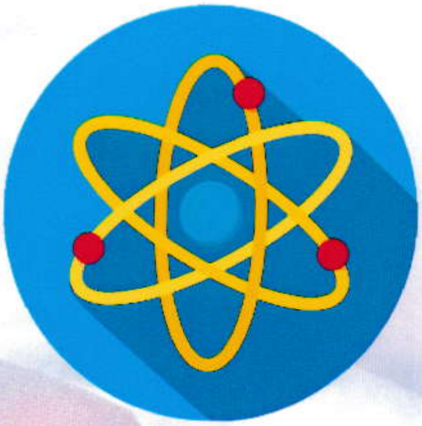
F.O.Orazova

English for PHYSICS students



O'ZBEKISTON RESPUBLIKASI
OLIY TA'LIM, FAN VA INNOVATSIYALARI VAZIRLIGI
CHIRCHIQ DAVLAT PEDAGOGIKAUNIVERSITETI

F.O.Orazova

English For PHYSICS students

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Mazkur uslubiy qo'llanma oliy o'quv yurtlarining mutaxassisligi chet tili bo'lmagan fakultetlarining fizika bo'limi talabalariga fizika fanini ingliz tilida mustaqil o'qib o'rganishlari uchun mo'ljallangan.

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Content / Mundarija

KIRISH

O'zbekistonda bevosita o'ziga xos, o'ziga mos bo'lgan, takrorlanmas tariximiz, an'analarimizga asoslangan va shu bilan birga hozirgi davr talablariga javob bera oladigan kadrlar tayyorlash modeli yaratildi.

Milliy dasturimizning bunday hususiyatlaridan biri xorijiy tillarni puxta egallaydigan O'zberistonning xalqaro andazalariga taraqqiyotni taminlay oladigan,dadil,o'z mustaqil fikriga ega, malakali, bilimdon va ma'nan boy mutahasis kadrlarni tayyorlashdan iboratdir. Butun jahon hamjamiyatidan munosib o'rin egallashga intilayotgan, o'z buyuk kelajagini qurishga intilayotgan xalqimiz uchun xorijiy tillarni mukammal bilishning ahamiyati juda kattadir.

Ushbu uslubiy qo'llanma nofilalogik yo'nalishdagi oliy ta'lim muasasalarining fizika yo'nalishi talabalari uchun mo'ljallangan.Qo'llanmada fizika faniga oid matnlar va shu matnlarga oid savollar va mashqlar ingliz tilida berilgan. Bu vaziva va topshiriqlar talabalirining o'z yo'nalishilari bo'yicha og'zaki nutq,yozma tarjima va ingliz tilida gapira olish mahoratlarini oshirish maqsadida auditoriya va mustaqil o'rganish uchun mo'ljallangan. Matnlarga oid berilgan vazifalar talabalarni o'rganilgan matn bo'yicha ijodiy fikrlash qobiliyatini oshiradi va ularni o'z fikrlarini erkin ifodalashga o'rgatadi, tarjima qilish mahoratini, o'qish texnikasini oshiradi. Ularning nafaqat bilimini mustahkamlaydi balki o'z fanlariga oid dunyoviy bilimlarni egallashga yordam beradi.

Lesson 1. What is Physics?
Physics and scopes of Physics

Physics is the major science dealing with the fundamental constituents of the universe, the forces they exert on one another, and the results produced by these forces. Sometimes in modern physics a more sophisticated approach is taken that incorporates elements of the three areas listed above; it relates to the laws of symmetry and conservation, such as those pertaining to energy, momentum, charge, and parity.

Physics is closely related to the other natural sciences and, in a sense, encompasses them. Chemistry, for example, deals with the interaction of atoms to form molecules; much of modern geology is largely a study of the physics of the earth and is known as geophysics; and astronomy deals with the physics of the stars and outer space. Even living systems are made up of fundamental particles and, as studied in biophysics and biochemistry, they follow the same types of laws as the simpler particles traditionally studied by a physicist.

The emphasis on the interaction between particles in modern physics, known as the microscopic approach, must often be supplemented by a macroscopic approach that deals with larger elements or systems of particles. This macroscopic approach is indispensable to the application of physics to much of modern technology. Thermodynamics, for example, a branch of physics developed during the 19th century, deals with the elucidation and measurement of properties of a system as a whole and remains useful in other fields of physics; it also forms the basis of much of chemical and mechanical engineering. Such properties as the temperature, pressure, and volume of a gas have no meaning for an individual atom or molecule; these thermodynamic concepts can only be applied directly to a very large system of such particles. A bridge exists, however, between the microscopic and macroscopic approach; another branch of physics, known as statistical mechanics, indicates how pressure and temperature can be related to the motion of atoms and molecules on a statistical basis.

Physics emerged as a separate science only in the early 19th century; until that time a physicist was often also a mathematician, philosopher, chemist, biologist, engineer, or even primarily a political leader or artist. Today the field has grown to such an extent that with few exceptions modern physicists have to limit their attention to one or two branches of the science. Once the fundamental aspects of a new field are discovered and understood, they become the domain of engineers and other applied scientists. The 19th-century discoveries in electricity and magnetism, for example, are now the province of electrical and communication engineers; the properties of matter discovered at the beginning of the 20th century have been applied in electronics; and the discoveries of nuclear physics, most of them not yet 40 years old, have passed into the hands of nuclear engineers for applications to peaceful or military uses.

COMPREHENSION QUESTION

Exercise 1: *Answer the following questions by referring to the reading passage.*

1. What does physics study in general?

....

....

2. What is an approach in modern physics related to?

....

....

3. Are there any relations between physics and other sciences? Give some illustrations.

....

....

4. What does statistical physics how?

....

....

5. When was physics seen as a separate science?

....

....

Exercise 2: *Complete each of the following statements with words/ phrases from the reading passage*

1. Physics .... the fundamental constituents of the universe

2. ... a more sophisticated approach ....elements of the three areas...

3. It relates to the laws of ....and conservation

4. Physics is closely related to the other natural................

5. Chemistry deals with the..............................of atoms to form molecules

6. Even living systems are made up of.........................particles.

7. The emphasis on the interaction between particles in modern physics, known as the .... approach

8. This macroscopic approach is........................ to the application of physics

9. These thermodynamic concepts can only be applied ....to a very large system of such particles

10. A bridge exists, ...,between the microscopic and macroscopic approach

Exercise 3*: Decide whether each of the following statements is true (T), false (F) or with no information to clarify (N).*

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 theme sure of property so 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 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.

GRAMMAR IN USE

I) Participle phrases replacing relative clauses

1. Participles of verbs

In English, each verb has two participles: $\begin{cases} participleI\ (PI) = verb\_ing \\ ParticipleII(PII) = verb\_ed \end{cases}$

In which the former is considered the active participle and the second is known as passive particle.

A participle phrase is the one with the center element being a participle.

Example:

1. **working** with me
2. **studying** Physics last year
3. **written** by a famous scientist
4. **clarified** by the International Bureau of Weights and Measures
5. *having been* carefully **conducted** in the laboratory
6. *being* **considered** by the Government

II) Participles replacing relative clauses

From the above mentioned, it is deduced that each type of participle, therefore, will replace a corresponding relative clause with the same grammatical implication (whether passive or active), basing on the form of the verb phrase in the relative clause.

Consider the following examples

1. Science (pure science) is a term which is used to denote systemized knowledge in any field.

2. Applied science is the term that is used to refer to the search for practical uses of scientific knowledge.

3. Neil Armstrong was the first person who walked on the Moon.

4. Here, we should distinguish pure science from technology through which applications are realized.

5. Newton whom many of us, scientists have respected used not to be a good student at all.

6. Newton, whose discovery of the theory of gravity was very strange, has been the pioneer in Mechanics Physics.

It is clearly seen that half of the above examples of relative clauses are active (3, 5, 6) and the other half are passive (1, 2, 4).

However, not all relative clauses but the ones with relative pronoun in subject position can be replaced with participle phrases. This is applicable to both types of relative clauses. Hence, among the above relative clauses, only the first three can be replaced.

