the magnet from which field lines originate and around which the exterior magnetic action is intense.
8.	magnetic field	h)	force by which two bodies push against each other. Two poles of the same orientation (both positive or both negative) repulse each other.

Activity VII.

Insert the words into the following sentences: *direction, nucleus, orbits, poles, particles, wires, field lines, electrons*

1. The … in each atom are arranged so that their magnetic effects cancel out each other. 2. If you place an object in a magnetic field, it will be affected, and the effect will happen along … . 3. Two … , with current flowing, when placed next to each other, may attract or repel like two magnets. 4. Magnetic fields force moving electrically charged … in a circular or helical path. 5. At the … of a magnet, for example, where the magnetic field is strong, the field lines are crowded together, or denser. 6. Metals, like copper, have electrons that are moved easily and can be readily moved from their … . 7. A magnetic field is also created when electrons rotate around a … and when they spin while in orbit. 8. Atoms such as iron have most of their electrons aligned in the same … .

Activity VIII. ***Put the words in the brackets into English:***

1. At the atomic level, magnetism is the result of (*руху*) by electrons, (*негативно заряджені)* subatomic particles, relative to one another. 2. Every magnet has two (*полюси*): the (*північний*) pole and the (південний) pole. 3. Magnets (*впливають*) one another. 4. The North Pole of one magnet (*відштовхує*) the Norths Pole of another magnet. It is the same with the South pole. 5. The North Pole of one magnet (*притягує*) the South Pole of another magnet. 6. Almost all metals are good (*провідники*) of electricity. 7. Magnetic fields are areas where an object exhibits a magnetic (*вплив*).

Activity IX.

Choose the correct answer:

1. Magnetism has the property of attracting ...

a) glass, paper; b) metals, iron

2. A magnet shows the strongest magnetism at ...

a) the North pole; b) the South pole; c) either pole

3. A magnet ...

a) repels another magnet; b) attracts another magnet.

4. A magnetic field is the region in which ...

a) electric forces act; b) magnetic forces act.

5. Glass, paper, rubber are ...

a) conductors; b) insulators.

6. Copper is ...

a) the worst conductor; b) the best conductor.

7. Two poles that are the same (like north and north) … each other apart.

a) push b) pull

8. Liquid oxygen

a) magnetic b) paramagnetic

9. Does distance strengthen or weaken a magnet's ability to attract a steel object?

a) It weakens it. b) It strengthens it.

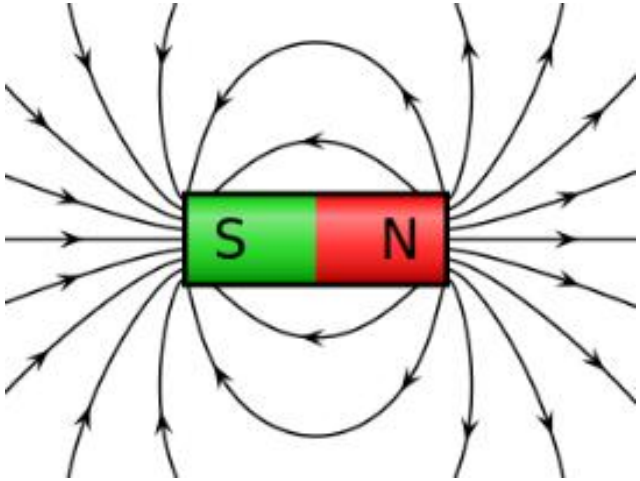
10. There is more than one type of magnetism. Which is the strongest and most persistent type?

a) paramagnetism b) diamagnetism c) ferromagnetism

Activity X.

Fill in the prepositions, if necessary.

