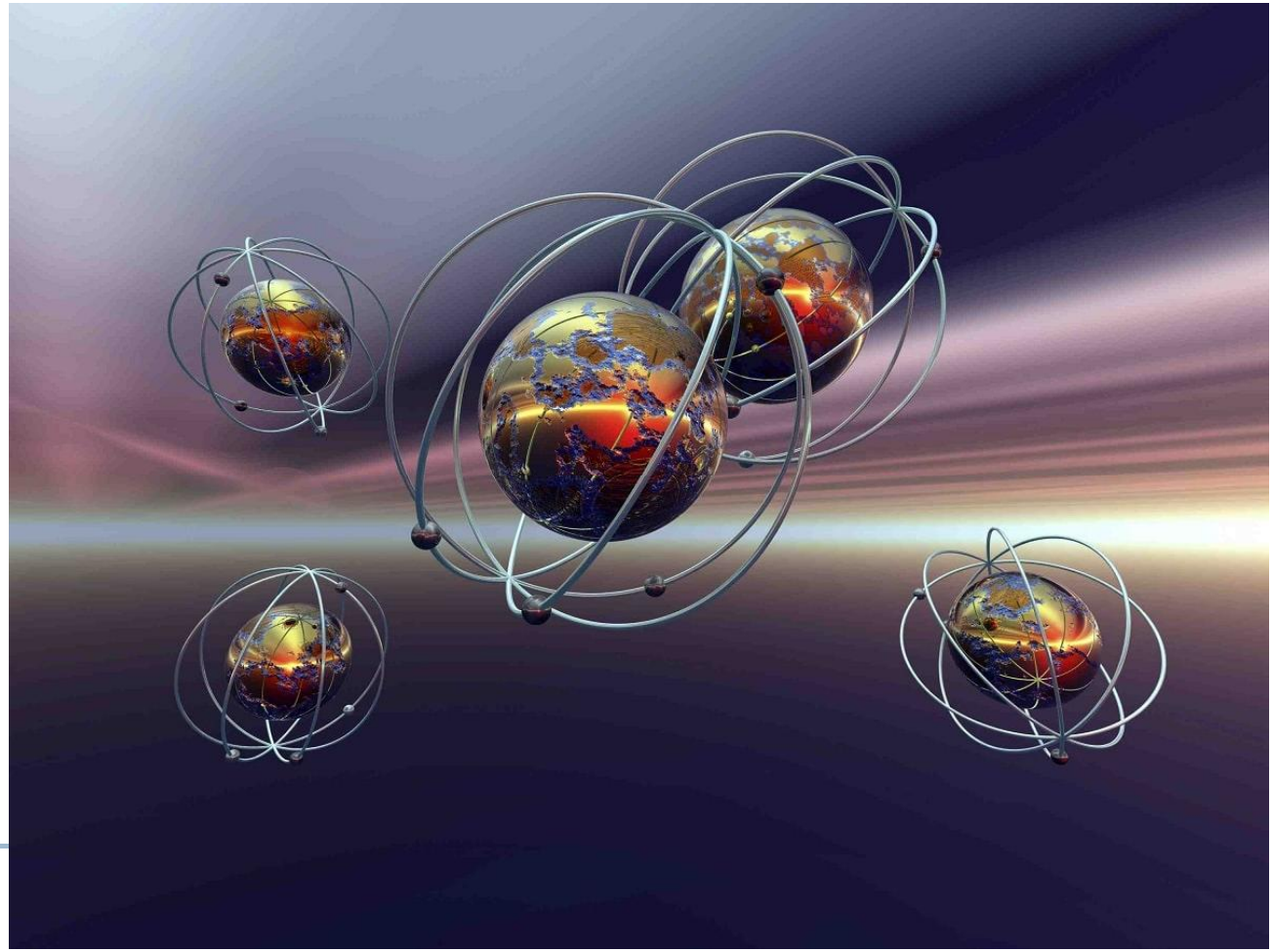
Unit 1

WHAT IS PHYSICS?



Activity I.

Learn the words and phrases

a branch – *галузь, розділ*	particle – *частка, частинка, дрібка*
approach – *підхід*	phenomenon – *явище*
attempt – *спроба*	quality – *якість*
complicated – *складний*	quantity – *кількість*
constituents – *складові*	surface – *поверхня*
dueto – *через, відповідно до*	thermal – *тепловий, термічний*
exceptions – *винятки*	volume – *том, об'єм, ємкість*
expansion – *розширення*	to cover – *охоплювати*
inertia – *інерція*	to design – *розробляти*
infinite – *нескінченний, незліченний*	to discover – *відкривати*
interaction – *взаємодія*	to emerge – *з'являтися*
magnitude – *величина*	to include – *включати*
medium – *середовище*	to supplement – *доповнювати*
observation – *спостереження*	to transverse – *перетинати*

Activity II.

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

Rate *(n)*	***Rate*** *(v)*
1) розмір, показник, індекс 2) темп, швидкість 3) відсоток 4) норма, ступінь 5) тариф, розцінка 6) курс 7) ставка, пропорція 8) місцевий податок *9) тех.*витрати (води)	1) класифікувати, розглядатися 2) цінувати 3) обчислювати, тарифікувати 4) вказувати значення параметрів 5) обкладати місцевим податком ***Rated*** *(adj)* *1)* номінальний *2)віднесений до певного класу*

ЗАПАМ'ЯТАЙ!

heart rate – *пульс*
at any rate – *у будь-якому разі*
flow rate – *розхід палива*
rate of growth – *темп зростання*
interestrate – розмір відсоткової ставки
decayrate –*постійна розпаду*
reductionrate - *швидкість зменшення*
radiationrate – *інтенсивність опромінювання*
samplerate - *частота вибірки*

Activity II.