We have:

1. Science (pure science) is a term used to denote systemized knowledge in any field.

2. Applied science is the term used to refer to the search for practical uses of scientific knowledge.

3. Neil Armstrong was the first person walking on the

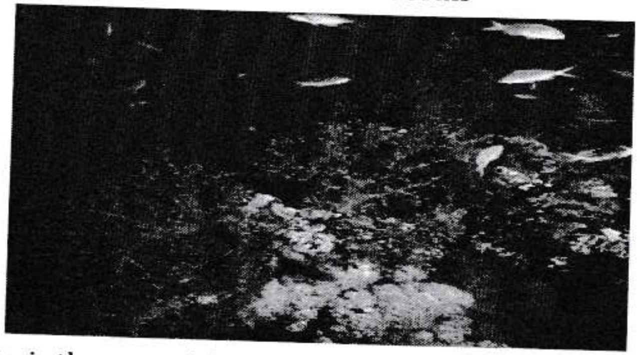
Moon.*

These sentences will be interpreted basing on the context in which it appears:

As in the first two participle phrases, they are used to make definitions so the verbs in the corresponding relative clauses must be in present tense while, in the last one, the tense of verb in the corresponding relative clause must be the simple past tense (it is the action of the past). **Note**

- The third case of relative clause can be replaced with a to- infinitive
- Relative clauses with intransitive verbs can not be replaced with –ed, phrase.

Lesson 2 Blue ocean



Why is the ocean blue?

There are some theories:

- Blue wavelengths are absorbed the least by the deep ocean water and are scattered and reflected back to the observer's eye.
- Particles in the water may help to reflect blue light.
- The ocean reflects the blue sky.

Most of the time the ocean appears to be blue because this is the color our eyes see. But the ocean can be many other colors depending upon particles in the water, the depth of the water, and the amount of skylight.

The colors we see depend upon the reflection of the visible wavelengths of light to our eyes. Wavelengths of light pass through matter differently depending on the material's composition. Blue wavelengths are transmitted to greater depths of the ocean, while red wavelengths are absorbed quickly. Water molecules scatter blue wavelengths by absorbing the light waves, and then rapidly reemitting the light waves in different directions. That is why there are mostly blue wavelengths that are reflected back to our eyes.

Sometimes oceans look green. This may be because there is an abundance of plant life or sediment from rivers that flow into the ocean. The blue light is absorbed more and the yellow pigments from plants mix with the blue light waves to produce the color green.

Sometimes parts of the oceans will look milky brown after a storm passes. This is because winds and currents associated with the storm churn up sand and sediment from the rivers that lead into the oceans.

The ocean may also reflect the blue sky. However, this is prominent only at relatively low angles and when the water is smooth.

1. Read a story about early studies of the nature of color. Read for the first time and say who contributed to the study of colors.

2. Read the text for the second time and answer the following questions:

a) How many colors did Aristotle identify?

b) What elements did he correspond them to?

c) Who was the first to suggest hierarchy of colors?

d) What color did philosophers view as the absence of color according to Leonardo da Vinci?

e) When did the detailed understanding of color begin?

f) Who was the first to use the word spectrum for the array of colors produced by a glass prism?

g) How many colors did Newton assign to the spectrum?

Early studies of the nature of color

In Ancient Greece, Aristotle developed the first known theory of color. He postulated that God sent down color from the heavens as celestial rays. He identified four colors corresponding to the four elements: earth, fire, wind, and water.

Leonardo da Vinci was the first to suggest an alternative hierarchy of color. In his *Treatise on Painting*, he said that while philosophers viewed white as the "cause, or the receiver" of colors and black as the absence of color, both were essential to the painter, with white representing light, and black, darkness. He listed his six colors in the following order: white, yellow

(earth), green (water), blue (air), red (fire), and black.

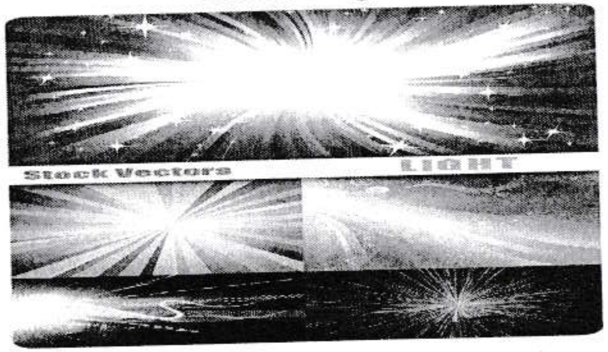
The detailed understanding of the science of color began in 1666, when Isaac Newton using two prisms observed that white light was composed of all the colors of the rainbow, and could be identified and ordered. Newton first used the word "spectrum "for the array of colors produced by a glass prism. He recognized that the colors comprising white light are "refracted" (bent) by different amounts and heal so understood that there is no "colored" light, the color being in the eye of the beholder. Instead, there is merely a range of energies-or the proportional frequencies and the inverse wave lengths. Newton as signed seven colors to the spectrum in an analogy to the musical scale.

<u>WRITING</u>

Write a paragraph about the role of physics in the development of other sciences, industries, and modern technologies. Use the following phrases to present your opinion:

In my opinion...; I strongly believe that...; Personally, I think that...; As far as I'm concerned...; To my mind...; It seems to me that...

Lesson 3 Light



The sun, the moon and the stars would have disappeared long ago...had they happened to be within the reach of predatory human hands.

Henry Havelock Ellis

(British psychologist)

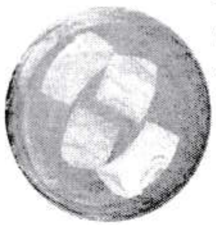
What does the author mean?

Do you agree with him? Why (not)?

Do you think human influence on nature is positive or negative? Why?

1. Now read the text. How many right answers did you have ?

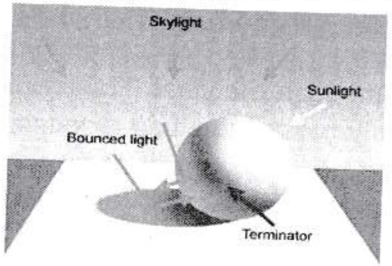
LIGHT.



Light **makes** the world **seem** bright and colorful to our eyes. Radiation that **carries** energy from a **source** (something that makes light)at the very high **speed** of 300,000kps(186,000 miles per second, or 670 million mph).Light **rays** travel from their source **in straight lines**. Although they can **pass through** some objects, they bounce off others or pass around them to make **<u>SHADOWS</u>**.

When light **shines** on a soap bubble, some of the rays

reflect back from its **outer surface**. Others travel through the thin soap **film** and bounce back from its **inner surface.** The two sorts of reflected rays are slightly **out of step** because they travel different distances. They **interfere** with one another and produce colorful swirling **patterns** on the bubble's surface.



WAVES AND PARTICLES.

Sometimes <u>light seems to behaveas though</u> it carries energy in **waves**. Other times <u>it seems to carry</u> energy in **particles** or packets, called photons, fired off in quick **succession** from the source. Scientists argued for many years over whether light was really a wave or a particle. Now they agree that light can behave as **either** a wave **or** a particle, depending on the situation.

LIGHTHOUSE.

The **powerful beam** from a lighthouse illustrates that light travels in straight lines. Under normal **circumstances**, light never **bends** or goes round corners but travels in a perfectly straight **path**, making what is known as a light ray.

Nothing can travel faster than light. The beam from a lighthouse travels its full length in a **tiny fraction** of a second.

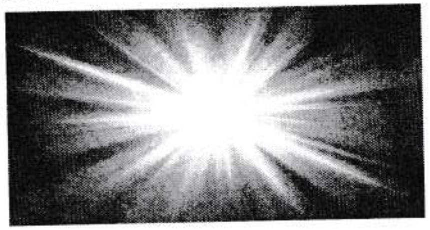
TRANSMISSION OF LIGHT.

Some objects **transmit** light better than others. **Transparent** objects, such as glass, let virtually all light rays pass straight through them. When you look at a glass of orange juice, you can see the juice inside very clearly. You can also see other things through the glass. Translucent objects, such as plastic, **allow** only part of the light through. A plastic bottle lets some light rays pass through it. It is possible to see the orange juice inside the bottle, but you cannot see anything behind the bottle.

Opaque objects, such as metal, reflect all the light falling on them and allow none to pass through. When you look at a **can** of orange juice, all you can see is the can. It is impossible to tell, just from looking, **whether or not** the can has any orange juice in it.

LIGHT SOUSCES.

Things that give off light are called **light sources**. When we see something, light rays have travelled from a source of light into our eyes. Some objects **appear** bright to us because they give off energy as light rays; these objects are said to be **luminous** or **light-emitting**. Other objects do not make light themselves, but appear bright because they reflect the light from a light source.



SUNLIGHT.

The Sun shines because it produces energy deep in its **core**. The energy is made when atoms **join together** in **nuclear fusion** reactions. The Sun fires off the energy into **space** in all **directions** in the form of electromagnetic radiation. Some of the radiation travels to Earth as the **light** and **heat** we know as sunlight. The Sun is a luminous light source because it makes energy inside itself.