All substances exhibit magnetic properties ____ some extent, although most ____ materials do so ____ such a minute degree that they are generally regarded ____ nonmagnetic. 2. Each material behaves ____ a characteristic way when placed inside a current-carrying solenoid, depending ____ the electronic structure ____ the atoms and the arrangement ____ the atoms themselves within the material. 3. In a piece of diamagnetic material such ____ bismuth or copper, the electrons ____ each atom are arranged so that their magnetic effects cancel ____ each ____ other. 4. If a bar ____ the diamagnetic material is placed ____ an inducing field, the electron paths are slightly distorted ____. 5. ____ normal circumstances, these atomic dipoles are oriented ____ random and there is no overall magnetic effect. 7. Under the influence ____ an inducing field the dipoles tend ____ align ____ the field. 8. Ferromagnetic materials display ____ paramagnetic behaviour, but much more strongly ____ most paramagnetic substances.



ACTIVITY XI.

PAY ATTENTION TO THE FOLLOWING FACTS:

1. Scientists measure magnetic fields with an instrument called a magnetometer. The instrument can also be used to measure the magnetism in ancient rocks.
2. The Earth's magnetic field is 1,000 times weaker than a typical bar magnet.
3. Earth, Saturn, Jupiter, Neptune, and Uranus are the only planets in our solar system with magnetic fields.
4. Magnets will always have two poles, magnetic north and magnetic south. Even if you cut them in half, the remaining pieces will still have a north and south.
5. Magnetic poles are always moving. The poles move an at average speed of 27 miles (43 kilometers) per year.
6. Many animals can actually sense magnetic fields. Birds, bees, whales, sharks, and turtles all use the Earth's magnetic field to guide their behaviour.
7. If you tie a bar magnet to a piece of wood and place it in a bowl of water, it will slowly rotate and the north pole of the magnet will point to the north pole of the earth.
8. If you put a bar magnet under a sheet of paper and scatter iron dust lightly over the top, you will suddenly see the invisible magnetic field as the particles stick to it.
9. Heating a magnet or hammering it, will cause it to lose its properties.
10. Magnets are dangerous. If you trap yourself between two magnets, you could cause yourself a serious injury!

Activity XII.

Find Ukrainian equivalents:

1. **fundamental properties** _____
2. **to some extent** _____
3. **the property of attracting** _____
4. **are generally regarded as** _____
5. **a current-carrying solenoid** _____
6. **magnetic field gets weaker** _____
7. **electron paths** _____
8. **to have an effect on objects** _____
9. **to represent the invisible magnetic field** _____
10. **to be bunched closely** _____
11. **under normal circumstances** _____
12. **at random** _____
13. **the strongest magnetism** _____
14. **a freely-suspended bar** _____

Activity XIII.

Find English equivalents:

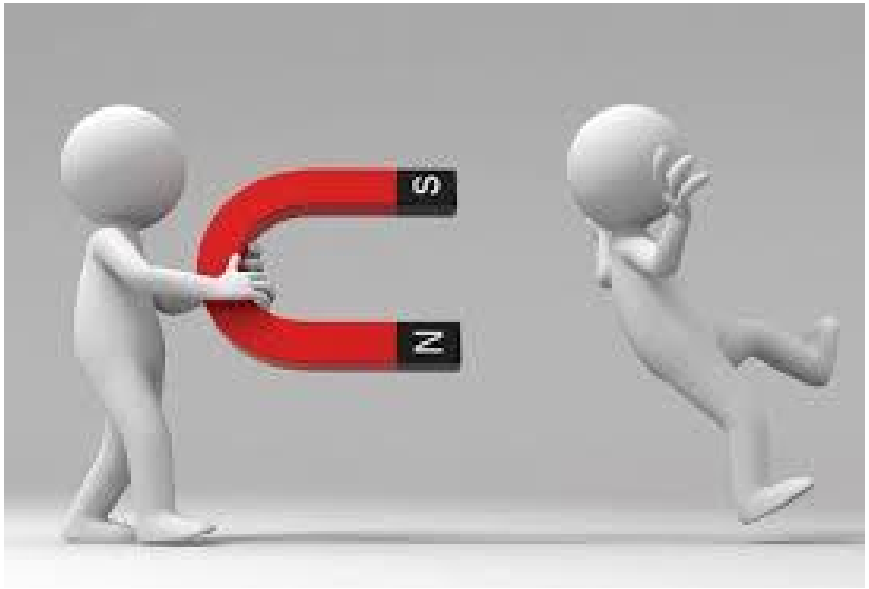
проявляти магнітні властивості _____
більшість матеріалів _____
деякі з сплавів _____
залежати від електронної структури атомів_____
всередені матеріалу _____
розташовані таким чином, що _____
нейтралізують один одного _____
протилежний напрям _____
магнітна сприйнятливість _____
незначний, слабкий магніт _____
під дією індукованого поля _____
такий же напрям _____
дипольна синхронізація _____
проявляти поведінку парамагнетиків_____