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

1. Wood burns at a fairly even **rate**.
2. *Velocity* is the *rate* of change in position within given time.
3. Two researchers in the US are making the bold claim that nuclear *decay rates* are not constant, as is widely thought.
4. If supported, this option allows you to set the **rate** at which keycodes are generated while a key is pressed.
5. Gold was **rated** highly among the Romans.
6. Australia's unemployment **rate** rose to 6.5% in February.
7. Mass *Flow Rate* is *defined* as the **rate** of movement of fluid mass through a unit area.
8. **At this rate** we'll have twelve pints in less than two hours.
9. Such comparison gives curious information as to the **rate of growth**.
10. The rise in q and Q indicates that the diminished **rate** of dissipation is most marked for positive charges, and that negative ions are even more reduced than positive
11. **At any rate**, the deaf-blind cannot learn to use signs.

Activity III.

Read and translate the text

What is your first reaction when you hear the word “physics”? Did you imagine working through difficult equations or memorizing formulas that seem to have no real use in life outside the physics classroom? Many people come to the subject of physics with a bit of fear. But as you begin your exploration of this broad-ranging subject, you may soon come to realize that physics plays a much larger role in your life than you first thought, no matter your life goals or career choice.

Physics is the science aimed at describing the fundamental aspects of our universe. This includes what things are in it, what properties of those things are noticeable, and what processes those things or their properties undergo. In simpler terms, physics attempts to describe the basic mechanisms that make our universe behave the way it does.

Physicists try to answer fundamental questions. What is the world made of? How do these parts interact? How do relatively simple laws of nature give rise to complicated behaviors? Physicists hunt for new phenomena, and then puzzle out the explanation behind these effects. Physicists are always asking the question “How does this work?” and then the natural question that follows, “Why does it work that way?”

Physicists design and perform experiments with lasers, particle accelerators, electron microscopes, mass spectrometers, and other equipment.

Activity III.

Read and translate the text

On the basis of their observations and analysis, they attempt to discover and explain laws describing the forces of nature, such as gravity, electromagnetisms, and nuclear interaction. Experiments also help physicists find ways to apply physical laws and theories to problems in nuclear energy, electronics, optics, materials, communications, aerospace technology, and medical instruments.

Physics is the foundation of many important disciplines and contributes directly to others. Chemistry deals with the interactions of atoms and molecules, so it is rooted in atomic and molecular physics. Most branches of engineering are applied physics. In architecture, physics is at the heart of structural stability and is involved in acoustics, heating, lighting, and the cooling of buildings. Parts of geology rely heavily on physics, such as the radioactive dating of rocks, earthquake analysis, and heat transfer in the Earth. Some disciplines, such as biophysics and geophysics, are hybrids of physics and other disciplines.

Physics has many applications in the biological sciences. On the microscopic level, it helps describe the properties of cell walls and cell membranes. On the macroscopic level, it can explain the heat, work, and power associated with the human body. Physics is involved in medical diagnostics, such as X-rays, magnetic resonance imaging (MRI), and ultrasonic blood flow measurements. Medical therapy sometimes directly involves physics: cancer radiotherapy uses ionizing radiation, for instance. Physics can also explain sensory phenomena, such as how musical instruments make sound, how the eye detects color, and how lasers can transmit information.

Activity IV.

Answer the questions

1. What is the subject matter of physics?
2. What is the role of physics in nature?
3. What are the branches of physics?
4. Are there any relations between physics and other sciences? Give some illustrations.
5. What is the physicist's job?
6. What experiments have been done in physics?
7. How can you understand the phrase 'physics is a fundamental science'?
8. What is a laboratory?
9. Name famous physicians and their main discoveries?
10. Which branches of physics require expensive appliances?

Activity V.

Define whether the sentences are true or false

1. Modern physics also deals with the fundamental constituents of the universe.
2. There are relations between physics and other natural sciences.
3. The microscopic approach is more important than the macroscopic one.
4. The macroscopic is unnecessary to the application of physics to much of modern technology.
5. Thermodynamics deals with the measurement of properties of a system as an individual.
6. Statistical mechanics shows the way in which pressure and temperature are related to each other.
7. Before the 19th century, people had had no ideas of what physics was like.
8. Many people studied physics because it was interesting.
9. Today, physics has become the most important science.
10. Nuclear physics was originally for peaceful purposes.

Activity VI.

Define the part of speech these words belong to, translate them:

Scientific, apply, motion, universe, behavior, formulate, utilize, entire, study, guess, collect, chemical, subcategory, specific, acknowledged, interaction, scales, light, phenomenon, property, test.

Activity VII.

Insert the words into the following sentences:

fields of study, natural sciences, physical world, tools, mathematics, scientific laws, observation, scientific method, deals with, a branch of science

1. Physics is ... which studies all acknowledged physical objects and their behavior in the universe. 2. Physics also ... matter on scales ranging from sub-atomic particles to stars and even entire galaxies. 3. As an experimental science, physics utilizes the ... to formulate and test hypotheses that are based on ... of the natural world. 4. The goal of physics is to use the results of experiments to formulate ... , usually expressed in the language of ... , which can then be used to predict other phenomena. 5. The ... that physicists use range from the physical to the abstract, from balance scales to laser beam emitters to mathematics. 6. Understanding this wide range of tools and the methods for applying them is essential to understanding the process that physicists go through in studying the ... . 7. In a broader sense, physics can be seen as the most fundamental of the ... . 8. Because physics covers so much area, it is divided into several specific ... , such as electronics, astronomy, and biophysics.

Activity VIII.