MOONLIGHT

The Moon shines much less brightly than the Sun. Unlike the Sun, the Moon does not **generate** its own energy, so it produces no light of its own. We can see the Moon only because its grey-white surface reflects sunlight **towards** Earth. If the Earth **passes** between the Sun and the Moon, the Moon seems to disappear from the sky. This is called a **lunar eclipse.**

BIOLUMINESCENCE.

Some sea organisms can make their own light. This **ability** is called bioluminescence, which means making light biologically. Transparent polychaete **worms** such as this one make yellow light inside their bodies. In their dark seawater habitat they can **glow** or **flash** to **scare** off **predators**. Other bioluminescent sea **creatures include shrimps**, **squid**, and **starfish**

SHADOWS.

Shadows are made by blocking light. Light rays travel from a source in straight lines. If an opaque object gets in the way, it stops some of the light rays travelling through it, and an area of darkness appears behind the object. The dark area is called a **shadow.** The size and shape of a shadow depend on the position and size of the light source **compared to** the object.

YOUR CHANGING SHADOW

When you stand with the Sun behind you, the light rays that hit your body are blocked and **create** a shadow on the ground in front of you. When the Sun is high in the sky at midday, your shadow is quite short. Later on, when the Sun is lower, your shadow is much longer.

UMBRA AND PENUMBRA.

Shadows are not totally black. If you look closely at a shadow, you will see a dark area in the centre and a lighter area around it. The central dark area, called the umbra, **occurs** where rays of light from the source are totally blocked. The outer area, called the penumbra, is lighter because some rays do get through.

2. Match the titles with the correct paragraphs.

WAVES AND PARTICLES, UMBRA AND PENUMBRA, LIGHTHOUSE, MOONLIGHT, BIOLUMINESCENCE, YOUR CHANGING SHADOW, LIGHT,

TRANSMISSION OF LIGHT, LIGHT SOUSCES, SUNLIGHT, SHADOWS.

3. Find the highlighted words from the text that will match the definitions.

a) a dark image or shape cast on a surface by the interception of light rays by an opaque body

b) possession of the qualities required to do something; necessary skill, competence, or power

c) permitting the uninterrupted passage of light; clear

d) the exterior face of an object or one such face

e) to turn or cause to turn from a particular direction

f) to happen; take place; come a bout

g) not transmitting light; not transparent or translucent, not reflecting light; lacking lustre or shine; dull

h) any of various invertebrates, the annelids having a slender elongated body

i) to emitor reflector cause to emitor reflect light suddenly or intermittently(flash)the central, inner most, or most es sential part of something

j) a ray or column of light, as from a beacon

k) to seem or look

l) a small piece; fragment

4. Here you have a gapped text. Try to recall the information from the text and complete the gaps with the correct words.

LIGHT.

Light makes the________________s e e m ________________________________ to our eyes. Light is a type of________________ that carries__________from a________(something that makes light)at the______________speed of 300,000 k.ps (186,000 miles per second, or 670millionmph).Light________ travel from their source in____________________.

Although they can pass through_______,they bounce off others or __________________them to make______.

______________**OF LIGHT.**

Some objects__________________light better than others.____________________objects, such as glass, let virtual light_____________________pass straight through them. When you look at a ______of orange juice, you can see the juice__________________very clearly. You can also see ________________through the glass.

______________objects, such as plastic,___________ only part of the light through. A plastic bottle lets some light rays_______________________________it. It is possible to see the orange juice________________t h e bottle, but you_________see anything behind the bottle.

_____________________objects, such as metal,________________ all the light falling on them and all own one to_________________ ____. When you look at a can of orange juice, all you can see is the can.

Lesson 4 Inventing telephone

'To invent, you need a good imagination and a pile of junk.'
(Thomas Edison)

LEAD IN.

How often do you watch TV, use your mobile phone? Can you imagine your life without them?

What do you think was the most important invention of the last fifty years? Why?

1. Match the names of the inventors with the things they invented. Imagine that you had a chance to meet any of these people. Who would you like to meet? Why? What questions would you ask?

1) G. Babakin(Russia)	A) paper
2) K. Benz(Germany)	B) electric motor
3) C'ai Lun(China)	C) the petrol-power edauto
4) M. Faraday(England)	D) powered airplane
5) Y. Nakamatsu(Japan)	E) soft landing space vehicle
6) Wright brothers(USA)	F) floppy disk

1. The words below are all connected to inventions/ technology. Translate them into Russian and name their part of speech.

Microscope, battery-operated, engine, inventor, technician, discover, remote- controlled, communications satellite, gadget, invent, technical, scientific, machine, speedometer, scientist, researcher, appliance, experiment, research, robot.

In pairs discuss what you think were the top 5 inventions of the last century. Give reasons for your opinion.

READING INVENTING A TELEPHONE

1. Match the following words and word expressions with their definitions.

1.frequency	A) a special network, one that has one closed loop giving are turn path for the current
2.amplitude	B) a metal that has been drawn into a very long, thin thread or rod
3. liquid transmitter	C) the height of the wave
4. current	D) a water microphone or water transmitter based on Ohm's law
5. circuit	E) number of cycles per a unit of Time
6. wire	F) a flow of electric charge

2. Read the text as quickly as possible and complete the sentences with the dates of the events described.

1) The telephone was invented in ....

2) Bell was working on both voice transmission and a "harmonic telegraph"

3) He was visiting his parents in ....

4) Bell succeeded in transmitting speech sounds on ....

5) Bell married Mabel Hubbard in ....

Read the text more attentively and find answers to the following questions:

6) What were the first words spoken by Alexander Graham Bell into his experimental telephone?

7) What was the cutting-edge technology in 1870s?

8) What is a "harmonic telegraph"?

9) What did Bell understand while visiting his parents in1874?

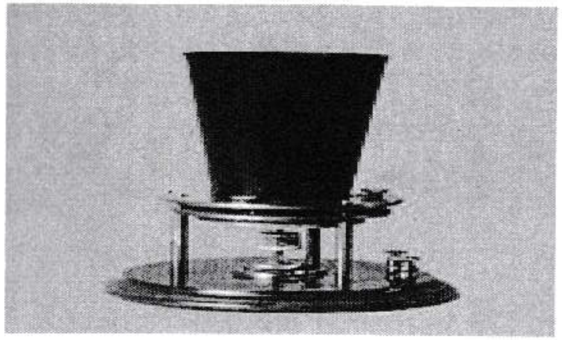
10) How did Bell announce his discovery?

11) Did Bell understand the importance of his discovery?

INVENTING A TELEPHONE

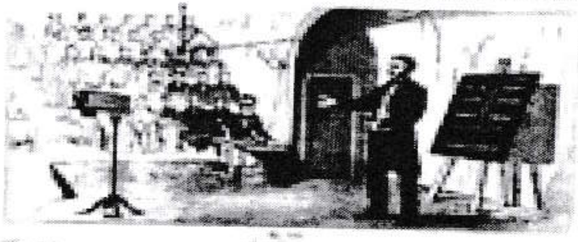
"Mr. Watson, come here, I want you. "With these words, spoken by inventor Alexander Graham Bell in to his experimental telephone on March 10,1876,an industry was born. Ford own the hall, Bell's assistant, Thomas Watson, distinctly heard Bell.

Butter the first spoken sentence ever transmitted via electricity. That achievement was the culmination of an invention process Bell had begun at least four years earlier. In the 1870s, electricity was the cutting-edge technology. Like todays Internet, it attracted bright, young people, such as Bell an Watson, who were only 29 and 22 in 1876. The field of electricity offered them the opportunity to create inventions that could lead to fame and fortune.

