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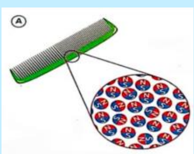
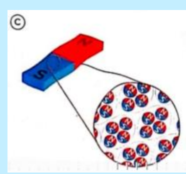
Inspire Science grade 8 تجميع هيكل

Lesson 1: Magnetic forces

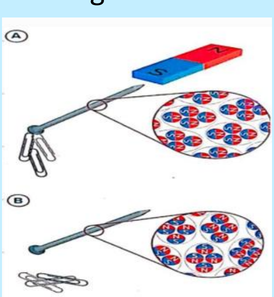
Magnetic domains:

All matter is made of particles called atoms. Every atom has its own magnetic field, in some materials, atoms are grouped in magnetic domains.

A magnetic domain: **is a region in a magnetic material in which the magnetic fields of the atoms all point in the same direction.**

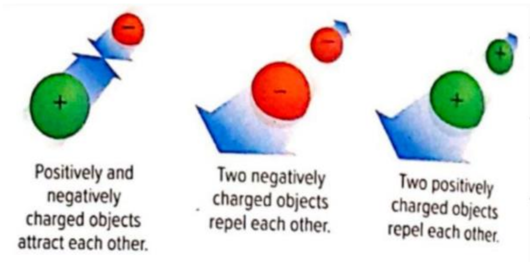
Non-magnetic material	Magnetic materials
Nonmagnetic material doesn't have atoms groups in agnetic domains.  These **nonmagnetic materials don't have any magnetic properties** and **cannot be made into magnets.**	▪ In **magnetic materials** atoms are grouped in magnetic domains. However, not all magnetic materials are magnets.  The magnetic field of the domains of the nail point in different directions. The magnetic field of these domain cancel each other. So, the magnetic material is **not a magnet**.  A magnetic material becomes a magnet as the magnetic fields of the material's magnetic domains line up in the same direction. A magnetic material **is a magnet**.

Temporary and permanent magnets:

Temporary magnets	Permanent magnets
▪ Act like a magnet only when it is close to another magnet.  The magnetic field is strong enough to cause the nail's magnetic domains to line up. However, when you move the nail away from the magnet, the domains in the nail will return to pointing in different directions.	▪ **In permanent magnet**, the magnetic domains remain lined up even when the magnetic field is removed. - You made the nail **a permanent magnet** by moving it across the bar magnet 25 times. - Or by heating the magnetic materials and allowing them to cool in a very strong magnetic field.

Lesson 2: Electric forces

There are two types of electric charge
- **+ Positive charge**
- **- Negative charge**



- Oppositely charged particles attract each other.
- Similarly charged particles repel each other.

Electric force is noncontact force.

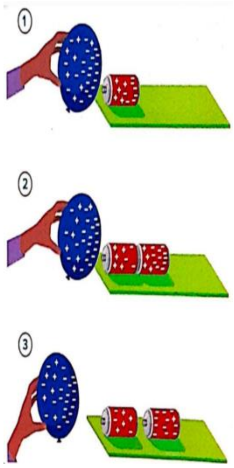
How do charged objects apply electric forces to each other without touching?

There is an invisible region around a charged object that applies an electric force to another charged object, this invisible region called **"electric field".**

Q: What is the meaning of electric field?

Positive charges accumulate on the woman, the charges spread out and **push away** from each other, when charges accumulate on hair each hair will **repel** away from every other hair.

Charged object	Neutral object
▪ Charged particles often move from one object to another so an **electrically charged** object has an unbalanced amount of positive charge or negative charge.	▪ An object with equal amount of positive charge and negative charge is **electrically neutral.**



What is the meaning of induction?

This method of the charging an object without touching it.