Match the following words with their definitions:

1	Astrophysics	a)	studies light
2	Optics	b)	studies the forces that cause objects and systems to move.
3	Biophysics	c)	the study of the physical characteristics and properties of the earth;
4	Quantum mechanics	d)	deals with the physics of the universe, including the physical properties;
5	Mechanics	e)	Deals with thelifeprocesses;
6	Geophysics	f)	studies the different forms of energy, the conditions under which one can be transformed into the other
7	Thermodynamics	g)	studies the motion of bodies in a frame of reference.
8	Dynamics	h)	studiesthelawsthat govern the behavior of subatomic particles
9	Kinematics	i)	studiesthebehaviorof matter at extremely low temperatures
10	Cryogenics	j)	studies objectsinmotion

Activity IX.

Pay attention to the following facts:

1. Neutrons and protons have almost the same mass.
2. Many scientists believe that birds are able to find their way home by using the Earth's magnetic field to guide them on long distance flights.
3. Hot water freezes quicker than cold water.
4. When a flea jumps, the rate of acceleration is 20 times that of the space shuttle during launch.
5. A TV screen shows 24 pictures a second.
6. The Eiffel Tower is 15 cm taller in summer because of thermal expansion.
7. Due to gravity, the maximum speed a raindrop during a rain with falling speed can hit you is about 18 miles per hour (29 kilometers per hour).
8. If an object floats on water, it displaces the water equal to its mass, but if the objects sinks, it displaces water equal to its volume.
9. The first laser was constructed in 1960 by Theodore Maimane of the Hughes Research Laboratory in California, USA.
10. A calorie is defined as the amount of energy needed to raise one gram of water one degree Celsius (or from 14.5 degrees Celsius to 15.5 degrees Celsius).
11. Sound waves are mechanical longitudinal waves. Light waves are electromagnetic transverse waves.
12. The angle at which light reflects off of water to create a rainbow is 42 degrees.
13. The Air around us is not weightless. Its weight is what creates the phenomenon known as "atmospheric pressure".
14. Sound travels fifteen times more swiftly through steel than through air.

Activity X.

Do physics quiz:

1. What was Albert Einstein's first Nobel prize all about?

a) Gravity b) the photo-electric effect c) general relativity d) the quantum-electric effect

2. Light from the Sun reaches us in nearly

a) 12 minutes b) 8 minutes c) 4 minutes d) 24 minutes

3. The basic principle for generating electric current was thought of by:

a) Gauss b) Rutherford c) Faraday d) Maxwell

4. Pa(Pascal) is the unit for:

a) Thrust b) frequency c) pressure d) conductivity

5. Magnetism at the centre of a bar magnet is

a) Minimum b) maximum c) zero d) minimum

6. Of the following natural phenomena, tell which one known in Sanskrit as 'deer's thirst'?

a) Rainbow b) Earthshine c) Halo d) Mirage

7. Sound travels with a different speed in media. In what order does the velocity of sound increase in these media?

a) Water, iron and air b) Iron, air and water c) Air, water and iron d) Iron, water and air

8. In what year did Albert Einstein win the Nobel Prize for Physics?

a) 1905 b) 1915 c) 1921 d) 1931

9. If you rolled a ball along a hypothetically infinite path, what would stop that ball from rolling forever?

a) Gravity b) Inertia c) Friction d) A wicket keeper

10. Which of the following is not a form of energy?

a) Friction b) Thermal c) Electrical d) Chemical

Activity XI.

Give Ukrainian equivalents:

it can be related to _____

take the form _____

give rise to _____

puzzle out the explanation _____

perform experiments _____

on the basis of _____

draw a conclusion _____

to apply physical theories to _____

collect data _____

it covers the area _____

Activity XII.

Find English equivalents:

галузі науки _____

основні питання _____

прогнозувати нове явище _____

це вимірюється _____

формулювати гіпотези _____

включати елементи _____

взаємодія атомів _____

властивості фізичних явищ _____

закони природи _____

Activity XIII.

Translate into English:

Що вивчає фізика?

Фізика – одна з основних наук про природу. Якщо уважно придивитися до подій у навколишньому світі, то можна помітити, що в ньому відбуваються різноманітні зміни. Зміни, що відбуваються з тілами і речовинами в навколишньому світі, називають явищами. Так, наприклад, шматочок льоду, внесений в теплу кімнату, почне танути. Вода в чайнику, поставленому на вогонь, закипить. Якщо по провіднику пропустити електричний струм, то він нагріється і може навіть розжаритися до червоного кольору (як в електричній лампочці).

Танення льоду, кипіння води, падіння каміння, нагрівання дроту струмом, вітер, грім – все це різні явища.

Фізика володіє незвичайною особливістю. Вивчаючи найпростіші явища, можна вивести загальні закони. Наприклад, вивчаючи вільне падіння кульок, які мають різний розмір, з різної висоти, можна встановити закони, які будуть виконуватися при падінні інших тіл.

Завдання фізики полягає в тому, щоб відкривати і вивчати закони, які пов’язують між собою різні фізичні явища, що відбуваються в природі.

Word-study

1W.

Write out the wordsfrom the text that can be different parts of speech.

Model: work (n) — work (v) (праця — працювати)
fast (adj) — fast (adv) (швидкий — швидко)
separate (adj) — separate (v) (окремий — розділяти)

2W.

Learn the following speech patterns. Make your sentences with the following patterns

A

He did his job as well as we expected.
I don't play chess as well as my friend.
Professor Hunt teaches programming as well as mathematics.

B

It was they/them who told me the news.
It was in May that I saw him last.
It is a good horse that never stumbles.
It is in the memory that the data are stored

3W.