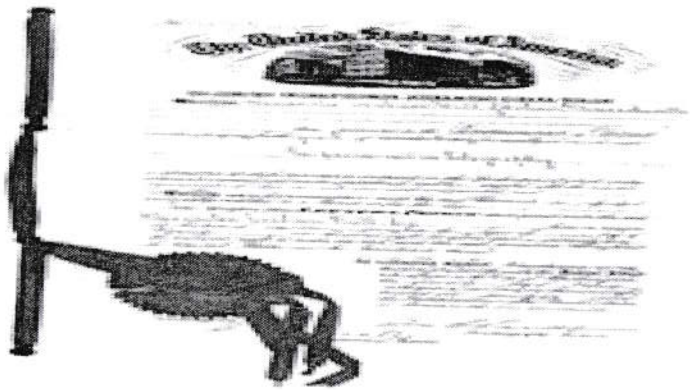


There was already one great electrical industry—the telegraph ,whose wires crossed not only the continent but even the Atlantic Ocean. The need for further innovations , such as a way to send multiple messages over a single telegraph wire, were well known and promised certain rewards .But other ideas ,such as a telegraph for the human voice, were farm or speculative. By 1872, Bell was working on both voice transmission and a "harmonic telegraph " that would transmit multiple messages by using musical tones of several frequencies

The telegraph transmitted information by an intermittent current. An electrical sign all ways it her present or absent , forming the once-familiars of Morse code. But Bell knew that sounds like speech were complex, continuous waves, with not only tone but amplitude. In the summer of 1874, while visiting his parents in Brantford, Ontario, Bell hit upon a key intellectual in sight: To transmit the voice electrically, one needed what he called an "inducedundulating current." Or to put it an other way, what was required was not an intermittent current, but continuous electrical waves of the same form as sound waves.



On July 1, 1875, Bell succeed in transmitting speech sounds, but they weren't intelligible. He returned to his experiments in Boston. On March 10, he hooked up his latest design, known as the liquid transmitter, in to an electrical circuit, and Watson heard Bell's voice.



Bell announced his discovery, first in lectures to Boston scientists and then at the Philadelphia Centennial Exposition to a panel of notables including Brazilian Emperor Dom Pedro II and eminent British physicist William Thomson. The emperor exclaimed, "My God! It talks!" Thomson took news of the discovery across the ocean and proclaimed it "the greatest by far of all the marvels of the electric telegraph."

Alexander Graham Bell had little interest in being a businessman .In July 1877, he married Mabel Hubbard ,and set sail for what proved along honey moon in England. He left the growing business to Hubbard and Sanders, and went on to a long productive career a scientist and inventor.

THREE INVENTIONS THAT CHANGED THE WORLD

Throughout history, people have made inventions that changed the world. Some got lucky and stumbled on something, some actually set out to make something, and still others improved upon existing technology to create something revolutionary. We're going to show what we consider the top 3 world changing inventions, from how they were found, to how they ended up being used.

Penicillin

Penicillin was actually discovered a bit by accident. It is credited to scientist Alexander Fleming in 1928. He noticed that certain mold could kill bacteria, which proved that there was an antibacterial agent in the mold.

Fleming did not actually invent penicillin though–he merely made popular the knowledge that there was an anti-bacterial agent in the mold Penicilliumnotatum. It was original noticed by French medical student Ernest Duchesne in 1896. Fleming, however, saw the potential importance of what he named penicillin. Ina 1929paper, he noted that the result she observed could have medical implications if the anti-bacterial agent could be isolated and produced in quantity.

Electricity

While most people generally attribute Benjamin Franklin as electricity discoverer, it isn't entirely accurate. He did, however, lay the ground work for future scientists to make world changing breakthroughs, so there is some degree of accuracy in calling him the father of electricity.

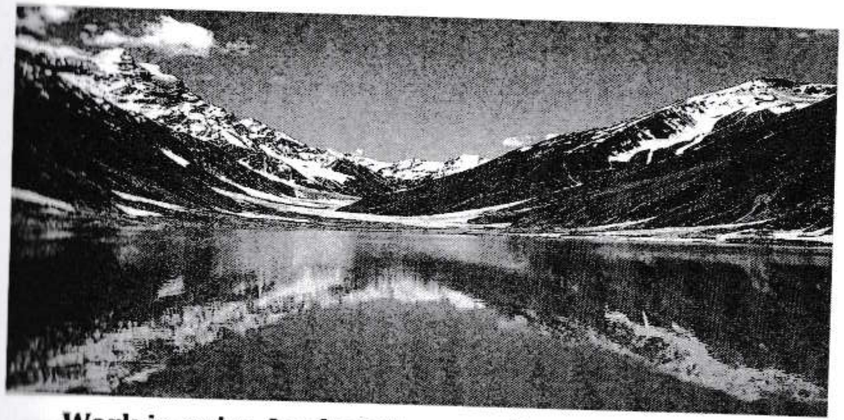
The list of scientists who did groundbreaking work with electricity reads like a who's who list of famous inventors – Thomas Edison, Alessandro Volta (volt), Andre- Marie Ampere (amp), Georg Simon Ohm (ohms), Nikola Tesla, Samuel Morse, and Alexander Graham Bell, among others. Each of them contributed to our modern electrical technology.

Speaking

Imagine that you were to talk to some of the most famous inventors of e.g. a computer, penicillin, disposable nappies, different appliances and so on. What questions would you ask them? Tell them about how our society benefitted from their discoveries.

Give a reasons.

Lesson 5 Miror and mirage



Work in pairs. Look at the experiment below. Be ready to perform it to the whole group.

Reflecting Light Experiment - Back to Front Writing

Materials you will need: • Pencil • Paper • Mirror This is a tricky experiment! **Steps:** **1.**Write your name on a piece of paper, back to front-(so that it reads correctly when you look at it in a mirror).	
	2.Next, place the mirror in front of you and try to write your name the right way around whilst you look at what you are doing through the mirror.
3.What conclusion can you make?	

Read the quotations and translate them. Which do you like best of all? Why?

Do they have anything in common? If yes, what?

Do you know the phenomenon that is connected with this object? What is it?

Most people are mirrors, reflecting the moods and emotions of the times. Some people are windows, bringing light to bear on the dark corners where troubles fester .The whole purpose of education is to turn mirrors into windows. ***Sydney J. Harris***

A loving person lives in a loving world. A hostile person lives in a hostile world. Everyone you meet is your mirror. ***–Ken Keys***

There are two ways to spread happiness; either be the light who shines it or be the mirror who reflects it. – ***Edith Wharton***

The best mirror is an old friend. – ***Peter Nivio Zarlenga***

"If someone shows you their true colors, don't try to repaint them." - ***Taina, N***

1. Look at the definitions given below? Try to guess the words they define. (reflection)

A process in which light, other electromagnetic radiation, sound, particles, etc., are thrown back after impinging on a surface.

The change in direction of a propagating wave, such as light or sound, in passing from one medium to another in which it has a different velocity.

2. You are going to read a text about reflection and refraction. Before reading try to answer the questions

given below, discuss them with your group-mates.

a) What is refraction? Try to define it.

b) What happens if light rays move into a dense material?

c) When does the speed of the light rays grow as they pass through different materials?

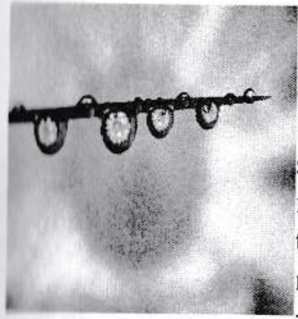
d) How does the light behave when it travels through a glass panel at an angle? Describe its movement.

e) What will happen to a straw if you stand it in a glass of water?

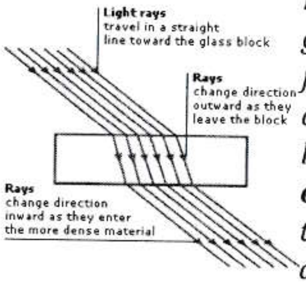
f) What causes hazy appearance of objects on a hot day?

g) Have you ever heard of the mirage? What is it?

REFRACTION.



Light rays usually travel in straight lines, but when they pass from one material to another they can be **forced** to **bend** (change direction and continue on a new straight path). The bending is called refraction. It happens because light travels at different speeds in different materials. If light rays travel through air and enter a more **dense** material, such as water, they **slow down** and bend into the more dense material. Light rays moving into a less dense material, such as from water to air, **speed up** and bend **outwards**.

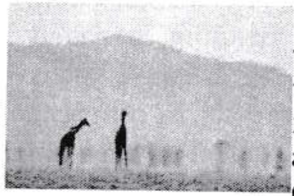


Light rays bend or refract if they enter a glass block at an ***angle****. When they pass from air into glass, they bend* ***inwards*** *and slow down. They travel in a straight line through the glass at an angle to their* ***original*** *direction. As they pass out from the glass into air, they bend outwards and speed up again.*

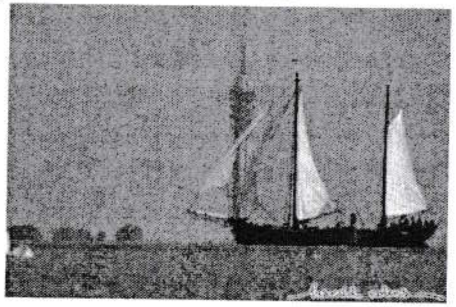
PUZZLE FOR THE EYE.