Activity XIV.

Translate into english:

Аж до початку XIX століття електричні та магнітні явища були для людей великою таємницею. А магнітам приписували неймовірні властивості. Вважалося, що їх створили злі демони на загибель людям, а користь вони приносять тільки злодіям, бо з їхньою допомогою можна легко відчиняти замкнені двері. Ніхто не сприйняв би серйозно думку про те, що магнетизм пов'язаний з електрикою.

Однак Ампер висунув геніальну ідею: магніт є сукупністю елементарних кругових струмів. Струми взаємодіють між собою. Якщо магніти можуть притягуватись і відштовхуватись, то чи не робитимуть так провідники, по яких тече струм? Таке припущення зробив Ампер, і одразу ж підтвердив це експериментально: узяв два провідники і пропустив через них струм. Коли напрям струму в провідниках був однаковим, вони притягувались, коли різним — відштовхувались. Саме з цього і виходить знаменитий закон Ампера — закон взаємодії струмів, сформульований у 1820 році.



WORD STUDY

1W. Read the following sentences and determine the meaning of "would" in each sentence based on the context. Choose the correct meaning from the list provided.

1) ***Past tense of "will" (future in the past)***
2) ***Conditional mood***
3) ***Polite request or offer***
4) ***Habitual action in the past***
5) ***Indirect speech (reported speech)***

1) ***Expressing desire or preference***
2) ***Assumption or probability***
3) ***Polite suggestion***
4) ***Polite past refusal***

Meaning Options:

1. If the friction on the surface were reduced, the object **would** slide more easily.
2. He said he **would** come to the physics club meeting.
3. I wish I **would** understand these equations better.
4. The professor said she **would** explain the concept again if necessary.
5. When I was in high school, I **would** conduct simple physics experiments in my garage.
6. **Would** you mind passing me the ruler, please?
7. If the angle of the incline were steeper, the object **would** accelerate more quickly.
8. She mentioned that she **would** prefer studying quantum mechanics over classical physics.
9. We knew that the ball **would** fall to the ground due to gravity.
10. The teacher asked if anyone **would** volunteer to demonstrate the experiment.
11. During the presentation, she mentioned that they **would** calculate the velocity using the given data.
12. He explained that the motion of the pendulum **would** follow a predictable pattern due to its length.
13. Last week I was invited to play tennis, but I had my exam the next day, so I had to tell that I **would** have loved to, but I needed to study.

WORD STUDY

2W. Match each numbered sentence on the left with the letter of the corresponding meaning of the modal verb "must" on the right.

1. I can't find my keys anywhere, so they must be in the living room. 2. You must complete your homework before the due date. 3. The weather is getting cloudy; it must rain soon. 4. Students must not use their phones during the exam. 5. If you want to improve your skills, you must practice regularly. 6. He said he must have left his bag at the restaurant. 7. As a citizen, we must participate in the community clean-up. 8. This is a critical situation; we must act quickly. 9. Must I remind you to be respectful to your teachers? 10. The instructions are clear; you must follow them precisely.	A. Obligation or Necessity B. Strong Probability C. Deduction or Inference D. Prohibition E. Advice or Strong Recommendation F. Certainty in the Past G. Duty or Responsibility H. Assumption or Conjecture I. Insistence J. Polite Request