Complete the sentences using the speech patterns:

as well as; whether or not; whether … or not; when; while; such that; it is/was … that/who; of what; on what; that is.

1. I don't know … I like it … because I haven't tried it before. 2. … my question … made him angry. 3. The air traffic service unit should provide the flight crew with any information requested … any additional relevant information. 4. … making a conscious effort to memorize something, many people engage in 'rote rehearsal' repeating it over and over again. 5. A scratch card is a ticket that reveals … the holder is eligible for a prize when the surface is removed by scratching. 6. … congratulating ourselves on what has been accomplished over the last twenty years, we should remember gratefully the services of many people. 7. Computer programming is issuing a sequence of commands to a computer to achieve an objective, … to make a computer perform calculations on numerical data. 8. The architect believed that buildings are most interesting … still unfinished. 9. He was known for his ill temper … everyone disliked him. 10. It depends … you want. 11. … he/him … has done it.

Word-study

4W.

Find the sentences in which the verbs 'to have' and 'to be' are translated as «повинен»:

1. This ordinary adding machine has ten keys for each column of digits. 2. The main task of this article was to show the results of research work. 3. This personal computer has been constructed at our lab. 4. The lecture was to begin at 9 o'clock. 5. Our aim is to study hard and master our speciality. 6. Our lab assistant has to construct this electronic device (прибор). 7. The general purpose of this unit (block) is to perform different arithmetic operations. 8. The participants of the scientific conference are to arrive tomorrow. 9. You have to remember the names of the scientists who have contributed to the development of your speciality. 10. The results of the experiment have carefully been checked up today.

5W.

Form the nouns using the suffixes: -ment, -er/-or, -tion, -ssion, -ness, -ance/-ence from the verbs:

to compute	to operate	to inform	to teach	to perform
to generate	to measure	to determine	to manage	to relax
to apply	to produce	to process	to exist	to execute

Additional reading passage

Science and fields of science

Science (Latin *scientia*, from *scire*, “to know”), is the term which is used, in its broadest meaning to denote systematized knowledge in any field, but applied usually to the organization of objectively verifiable sense experience. The pursuit of knowledge in this context is known as pure science, to distinguish it from applied science, which is the search for practical uses of scientific knowledge, and from technology, through which applications are realized.

Knowledge of nature originally was largely an undifferentiated observation and interrelation of experiences. The Pythagorean scholars distinguished only four sciences: arithmetic, geometry, music, and astronomy. By the time of Aristotle, however, other fields could also be recognized: mechanics, optics, physics, meteorology, zoology, and botany.

Chemistry remained outside the mainstream of science until the time of Robert Boyle in the 17th century, and geology achieved the status of a science only in the 18th century. By that time the study of heat, magnetism, and electricity had become part of physics. During the 19th century scientists finally recognized that pure mathematics differs from the other sciences in that it is a logic of relations and does not depend for its structure on the laws of nature. Its applicability in the elaboration of scientific theories, however, has resulted in its continued classification among the sciences.

Additional reading passage

The pure natural sciences are generally divided into two classes: the physical sciences and the biological, or life, sciences. The principal branches among the former are physics, astronomy, chemistry, and geology; the chief biological sciences are botany and zoology. The physical sciences can be subdivided to identify such fields as mechanics, cosmology, physical chemistry, and meteorology; physiology, embryology, anatomy, genetics, and ecology are subdivisions of the biological sciences.

The applied sciences include such fields as aeronautics, electronics, engineering, and metallurgy, which are applied physical sciences, and agronomy and medicine, which are applied biological sciences. In this case also, overlapping branches must be recognized. The cooperation, for example, between astrophysics (a branch of medical research based on principles of physics) and bioengineering resulted in the development of the heart-lung machine used in open-heart surgery and in the design of artificial organs such as heart chambers and valves, kidneys, blood vessels, and inner-ear bones. Advances such as these are generally the result of research by teams of specialists representing different sciences, both pure and applied. This interrelationship between theory and practice is as important to the growth of science today as it was at the time of Galileo.

Unit 2

MEASUREMENT

Activity I.

Learn the words and phrases

measurement – *вимірювання*	therangeof – *діапазон*
width - *ширина*	scientificnotation – *наукові нотатки*
length – *довжина*	equalto – *дорівнює*
weigh – *вага*	exponentialform – *експоненціальна форма*
volume – *об'єм*	decimalrelationship – *десятковий зв'язок*
magnitude –*величина*	bodydimensions – *розміри тіла*
the base unit – *базовий блок*	luminousintensity – *сила світла*

Activity II.

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

Scale *(n)*	***To scale****(v)*
1. Чаша 2. Масштаб 3. Розмір, розмах 4. Шкала, градуювання 5. Масштабна лінійка 6. Система числення 7. Накип, осад ***Scales****(n)* Ваги, терези	1. Важити, мати вагу 2. Зважувати (ся) 3. Очищати, чистити 4. Покривати шаром 5. Зображувати у певному масштабі 6. Визначати за масштабом 7. Градувати, робити поділки

ЗАПАМ'ЯТАЙ!

У значенні обсяг синоніми ***scale i volume*** розрізняються за додатковою характеристикою поняття, яке вони передають. **Scale** – масштаб, мірило, **volume** – об'єм, обсяг, маса. В інших значеннях ці слова не є синонімічними.

Scaledrawing – креслення у масштабі
Grandscale – великий розмір
Toscaledown – поступово знижувати
Full-scaleoutput – повна сила
Scaleline– лінійний масштаб
Slidingscale – логарифмічна лінійка
Fullscale – натуральний розмір
Equalscales – стан рівноваги чи невизначеності

Decimalscale– шкала в системі десяткового числення

Activity II.