If you stand a **straw** in a glass of water, the top and the **bottom** of the straw no longer seem to fit together. This trick of the light is caused by refraction. Light bends outwards when it travels from water to air, so the eye sees the bottom of the straw (in the water) as deeper than the top of the straw (in the air).

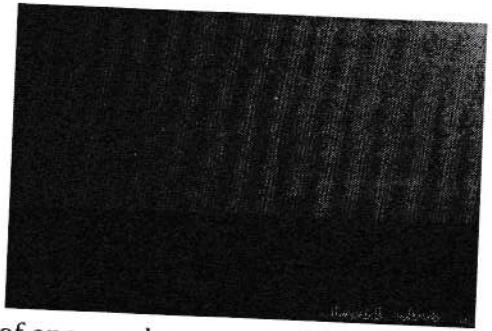
REFRACTION IN HEAT HAZE.



On hot days, the surface of the Earth is warmer than the sky above it. This means that air close to the ground is generally much warmer than the air higher up. Hot air rising from the ground can bend and **distort** the light rays passing through it. This gives a very **hazy appearance** to objects, such as this giraffe, as they move on the horizon.

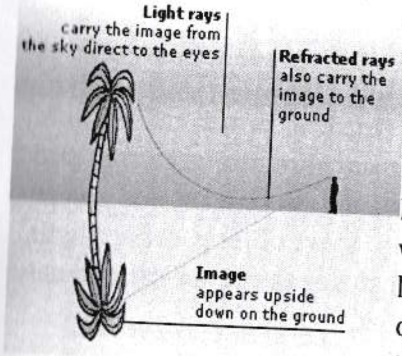


Mirage of buildings near Lelystad's radio transmitter tower, as seen over Lake Markermeer, The Netherlands



Mirage of energy plant at Lelystad, The Netherlands, seen over Lake Markermeer. The plant is about 30 km distant.

MIRAGE.

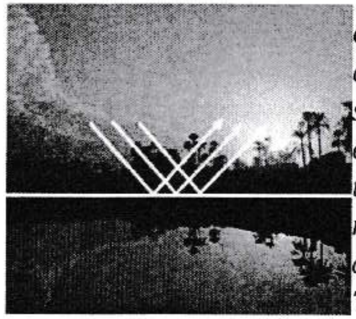


People who travel through hot deserts often think they can see water or trees on the ground ahead of them, when really there is nothing there. This trick of the light is called a mirage. **Layers** of warm and cold air bend or refract light rays coming from distant objects – perhaps real trees over the horizon. Our eyes are fooled into thinking the light rays come from objects on the ground instead of from the sky.

REFLECTION.

Reflections are usually **caused** by shiny things, such as MIRRORS, that show a **reversed** image of whatever is placed in front of them.

The image seems to be as far behind the mirror as the object is in front of it. Not only mirrors make reflections, however. Most objects reflect some of the light that falls on them. In daytime we see familiar objects like grass, trees, and the sky only because they reflect light from the Sun into our eyes.

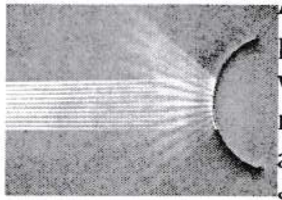


When light rays bounce off a ***completely smooth*** *surface, such as a* ***still*** *pool of water, a mirror, or even something like a shop window, we are able to see a very clear reflection on the surface. Every ray of light is reflected perfectly from the surface and bounces back in a regular way. The reflected image is very clear and sharp.*

IRREGULAR REFLECTION.

A **rough** surface, such as this **rippling pond**, causes light rays to bounce off it in many different directions. It may still be possible to make out an image on the surface, or, if it is very rough, the image is very broken up. Most objects reflect light in this irregular way. Although we can see them, we cannot see any images reflected in their surfaces.

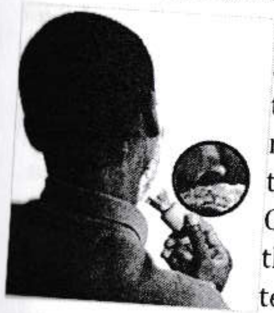
MIRRORS.



A mirror is a very smooth, highly **polished** piece of metal or plastic that reflects **virtually** all the light that falls onto it. The reflection appears to be behind the mirror and may look bigger, smaller, or the same size as the thing it is reflecting, depending on the mirror's shape. We use mirrors when checking our appearance or driving. They also play an important part in telescopes, microscopes, cameras, and other optical (light-based) instruments.

A ***convex*** *mirror* ***curves*** *or bends outwards and makes an object look smaller and further away than it actually is. It makes light rays seem to come from a point behind the mirror, further from our eyes. Things look smaller, but convex mirrors are* ***helpful*** *because they can show a* ***wider*** *picture or field of view.*

CONCAVE MIRROR.



A concave mirror curves or bends inwards and makes an object look bigger and nearer than it **actually** is. It works by making light rays seem to come from a point in front of the mirror, which is closer to our eyes. Concave mirrors are important in such things as bicycle reflectors and reflecting telescopes.

This man is shaving with the help of a concave mirror. Its curved surface makes the man's face seem closer to him than it really is. The reflected image he sees is ***magnified*** *and he can easily see what he is doing. The mirror's* ***drawback*** *is that less of the man's face fits into the mirror than in a flat mirror of the same size.*

CAR WING MIRROR.

Drivers use mirrors to see traffic coming up **behind** them. It is important for drivers to see as much of the road behind as they can, so wing mirrors and rear-view mirrors are convex. A drawback is that they make vehicles on the road behind look smaller and further away than they would in a flat mirror of the same size. Drivers must remember that the vehicles are nearer than they appear.

3. Mark the statements true or falls.

1. Mirrors used by drivers are concave.
2. Mirrors show a reversed image of whatever is placed behind them.

3. In a concave mirror everything seems bigger than it really is.

4. Reflection is caused by warm and cold air which bend light rays coming from distant objects.

5. Hazy appearance of objects on hot days is caused by warm air rising from the ground that distorts the light rays passing through it.

6. When we look in the mirror the object seems to be in front of it and may look bigger, smaller, or the same size as the thing it is reflecting, depending on the mirror's shape.

7. To reflect means to bend.

8. When light rays move water to air they bend out wards.

9. The advantage of a concave mirror is that less of the object fits into the mirror than in a flat mirror of the same size.

10. The majority of the objects reflect the light that falls on them.

4. Choose one of the experiments from your list and prepare a similar presentation for your group-mates (both oral and written), including all the steps, from the aim to the conclusion.

DID YOU KNOW?

Why do the English always drink milk with tea?

People from around the world often wonder why the English always drink milk with their tea. The answer is that in the 17th and 18th centuries the china cups tea was served in were so delicate they would crack from the heat of the tea. Milk was added to cool the liquid and stop the cups from cracking. This is why, even today, many English people add milk to their cups before adding the tea!

Here you have a gapped text. Try to recall the information from the text and complete the gaps with the correct words

CAR WING MIRROR.

Drivers use mirrors to____________________________ them. It is important for drivers______________________can, so wing mirrors and rear-view mirrors _________________. A____________is that they make vehicles on the road behind look_______________would in a flat mirror of the same size. Drivers must remember that the__ ____________________they appear.

TIME FOR EXPERIMENTING!

5.Work in pairs or small groups. Think of any experiments with refraction. Make a list of them.

6.Here you have an example of such an experiment. Read the information.

The Experiment

The Aim

To use refraction to make a pencil seem like it is broken.

Equipment Needed

A pencil (not one that has about one page of writing left in it – it needs to be fairly long)!

Water.

A drinking glass.

Method

Put water in the glass so that it is half to three quarters full. Stand the pencil in the glass.

Look at it from the side of the glass.

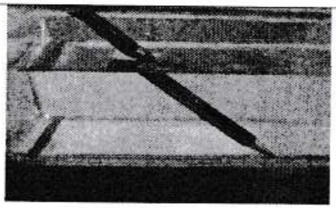
Then look at the pencil from above the glass.

Results

This is what you should see happening...

From the side of the glass, the pencil seems broken (check out the photos below – the first photo was actually a photo of the same experiment using a glass bowl with a straight side. The second photo shows the pencil in the glass). Notice the difference in the two photos? The curved glass and water act as a magnifying glas

1.