WORD STUDY

3W. Choose the correct linking word from the list to complete each sentence. Use each linking word only once : *in order to, unless, although, besides, due to, despite, whereas, unlike*

1. …magnets can attract or repel other magnets, they do not require physical contact.
2. … its simplicity, the compass remains a crucial tool for navigation.
3. … the strong magnetic field, the metal object remained unaffected.
4. You need to use an electromagnet …generate a magnetic field for the experiment.
5. … the attractive force of magnets, repulsion is equally important in various applications.
6. The soft magnetic materials are easily magnetized and demagnetized, …the hard magnetic materials maintain their magnetization over a long period.
7. …. permanent magnets, electromagnets can be easily controlled by adjusting the current flowing through the coils.
8. … the magnetic field is strong enough, the paperclip won't be attracted to the magnet.

WORD STUDY

4W. Study the different meanings of the word SINCE and translate the following sentences:

Прийменник	Сполучник	Прислівник
з від	з того часу, як після того, як оскільки через те, що раз	тому відтоді після того

1. Many of them have **since** disappeared.
2. The image has remained in my memory **ever since**.
3. It is a paradox that computers need much maintenance, **since** they are meant to save people time.
4. **Since** then, progress has been extremely quick.
5. This model has been used in many countries **since**, but not in the UK.
6. **Since** air passes over the wet sleeve, water is evaporated and cools the wet bulb thermomenter.
7. His work was not excepted **since** there were a lot of mistakes in it.
8. Humans have a special connection to the freshwater biome **since** they can’t live without it.
9. This is the greatest scientific discovery **since** Copernicus.
10. The lawyer advised me to drop the case, **since** there was no chance of winning.

Magnets are things that produce a magnetic field, a force field that either draws or repels certain materials, such as nickel and iron, but what are the magnets and what are the distinct magnet kinds? The three types of magnets are temporary, permanent, and electromagnets. Magnets are categorized by their source of magnetism.

Temporary magnets become magnetized in the presence of a magnetic field. They lose their magnetism gradually, when the magnetic field is removed. Some irons and iron alloys, as well as paper clips and nails, function as temporary magnets.

Permanent magnets do not easily lose their magnetism. These magnets may be naturally-occurring ("rare-earth") elements, or chemical compounds.

Permanent magnet examples include Alnico (an alloy of aluminum, nickel, and cobalt) and ferrites (ceramic-like material made from a mix of iron oxides with nickel, strontium, or cobalt).

Electromagnets are created by running an electrical current through a coil with a metal core. The energized coil creates a magnetic field. When the current is shut off, the magnetic field disappears.

Electromagnets are preferred for applications that require strength including rail road tracks, motor engines, MRI machines, and cranes. They're also used in computer and television hardware.

ADDITIONAL READING PASSAGE

Text 2

Various Applications and Uses of Magnets

- We might be using computers in our day-to-day lives but never wondered about the presence of a magnet inside it. Magnetic elements on a hard disk help to represent computer data, which is later ‘read’ by the computer to extract information.
- Magnets are used inside TVs, sound speakers and radios. The small coil of wire and a magnet inside a speaker transforms the electronic signal to sound vibrations.
- Magnets are used inside a generator to transform mechanical energy into electrical energy. In contrast, other kinds of motors use magnets to change electrical energy to mechanical energy.
- Electrically charged magnets can help cranes to move large metal pieces.
- Magnets are used in filtering machines that separate metallic ores from crushed rocks.
- It is also used in food processing industries for separating small metallic pieces from grains etc.
- Magnets are used in MRI machines which are used to create an image of the bone structure, organs, and tissues. Even magnets are used to cure cancer.
- At home, you use magnets when you stick a paper on the refrigerator in order to remember something. Attaching a magnetic bottle opener to the fridge can come in handy.
- We often use pocket a compass to find out directions when we are on a trek. The pocket compass uses a magnetic needle to point north.
- The dark strip on the back of debit and credit cards is magnetic and is used to store data like computers’ hard drives.
- Magnets can help collect all the nails which are scattered on the ground after a repair job.