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

1. Primates a rehighupon the evolutionary **scale.**
2. This models hip has been made to **scale**.
3. The mapis drawn **on a scale** of one inch to10 miles.
4. How would your a tey our tennis ability**on a scale** of one to ten?
5. **Scale** to New Size.
6. This way is usefull to **scale**-up an image to an hugesize.
7. For measuring temperature, the Celsius **scale** certainly makes more senseth an the Fahren heit **scale**.
8. This activity will teach you how to make a 1:2 **scaledrawing**.
9. Most lipstick contains fish **scales**.
10. Forvery accurate work it is desirable that the base-plate, the slide and **the scale** should be of nickel steel, having the same coefficient of expansion as gl

Activity III.

Read and translate the text

The whole world revolves around measuring things! Everything is measured: the milk you buy, the gas you fill for the vehicle, the steps you walk. System of measurement is very important as it expresses the different quantities of length, area, volume, and weightinourday-to-day communications. From an cienttimes to the present, there was a need forme asuringthings accurately.

Through out the history different civilizations devised standards of measurement and some tools for measuring. Among the earliest of all known weights is the Babylonianmina, which weighedab out 640 grams. The Egyptian cubit was generally recognized as the standard of linear measurement in the ancient world. It was based on the length of the arm from the elbow to the extended fingertips. A basic Greek unit of length was the finger (19.3 mm); 16 fingers equaled about 30 cm, and 24 fingers equaled 1 Olympic cubit. The Chinese system employed parts of the body as a source of units—for example, the distance from the pulse to the base of the thumb.In England distances were defined with reference to body feature soft the king. A "yard" was the circumference of his waist, an "inch" was the widt hofhisthumb, and a "foot" the length of his foot.

The lack of commonst and ardsled to a lot of confusion and significant in efficiencies between countries. European scientists had formany years discussed the desirability of a new, rational, and uniform system tore place the national and regional variantst hat made scientificand commercial communication difficult equipment.

Activity III.

Read and translate the text

The imperial system of measurement is defined as a system that originated in Britain. It was used from 1824 until the adoption of the metric system in 1965. The system uses some of the commonly used units like an inch, ton, pound, gallon, pint, etc.

The early English settlers brought the Imperial system of measurement with them to the American colonies. After the US gained independence from the British, they decided to keep the imperial system of measurement but with some changes. They made their own system of units of measurements - the Customary system.

One of the most significant results of the Frenchb Revolution was the establishment of the metric system of weights and measures. The metric system's conquest of Europe was facilitated by the military successes of the French Revolution and Napoleon, but it required a long period of time to overcome the inertia of customary systems. Nonetheless, in the competition between the two systems existing side by side, the advantages of metrics proved decisive. In 1840 it was established as the legal monopoly in France. The metric system is much simplier than the English system because they use a decimal-based system in which prefixes are used to denote powers of ten. For example, one kilometer is 1000 meters, and one centimeter is one one-hundredth of a meter. The English system has odd units of conversion. For example, a mile is 5280 feet, and an inch is one twelfth of a foot.

Activity III.

Read and translate the text

In 1960, the metric system was officially named the Système International d'Unités (or SI for short). Today 95% of the world's population live in metric system countries. In the USA there has been considerable debate about replacing the USA system of measurement by the metric system. Currently there is no plan to do so. Consequently, the USA is one of the tree countries that has retained a non-metric system (the others are Liberia and Myanmar). Although the Customary system is still widely used in America, scientists prefer to use the metric system.
The international System of Units (SI) is based upon seven base units for seven base quantities assumed to be mutually independent, as given in Table I:

Table 1: Seven fundamental units in the SI system. All other units can be decomposed to these units:

time	*t*	second	s
length	*l*, *x*, *r*, etc.	metre	m
mass	*m*	kilogram	kg
electric current	*I*, *i*	ampere	A
thermodynamic temperature	*T*	kelvin	K
amount of substance	*n*	mole	mol
luminous intensity	I_v	candela	cd

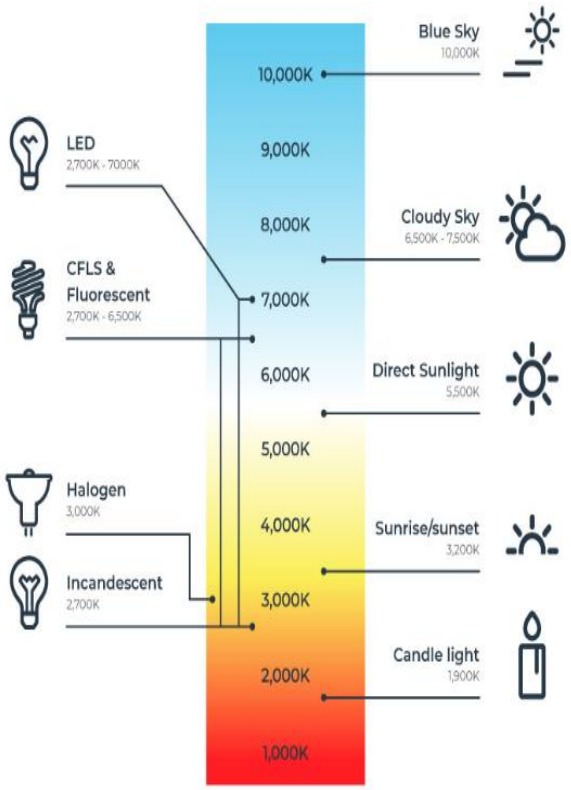
Activity III.