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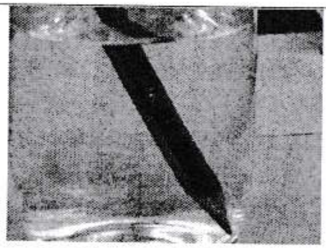
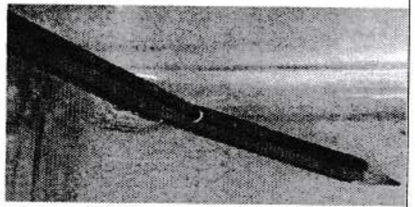


3. ☐ When looking from above, the pencil seems like it is bending at the surface of the water.



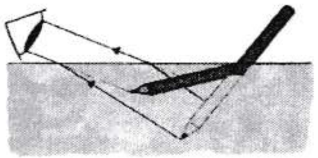
☐ If you move your eyes up and down from the side of the glass to the top you will get to a point where you will see what seems to be another pencil in the water.

4. **The Conclusion**

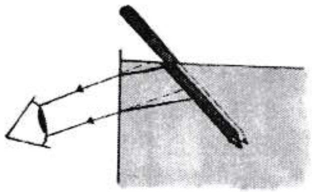
Check out the photo on below. You can see all the effects mentioned in the results. The different effects are simply because you are looking at the pencil from different angles. From above the bent light will make the pencil look like it is "above" the real pencil and so give the impression that the pencil is bent. From the side, the bent light will lower the image of the pencil, but because you are looking at it from the side, it will seem to be broken. The largeness of the pencil is because of magnification caused by the curved glass.

5. And just to help you out in your project a bit more, here are the refraction diagrams...

The bent pencil...

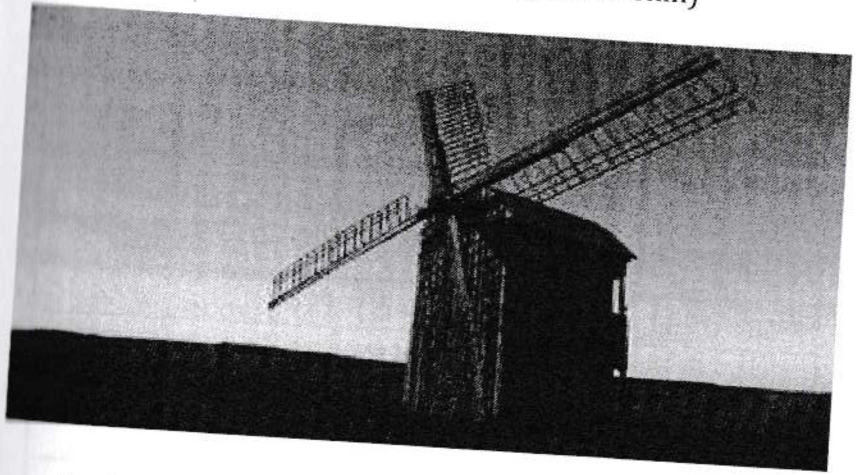


6. and the broken pencil...



Lesson 6 Power of wind

"Sunshine is delicious, rain is refreshing, wind braces us up, snow is exhilarating; there is really no such thing as bad weather, only different kinds of good weather". (John Ruskin)



Traditional Dutch-type windmill

LEAD IN.

What sources (TV, radio, internet etc.) do you usually use to find out about weather?

What do you think about weather forecasts? Do you always believe them?

Does your mood often depend on the weather outside?

1. Look at the words below describing weather conditions. Which of them are connected to the wind and its different types?

flooding, tornado, fog, typhoon, breeze, gale, hail, rain, storm, hurricane, drought, sleet, blizzard, sunshine.

2. Write down 5 adjectives which describe wind (for example, *icy wind*). Compare your list of words with your

partner. Check the answers with your teacher.

3. Match these idioms containing the word "wind" with their meanings; then, answer the questions.

1.Wind down	A close to danger
2.Second wind	B to come or bring to a finish
3. Scattered to the 4 winds	C restored energy of strength
4. Near the wind	D likely to occur
5. It's all an ill wind	E someone profits from every loss
6. Wind up	F to learn of; hear a rumor of
7. Get wind of	G all around the world
8. In the wind	H to relax; to unwind

1) How do you usually wind down?
2) Have you ever felt that something is in the wind?
3) Have you ever been near the wind?
4) What did you get the wind of recently?
5) Can you name a situation when a second wind helped you to wind something up?

READING THE POWER OF WIND

Read and translate the following words and word expressions. electricity (n.), **electric** (adj.), **electrical** (adj.) to generate electricity; to transport electricity; to produce electricity; enough electricity; electric field; electric guitar; electric light; electrical engineer.

pump(v.) they pumped water out of the hold; the tire needs more air pumping into it; I had maths pumped into me at school; the well had been pumped dry; I pumped him for information.

cluster (n.) (v.) clusters of stars; super clusters of galaxies; roses clustered round the window; the children clustered round the teacher.

scatter (v.) toys were scattered all over the room; he scattered his papers all over the floor; a wind scattered the clouds; the area is scattered with small hamlets. **energy** (n.) wind energy; to harness the energy of wind; to use the energy of wind; energy crisis; quantum energy; devote all one's energies to a task.

power (n.) (v.) electric power; power lines; there was a power cut; the machine is on full power; two to the power of ten; power station; an aircraft powered by four jets.

machine (n.) the machine age; machine shop; grinding machine; machine-made goods; machine operator.

4. You are going to read the text about the past and present of the power of wind. Read the text and answer the following questions:

a) How was the power of wind used in Egypt, China, and Persia?

b) Who refined the windmill and adapted it for draining lakes and marshes?

c) What did American colonists use wind mills for?

d) When did Americans start using windmills to generate electricity in rural areas without electric service?

e) What is a wind farm?

f) Where is the largest wind farm situated? How many wind turbines does it have?

g) What are the two types of wind machines?

h) What other alternative sources of energy do you know? Which of them are used in your country?

Wind farm

Nowadays, wind power plants, or wind farms, as they are sometimes called, are cluster so wind machines used to produce electricity. A wind farm usually has dozens of wind machines catered over a large area. The world's largest wind farm, the Horse Hollow Wind Energy Center in Texas, has 421 wind turbines that generate enough electricity top of over 220,000 homes per year.

5. Put these sentences into the chronological order.

A) Windmills were extensively used for food production in the Middle East.

B) Wind power plants came into being.

C) Wind energy propelled boats along the Nile River.

D) The settlers in the New World began using windmills to pump water for farms.

E) Simple windmills in China were pumping water.

F) American colonists started to generate electricity for homes and industry.

Lesson 7 The sound of music

Look at the idioms and match them with their meanings.

1. Roughmusic	A idle talk, empty words
2. Toblowone'sowntrumpet	B to confront the consequences of one's actions
3. A tinkling cymbal	C to call out in a loud voice; shout
4. Change one's tune	D a loud cacophony created with tin pans, drums, etc
5. Strike the false note	E to behave appropriately
6. Sing out	F to change one's attitude or tone of speech
7. Strike the right note	G to boast about oneself; brag
8. Face the music	H to behave inappropriately

1. Look at the words .Some of them are related to physics others to music and the rest are odd. Complete the chart with these words and translate/define them.

Glory, contain, note, pitch, pattern, sound wave, resonate, frequency, flute, amplify,

string, closely, tuning fork, precise, pipe, low pitched, piccolo, key, compose, arrange, scale, staff, increase, cymbals, mixture.

Physics	Music	Others
e.g. resonate	*Note*	*Contain*

2. Read the text and answer the questions.

a) How do musical instruments produce sound?

b) How do we call the most notice able sound?

c) What are harmonics?

d) What sounds more pure, a flute or a saxophone? Why?

e) Can musical instruments amplify sound? What for?

f) What part of a violin amplifies sound?

g) How does a tuning fork work?

h) What is a scale?

i) What's the difference between the sound of a tuning fork and cymbals?

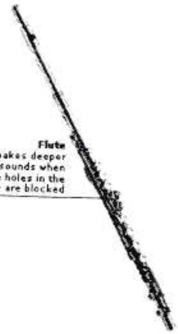
THE SOUND OF MUSIC.

Music **is** one of the glories of sound. When a musician **plays** a note of a certain pitch, the musical instrument **vibrates** or RESONATES and **produces** a complex pattern of sound waves made up of many different frequencies. The most noticeable sound wave is called the fundamental, but there are other waves with higher frequencies, called harmonics. Notes from a flute **sound** more pure than those from a saxophone because they **contain** fewer harmonics. Musical instruments often **make** very quiet sounds, but some are designed to AMPLIFY the sounds they make so we can hear them more easily.