Read and translate the text

Other quantities, called derived, are all written using lowercase letters. Most of the names are just combinations of base units, but there are 22 derived units with special names. The symbol for units named for persons begin with an uppercase letter. For example, the watt, hertz, and coulomb are derived units named for people. Their symbols are W, Hz, and C, respectively. Other examples of derived units include meters per second (m/s), cubic meters (m^3), and joule per kelvin (J/K).

The metric system also includes several units which are neithr base units nor derived units. These exists within the metric system either because they are multiples or fractions of SI units, or they are practical. Some of the permitted non-SI units are: units of time, astronomical unit, hectare, electrovolt , and others.

In today's world, the common usage of both historic and modern measurement systems can cause some confusion, especially when travelling or doing business, or when using resources from the internet that originate in a different region. It can therefore be helpful to have a basic understanding of the two main systems of measurement and know roughly how to convert between them.



Activity III.

Read and translate the text

Scientific notation

Scientific notation is a method of expressing numbers as a product of two factors. The first factor is a number that is greater than or equal to 1 but less than 10. The second factor is 10 raised to a power. The power of 10, or exponent, is positive for numbers greater than 10 and negative for numbers less than 1. Table 2 gives examples showing both the ordinary decimal form and the exponential form for some quantities. Notice how scientific notation eliminates the need to write a long list of zeros in very small and very large numbers.

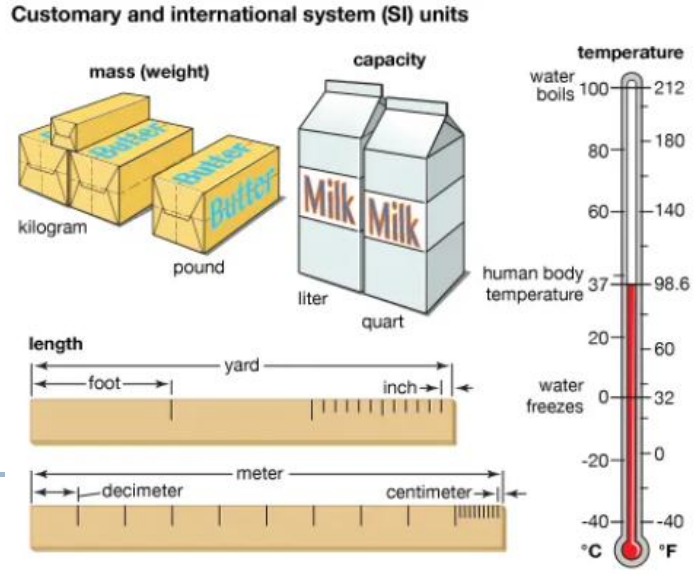
Table 2. Examples of Quantities Expressed in Scientific Notation

Quantity	Ordinary Decimal Form	Scientific Notation
Diameter of a hydrogen atom	0.000	$7.4 \cdot 10^{-11}$ m
Mass of a hydrogen atom	0.000 000 000 000 000 000 000 000	$1.1 \cdot 10^{-25}$ kg
Number of molecules in of hydrogen	600 000 000 000 000 000 000 000	$6.0 \cdot 10^{23}$

Activity IV.

Answer the questions

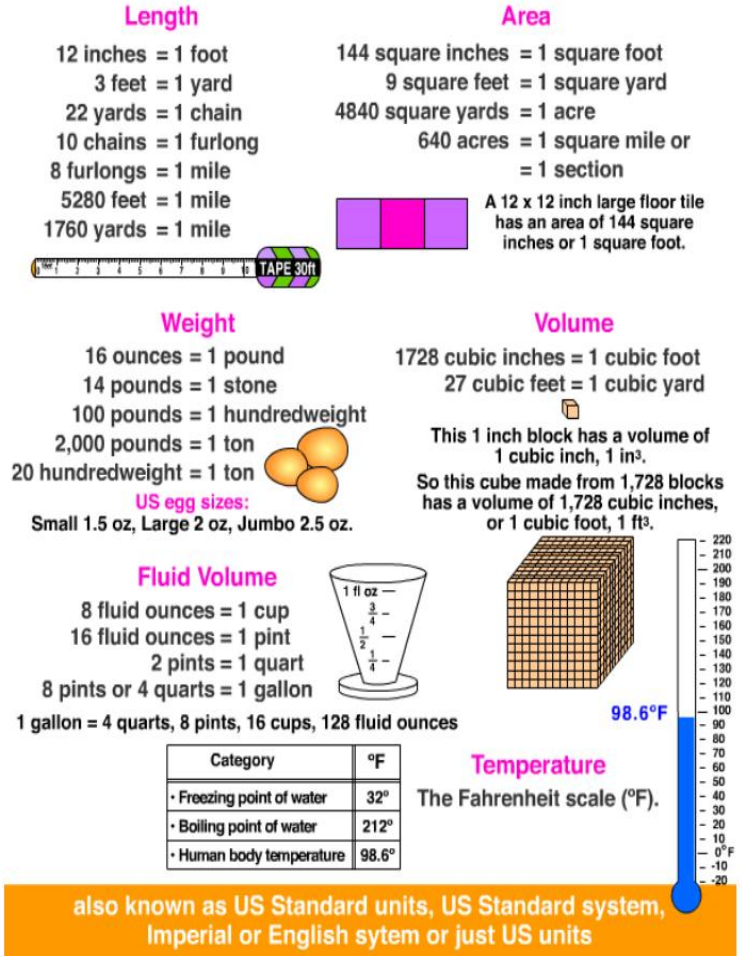
1. What systems of measurement are widely in use all over the world?
2. What is the customary system?
3. How do English units differ from metric?
4. What is the origin of the imperial system?
5. What kind of system do American scientists prefer to use?
6. How is the metric system organized?
7. How does the metric system simplify measurement?
8. What are the derived quantities?
9. How many countries do use Customary system nowadays?