A violin **makes** musical sounds when its strings **vibrate**.

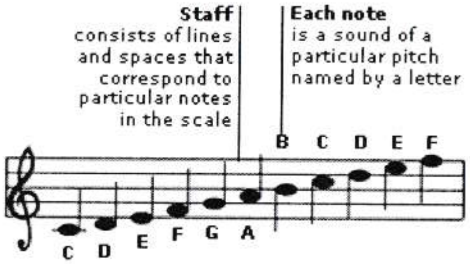
If you pluck a violin string and watch it closely, you can see it vibrating very quickly. The vibrations **begin** with the strings, but quickly **make** the large wooden body of the instrument vibrate as well. The vibrating body **amplifies** the sound greatly.

Hitting the two metal prongs of a tuning fork **causes** them to vibrate at a precise frequency. As they vibrate, they make the air around them vibrate, too. This produces sound waves in the form of a single, pure note. If you stand the base of the vibrating fork on a table, the table vibrates as well. This amplifies the note by making louder sound waves.

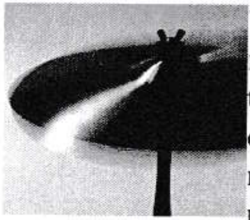


When you play any form of pipe instrument, such as a flute, the air inside vibrates in complex patterns. Sound waves come out and you hear them as musical notes. A long flute can make a long sound wave and a low-pitched note.

A short piccolo makes shorter sound waves and higher notes. By blocking holes in a pipe with your fingers or by pressing keys, you can play notes of different pitch.



People compose music using sounds of different pitch. When musical sounds are arranged from low pitch to high pitch, they make a scale that can be written down on a staff. Each note on a scale is a sound of a different pitch. Different scales can be made by choosing different notes or by changing the way the pitch increases from one note to the next.



When you crash two cymbals together, the metal discs vibrate and make the air around them move. Cymbals vibrate in a more complex way than a tuning fork and make more of a noise than a musical note. A mixture of harmonics of different frequencies is created, and the sound wave that results is much more complex in shape than the wave of a tuning fork.

3. Find equivalents for these definitions in the text.

a)________________________is a small flute.

b)________________________means to move or cause to move back and forth rapidly; shake, quiver, oscillate or throb.

c)________________________is a wave that propagates sound.

d)________________________means to increase in size, extent, effect, etc., as by the addition of extra material; augment; enlarge; expand.

e)________________________is to cause to come in to existence.

f)________________________means in addition; too.

g)________________________means made up of various interconnected parts; composite.

FAMOUS PEOPLE ABOUT MUSIC.

Jazz came to America 300 years ago in chains.-Paul Whiteman

Music sweeps by me as a messenger carrying a message that is not for me.- George Eliot

Swans sing before they die - 't were no bad thing, did certain persons die before they sing.- Samuel Taylor Coleridge

Too many pieces of music finish too long after the end.-Igor Stravinsky

Richard Wagner, a musician who wrote music which is better than it sounds.-Mark Twain

Music should strike fire from the hear to man, and bring tears from thee yes of woman.-Beethoven

DID YOU KNOW?

"He who pays the piper calls the tune." (old saying)

In medieval times, people were entertained by strolling musicians. Whoever paid the price could choose the music. This proverb means that whoever pays is in charge

The Names of the Months

- **January:** named after Janus, the god of doors and gates
- **February :**named after Februalia, a time period when sacrifices were made to atone forsins
- **March:** named after Mars, the god of war
- **April:** from *aperire,* Latin for "to open"(buds)
- **May:** named after Maia, the goddess of growth of plants
- **June:** from *junius,* Latin for the goddess Juno
- **July:** named after Julius Caesar in 44B.C.
- **August:** named after Augustus Caesar in 8B.C.
- **September:** from *septem,* Latin for"seven"
- **October:** from *octo,* Latin for"eight"
- **November:** from *novem,* Latin for"nine"
- **December:** from *decem,* Latin for"ten"

Lesson 8 Menerals and gems

A physicist is just an atom's way of looking at itself.
Niels Bohr

LEAD IN.

1. Match these "matter" words with their definitions.

1.Atom	A) particles that touch one another but are free to move
2.Liquid	B) to change from a solid to a liquid as a result of heating
3. Solid	C) the building block of life
4. Gas	D) a super-charged, super-heated gas
5. Plasma	E)tightly packed molecules that cannot change shape
6. Melt	F) particles that move freely and can change shape and size
7. Evaporate	G) to change from a liquid to a solid when energy is removed and a liquid is cooled
8. Freeze	H) to change from a liquid to a gas
9. Capacity	I) The ability to absorb or contain another subject

Complete the table about three states of matter.

A Table of the Properties of The 3 States of Matter		
SOLID	**LIQUID**	**GAS**
1.Particlesinasolid...	1.Particlesinaliquid...	1.Particlesinagas...
...are tightly packed, usually in a regular pattern		...are well separated with no regular arrangement
...vibrate (jiggle) but generally do not move from place to place	...vibrate, move about, and slide past each other	...vibrate and move freely at high speeds

2.Asolid...	2.Aliquid...	2.Agas...
...has particles locked into place... does not floweasily ...is not easily compressible	...assumes the shape of the part of the container which it occupies ...has particles which can move and slide past one another... flows easily ... is not easily	...has particles that can move past one another ...flows easily

3. Translate the sentences into Russian.

1. The most widely accepted model of an **atom** is the wave model based on the Bohr model, but takes into account recent developments and discoveries in quantum mechanics.

2. Unlike **solid**, a **liquid** has no fixed shape, but instead has a characteristic readiness to flow and therefore takes on the shape of any container.

3. A **solid** can be crystalline (as in metals), amorphous (as in glass), or quasi crystalline (as in certain metal alloys) depending on the degree of order in the arrangement of the **atoms**.

4. As most **gases** are difficult to observe directly with our senses, they are described through the use of 4 physical properties: pressure, volume, number of particles, and temperature.

5. The presence of a non-negligible number of charge carriers makes **plasma** electrically conductive so that it responds strongly to electromagnetic field.

6. Latent heat is the heat released or absorbed by a chemical substance or a thermodynamic system during a change of state that occurs without a change in temperature, meaning a phase transition such as the **melting** of ice or the boiling of water.

7. For molecules of a **liquid** to evaporate, they must be located near the surface, be moving in the proper direction, and have sufficient kinetic energy to overcome liquid-phase inter

molecular forces.

8. All known **liquids**, except **liquid** helium, **freeze** when the temperature is lowered enough.

9. At sufficiently high temperatures, the heat **capacity** per **atom** tends to be the same for all elements.

4. In pairs try to guess what solids, liquids, and gases are described below.

1) This fossil fuel is the largest source of energy for the generation of energy worldwide, as well as one of the largest worldwide sources of carbon dioxide emissions. It is extracted from the ground by mining

2) It is a mineral that is composed primarily of sodium chloride. It is essential for animal life in small quantities, but is harmful to animals and plants in excess. This mineral is one of the oldest, most ubiquitous food seasonings and an important method of food preservation. Its taste is one of the basic human tastes.

3) It is a liquid at ambient conditions, but it often co-exists on Earth with its solid state, ice, and gaseous state, vapor or steam. It covers 70.9% of the Earth's surface, and is vital for all known forms of life. On Earth, it is found mostly in oceans and other large water bodies.

4) This chemical element is the only metal that is liquid at standard conditionsfortemperatureandpressure. Withafreezingpointof−38.83 °C and boiling point of 356.73 °C, it has one of the broadest ranges of its liquid state of any metal. It is used in thermometers, barometers, manometers, some electrical switches, and other scientific apparatus.

5) It is a chemical compound composed of two oxygen atoms covalently bonded to a single carbon atom. It is a gas at standard temperature and pressure and exists in Earth's atmosphere in this state.

READIG

MINERALS AND GEMS

5.Think of minerals you know. What are they formed of? What structure do they have? Read the first part of the text and underline words connected to structure.

More than 4,000 naturally occurring minerals-inorganic solids that have a characteristic chemical composition and specific crystal structure-have been found on Earth. They are formed of simple molecules or individual elements arranged in repeating chains, sheets, or three-dimensional arrays.

Minerals are typically formed when molten rock, or magma, cools, or by separating out of mineral-rich water, such as that in underground caverns. In general, mineral particles are small, having formed within confined areas such as lava flows or between grains of sediments. Large crystals found in geodes and other rocks are relatively rare.