Activity V.

Define whether the sentences are true or false

1. As long as Americans continue to use Imperial System, they will have to remember how these units relate to the metric units.
2. In the metric system, temperature is measured in degrees Fahrenheit.
3. The word "Customary" is short for US customary units which are units of measure that have traditionally been used in the United States.
4. The metric system is now the mandatory system of measurement in every country of the world except the United States.
5. In the metric system, there is only one basic unit for each type of quantity.
6. The units of measurement in the international System of Units are based upon ten base units.
7. The kilogram is the metric unit of weight.
8. Nearly all early units of size were based on the always-handy human body.
9. A meter is a little less than a yard.
10. A liter of water weighs about a kilogram.



Activity VI.

Insert the words into the following sentences:

imperial units, SI system, physical quantity, volume, powers of ten, inches, scientific notation, meter, metrication, conversion, measure.

1. Physics is ... which studies all acknowledged physical objects and their behavior in the universe.
2. Physics also ... matter on scales ranging from sub-atomic particles to stars and even entire galaxies.
3. As an experimental science, physics utilizes the ... to formulate and test hypotheses that are based on ... of the natural world.
4. The goal of physics is to use the results of experiments to formulate ... , usually expressed in the language of ... , which can then be used to predict other phenomena.
5. The ... that physicists use range from the physical to the abstract, from balance scales to laser beam emitters to mathematics.
6. Understanding this wide range of tools and the methods for applying them is essential to understanding the process that physicists go through in studying the ... .
7. In a broader sense, physics can be seen as the most fundamental of the ... .
8. Because physics covers so much area, it is divided into several specific ... , such as electronics, astronomy, and biophysics.

Activity VII.

Express each number in scientific notation:

1) 0,0000000026 =
2) 651, 400 =
3) 0,00000154 =
4) 0,00000087 =
5) 0,000000000044391 =
6) 0,0000612 =
7) 4, 005, 000 =
8) 0,000000000000206 =
9) 5, 284 400 000 =
10) 200 000 000 =

Activity VIII.

Match the following words with their definitions:

1	Imperial System	a)	a method of writing or displaying numbers in terms of a decimal number between 1 and 10 multiplied by a power of 10.
2	scientific notation	b)	a system of weights and measures based on the meter and on the kilogram
3	volume	c)	strength of light emitted from a light source
4	metric system	d)	instrument that shows the extent or amount or quantity or degree of something
5	length	e)	a number characteristic of a quantity and forming a basis for comparison with similar quantities, as length.
6	luminosity	f)	a system of weights and measures originally developed in.
7	measuring system	g)	the linear extent or measurement of something from end to end
8	magnitude	h)	the amount of space occupied by a three-dimensional object or region of space, expressed in cubic units.
9	mass	i)	the amount of matter in an object.

Activity IX.

Choose the correct answer:

1. Which one of the following do you think will hold approximately 100 milliliters?
   a) a small cup b) a teaspoon c)a jug
2. What is the purpose of scientific notation?
   a) to represent very large or very small numbers
   b) to measure things c)to solve equations d) to convert
3. Which one of the following do you think measures about 0.3 km?
   a) the perimeter of a football field
   b) the distance run in a marathon race
   c) the length of the tennis court
4. What tool is used to find mass?
   a) scale b) meter stick c)graduated cylinder d) balance
5. Which of the following unit is used to measure nuclear diameter?
   a) picometer b) fermi c)micron d) millimeter
6. Dyne is a unit of?
   a) force b) work c)current d)luminous intensity
7. 1kW/h is a unit of
   a) time b) power c)energy d) force
8. A marathon is 26,2 miles long. How many kilometers is a marathon?
   a) 2,195 km b) 43, 095 km c)40 km

Activity X.

Pay attention to the following facts:

1. Many trade and administrative activities in United Kingdom are measured using metric system. But the public is still allowed to use the imperial units for certain purposes. It can be seen in the road signs of the country.
2. In 1866, after most of the South American countries started to use the metric system, the United States passed a law that allowed people to use either the metric system or US customary units for trade.
3. The definition of the meter (m), which is the international unit of length, was once defined by a physical artifact - two marks inscribes on a bar of platinum-iridium. Today, the meter (m) is defined in terms of constant of nature: the length of the path traveled by the light in vacuum during a time interval of 1/299 792, 458 of a second.
4. A pint in the United Kingdom is bigger than a pint in the United States. The UK pint is 20 fluid ounces, while the US pint fills up 16 fl oz.
5. In Ireland, before the 19th century, a "cow's grass" was a measurement used by farmers to indicate the size of their fields. A cow's grass was equal to the amount of land that could produce enough grass to support a cow.
6. The approximate volume of a double-decker bus, abbreviated to DDB, has been used informally to describe the size of hole created by a major sewer collapse. For example, a report might refer to "a 4 DDB hole".
7. In nuclear engineering and astrophysics contexts, the shake is sometimes used as a conveniently short period of time. 1 shake is defined as 10 nanoseconds.
8. The sidereal day is based on the Earth's rotation rate relative to fixed stars, rather than the Sun. A sidereal day is approximately 23 hours, 56 minutes, 4.0905 SI seconds.
9. In 1983 a Boeing 767 jet ran out of fuel in mid-flight because of two mistakes in figuring the fuel supply of Air Canada's first aircraft to use metric measurements.
10. In 1999 NASA lost a $125 million Mars orbiter because one engineering team used metric units while another used US customary units for a calculation.

Activity XI.

Find English equivalents:

десяткова система _____

метрична система мір _____

фізична величина _____

одиницю довжини _____

дюйм _____

експоненціальний запис числа _____

за межами діапазону _____

лінійна протяжність _____

Activity XII.

Give Ukrainian equivalents:

metricated countries _____

to standardize the metric system _____

decimal relationships units _____

of the same quantity _____

beyond the range _____

scientific notation _____

exponential form _____

to replace the system of measurement _____

the linear extent or measurement _____

the amount of matter _____

Activity XIII.

Translate into English:

Що вивчає фізика?

1. 5 жовтня 1793 року Франція ввела десяткову систему вимірювання часу - доба була поділена на 10 годин, що складались зі 100 хвилин по 100 секунд кожна; "революційний" тиждень складався з 10 днів. 2. Французька метрична система мір запроваджувала 5 одиниць - метр для вимірювання довжини, гектар (100 квадратних метра) для вимірювання площі, стер (кубічний метр) - для вимірювання об'єму твердих тіл, літр (0,001 $м^3$) - для вимірювання об'єму рідин і грам для вимірювання маси тіл. 3. Метрична система виникла у Франції в 1799 році після Французької революції, хоча десяткові одиниці використовувалися в багатьох інших країнах і культурах раніше. 4. Простота утворення одиниць метричної системи робила її зручною для використання в різних країнах. 5. Спочатку метр був визначений як 1/40000000 частина Паризького меридіана, а кілограм – як маса 1 кубічного дециметра води при t= 4C, тобто одиниці були засновані на природних еталонах. 6. Універсальність СІ забезпечується тим, що сім основних одиниць, покладених в її основу, є одиницями фізичних величин, які відображають основні властивості матеріального світу.

Word-study

1W. *Translate the words of the same root. Define parts of speech:*

to inform – information – informative – informed;
to purpose – purpose – purposeful – purposely;
to complete – completion;
to produce – product – production;
to require – requirement – required;
to perform – performance – performer;
to create – creation – creative – creator;
to store – storage – stored;
to develop – development – developed;
logic – logical – logician;
to provide – provider – provision – provided;
to add – addition – additional - additionally.

2W. Fix your attention to negative prefixes. Translate the words.

understand - misunderstand
read - misread
reparable - irreparable
place - misplace
shelve - misshelve
responsible - irresponsible
regular - irregular

Word-study

3W. Find synonyms:

a) set up
b) hold
c) step
d) feed
e) execute
f) via
g) currently
h) attach
i) provide
j) main
1) connect
2) input
3) chief
4) contain
5) by means of
6) give
7) now
8) install
9) perform
10) operation

4W. Choose the right word.

origin — original (adj.) — original (n.) — originally — originate

1. The vapour occupies the space ... filled with liquid. 2. There are words whose ... is not conclusively established yet. 3. My father speaks English very well. He can fluently read Shakespeare in the ... . 4. Coal may ... from isolated fragments of vegetation. 5. The ... structure of the crystal lattice changed as the result of the chemical reaction.

Translate

Translate into English choosing the right word.

1. Слово «комп'ютер» латинського походження. 2. Телевізори спочатку були чорно-білі. 3. Треба бути неабияким знавцем живопису, щоб відрізнити цю копію від оригіналу. 4. Сварка виникла через непорозуміння. 5. Цей матеріал набуває початкової форми, коли тиск на нього припиняється.

solve — decide solution — decision

1. We know enough to ... a question like this. 2. Last night they came to a ... that suited everybody. 3. Without this information we could not ... what to do next. 4. This problem seems not to have a ... . 5. At the age of 50 she left her country forever, although she came to this ... with difficulty.

Translate into English choosing the right word.

1. Він продав будинок, хоча це було нелегке рішення. 2. Цю задачу можна розв'язати за допомогою комп'ютера. 3. Розв'язання цієї задачі, запропоноване маловідомим англійським вченим, було доволі оригінальним. 4. Прислухатися до моєї поради, чи ні — це вам вирішувати. 5. Продати будинок? Це не вирішення проблеми.

Additional reading passage

Measuring Temperature

There are three scales commonly used for measuring temperature: Fahrenheit, Celsius or Centigrade, and Kelvin.

Fahrenheit is the oldest scale and least obvious for those not familiar with it. The Fahrenheit scale was formerly used across Europe but has now been replaced by the Centigrade scale. It is, however, still widely used in the USA. This scale was originally defined by 18th Century German physicist Fahrenheit as 180 equal intervals between the temperature at which water freezes and the temperature at which it boils. The exact measurement of these temperatures has undergone some refinement since then; freezing point is now 32°F and boiling point is 212°F. This is why it is not the most intuitive temperature scale.

Celsius / Centigrade is used across most of the rest of the world apart from the USA and its associated territories. It was developed to provide a simpler and more scientifically exact scale than the original Fahrenheit system. The freezing temperature of water is 0°C, and the boiling point is 100°C. 'Centigrade' broadly translates as '100 steps' in Latin. The Celsius scale was named after the Swedish Astronomer Anders Celsius, who created a virtually identical scale with 100 intervals between the two reference temperatures. 'Celsius' is the more commonly-used unit, but is interchangeable with Centigrade.

The weather is the most common reason for needing to understand the alternative scale. Anything below 10°C or 50°F is cool to cold, 20°C or 68°F is warm, and anything above 30°C, 86°F, is hot.

Kelvin is the scientific measurement scale, and the SI unit for temperature. It has exactly the same increments as the Celsius / Centigrade scale. The zero point, or 0K, is -273°C, which is absolute zero. Nothing can be colder than absolute zero, because this is the temperature at which all thermal motion of particles ceases and no thermal energy is left in a substance. Conversion to Celsius is therefore very easy: you simply add 273 to the Kelvin temperature.