Rocks themselves are made of clusters or mixtures of minerals, and minerals and rocks affect landform development and form natural resources such as gold, tin, iron, marble, and granite. Silicates-including quartz, mica, olivine, and precious minerals such as emeralds-are the most common class of minerals, as well as the major components of most rocks. Oxides, sulfides, sulfates, carbonates, and halides are other major mineral classes.

6. Read the second part of the text and complete the chart about gemstones.

Many minerals form beautiful crystals, but the most prized of all are gemstones. Uncut gems are often fairly ordinary looking. It's only when they are cut and polished that they obtain the brilliance and luster that makes them so valued.

Historically gems have been divided into precious and semiprecious classes. There are a number of semiprecious gems, many quite beautiful, but diamonds, rubies, sapphires, and emeralds continue to qualify as "precious." (At one time, amethyst was also considered a precious gem, but large reserves were later found in Brazil, reducing its value.)

Diamonds, made of carbon atoms, are the hardest natural substance found on Earth. Formed under extremely high pressure hundreds of miles underground, they are found in very few locations around the world. Graphite is also made of carbon atoms, but with a different arrangement- explaining why diamond is the hardest mineral and graphite (used in pencil lead) is one of the softest.

Rubies are formed of a mineral called corundum, comprised of aluminum oxide. The red color is caused by traces of chromium. Corundum also forms sapphire in many colors, which generally come from trace mixtures of iron, titanium, and chromium.

Emeralds are formed of a mineral called beryl whose chemical formula is a complex mix of beryllium, aluminum, silicon, and oxygen. The color comes from additional traces of chromium and vanadium. Different trace elements can produce other colors, allowing beryl to form semiprecious stones such as aquamarine.

Minerals and gems are classified by their physical properties, including hardness, luster, color, density, and magnetism. They're also identified by the ways in which they break, or the type of mark, or streak, that they leave when rubbed on a laboratory tool called a streak plate.

Gemstone	Type of formation	Specific characteristics	Physical characteristics by which they areclassified
Diamond			
Ruby			
Emerald			

7. Study the birth month's gemstone/mineral table. Make a research project and tell your groupmates about your gemstone, and its physical properties; add any new information you know that is not in the text.

Sign	Stone
Aquarius	Garuarius
Pisces	Amephyst
Aries	Bloodstone
Taurus	Sapphire
Gemini	Agate
Cancer	Emerald
Leo	Onyx
Virgo	Carnelian
Libra	Peridot
Scorpio	Beryl
Sagittarius	Topaz
Capricorn	Ruby

Part 2 Physics symbols

Type of radioactivity

Type	Symbol	*Particles emitted*	*Change in atomic number, Z*	*Change in atomic mass number, A*
Alpha	α	Helium nucleus	-2	-4
Beta negatron	β^-	Negative electron and antineutrino	+1	0
Beta positron	β^+	Positive electron and neutrino	-1	0
Electron capture	EC	Neutrino	-1	0
Isomerc transitin	IT	Gamma rays or conversion electrons or both (and positive-negative electron pair)	0	0
Proton	p	Proton	-1	-1
Spontaneous fission	SF	Heavy fragments and neutrons	Various	Various
Isomeric spontaneous fission	ISF	Heavy fragments and neutrons	Various	Various
Beta-delayed spontaneous fission	$(EC+\beta^+)$-SF	Positive electron, neutrino, heavy fragments, and neutrons	Various	Various
Beta-delayed neutron	β^{-n}	Negative electron, and antineutrino, neutron	+1	-1
Beta-delayed two-neutron (three-neutron)	$\beta^{-2n(3n)}$	Negative electron, antineutrino, and two (three) neutrons	+1	-2 (-3)
Beta-delayed proton	β^{+p} or $(\beta^+EC)p$	Positive electron, neutrino, and proton	-2	-1
Beta-delayed two- proton	β^{+2p}	Positive electron, neutrino, and two protons	-3	-2
Beta-delayed triton	$-^{3}H$ β^{1}	Negative electron, antineutrino and triton	0	-3
Beta-delayed alpha	$\beta^{+\alpha}$	Positive electron, neutrino and alpha	-3	-4
Beta-delayed alpha- neutron	$\beta^-\alpha$,n	Negative electron, antineutrino, alpha, and neutron	-1	-5
Double beta decay	$\beta^-\beta^-$	Two negative electrons and two antineutrinos	+2	0
Double electron capture	EC EC	Two neutrinos	-2	0
Two-proton	2p	Two protons	-2	-2
Neutron	N	Neutron	0	-1
Two-neutron	2n	Two neutrons	0	-2

2. Electromagnetic spectrum

Frequency Hz	*Wavelength, m*	*Nomenclature*	*Typical source*
10^{23}	$3*10^{-15}$	Cosmic photons	Astronomical
10^{22}	$3*10^{-14}$	Y-rays	Radioactive nuclei
10^{21}	$3*10^{-13}$	Y-rays, X-rays	
10^{20}	$3*10^{-12}$	X-rays	Atomic inner shell, positron- electron annihilation
10^{19}	$3*10^{-11}$	Soft X-rays	Electron impact on a solid
10^{18}	$3*10^{-10}$	Ultraviolet, X- rays	Atoms in sparks
10^{17}	$3*10^{-9}$	Ultraviolet	Atoms in sparks and arcs
10^{16}	$3*10^{-8}$	Ultraviolet	Atoms in sparks and arcs
10^{15}	$3*10^{-7}$	Visible spectrum	Atoms, hot bodies, molecules
10^{14}	$3*10^{-6}$	Infrared	Hot bodies, molecules
10^{13}	$3*10^{-5}$	Infrared	Hot bodies, molecules
10^{12}	$3*10^{-4}$	Far-infrared	Hot bodies, molecules
10^{11}	$3*10^{-3}$	Microwaves	Electronic devices
10^{10}	$3*10^{-2}$	Microwaves, radar	Electronic devices
10^{9}	$3*10^{-1}$	Radar	Electronic devices, interstellar hydrogen
10^{8}	3	Television, FM radio	Electronic devices
10^{7}	30	Short-wave radio	Electronic devices
10^{6}	300	AM radio	Electronic devices
10^{5}	3000	Long-wave radio	Electronic devices
10^{4}	$3*10^{4}$	Induction heating	Electronic devices
10^{3}	$3*10^{5}$		Electronic devices
100	$3*10^{6}$	Power	Rotating machinery
10	$3*10^{7}$	Power	Rotating machinery
1	$3*10^{8}$		Commutated direct current
0	Infinity	Direct current	Batteries

SI prefixes

Factor	Prefix	Symbol	Factor	Prefix	Symbol
10^{24}	yotta	Y	10^{-1}	deci	d
10^{21}	zeta	Z	10^{-2}	centi	c
10^{18}	exa	E		milli	m
10^{15}	peta	P	10^{-3}	mico	ỡ
10^{12}	tera	T	10^{-6}	nano	n
10^{9}	giga	G	10^{-9}	pico	p
10^{6}	mega	M		femo	f
10^{3}	kilo	k		atto	a
10^{2}	hectr	h		zepo	z
	deka	d		yocto	y

Some physicalproperties

AIR (dry, at 20⁰ C and 1 atm)	
Density	$1.21\ kg/m^3$
Specific heat at constant pressure	1010J/kg.K
Ratio of specific heats	1.40
Speed of sound	343m/s
Electrical breakdown strength	$3\ x10^6$
Effective molar mass	0.0289kg/mol
WATER	
Density	$1000kg/m^3$
Speed of sound	1460 m/s
Specific heat at constant pressure	4190J/kg.K
Heat of fusion(0⁰C)	333kJ/kg
Heat of evaporation (100⁰C)	2269kJ/kg
Index of refraction (l= 589nm)	1.33
Molar mass	0.0180kg/mol

EARTH	
Mass	5.9810^{24}kg
Mean radius	6.37×19^{6} m
Free-fall acceleration at the Earth's surface	$9.8 m/s^{2}$
Standard atmosphere	1.01×10^{6} Pa
Period of satellite at 100-km altitude	86.3min
Radius of the geosynchronous orbit	42,200km
Escape Speed	11.2km/s
Magnetic dipole moment	$8.0 \times 10^{22} A.m^{2}$
Mean electric field at surface	150V/m
DISTANCE TO:	
Moon	$\times 10^{8}$m
Sun	1.50×10^{11}m
Nearest star	4.04×10^{16}m
Galactic center	2.2×10^{20}m
Andromeda galaxy	2.1×10^{22} m
Edge of the observable universe	$\sim 10^{26}$m

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English For PHYSICS students

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