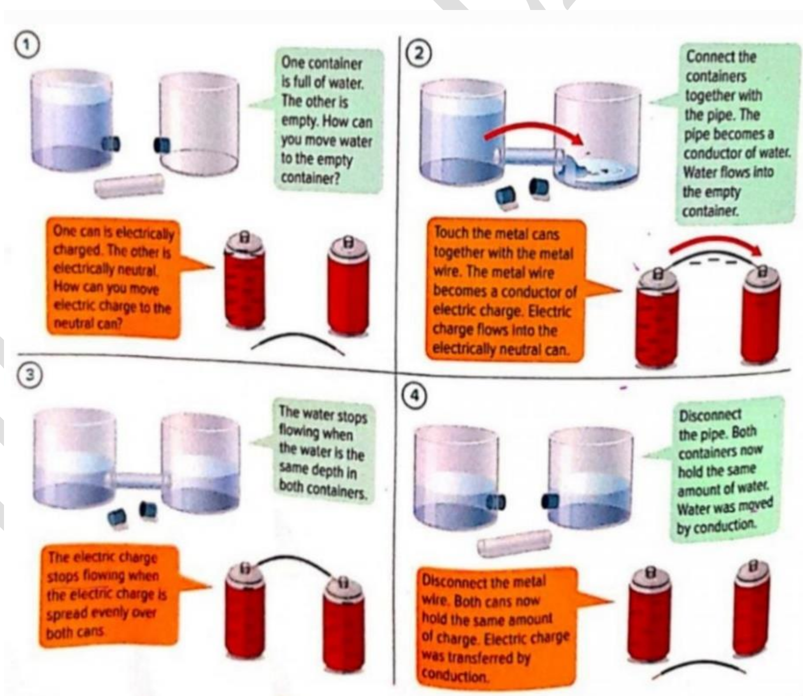
1. When a negatively charged balloon is brought near a can, the negative charges in the can are pushed to the opposite end.
2. When two cans are touching, negative charges are pushed to the farther can.
3. Once the negative charges are in the farther can, the cans are separated.

➢ This leaves the negative charges in the farther can and the positive charges in the closer can.

➢ This method of charging an object without touching it is called **induction**.

Conductors and insulator:

Electric insulator	Electric conductor
▪ A material in which charges **cannot** easily **move.** Ex: Glass – rubber – wood.	▪ A material in which charged particles **can** easily **move**. Ex: copper – aluminium.



Transferring charge:

Charged particles transfer between two conductors is called transferring charge by **conduction.**

As shown in the figure above:

- Charged particles flow from the object with a **greater concentration** of negative charge to the object with a **lower concentration**. Similar to water flowing from a container with **higher water level** to a container with **a lower level**.
- The flow of charged particles continues until the concentration of charge on both objects is **equal.**

Conservation of charge:

Notice that the amount of water didn't change. The amount of **water that started** in the **full container** is the **same** as the **amount of water after the two containers become equal**,

This is **similar** to the **charged particles** flowing between the two conductive objects.

- **Which statement explains why the socks cling to the blanket?**
  A) The socks and blanket dried together which caused them to cling to each other.
  B) The socks and blanket are conductors that picked up some positive charges that keep the clothes together.
  C) The socks and blanket are insulators that picked up some negative charges that keep the clothes together,
  D) The clothes picked up opposite charges. The opposite charges are attracted to each other.
- **Which solution would reduce this problem in a dryer?**
  A) crinkled-up ball of aluminum foil will conduct the charges and remove the charges from the clothes.
  B) Place less clothes in the dryer to prevent rubbing.
  C) Lower the electricity the dryer uses to lower the number of charges in the dryer.
  D) Dry clothes without them touching so that the clothes do not dry together.

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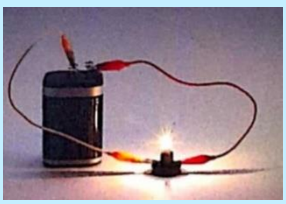
Lesson 3: Simple Circuit

All simple circuits contain: https://youtu.be/x4pdzG-DHnY

1. **A source of electric energy "battery"**
2. **An electric device "light bulb"**
3. **An electric conductor "wire"**
4. **A switch "on, off"**

Closed circuit	Open circuit
Is a circuit that is **complete** and **electric** energy flows through the circuit. 	Is a circuit that is **not complete** and **no electric** energy flows through a circuit ▪ A switch changes a circuit between open and closed.

Charged particles:

recall that charged particles repel like charges and attract unlike charges.

- The charged particles can travel along the conducting wire in a circuit by the repelling force between the like charges and the attraction between unlike charges.

❖ The movement of electrically charged particles is an **electric current.**

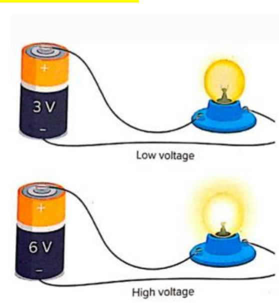
What factors affect an electric current?

1) Voltage: is the electrical potential energy difference between two places on a circuit.

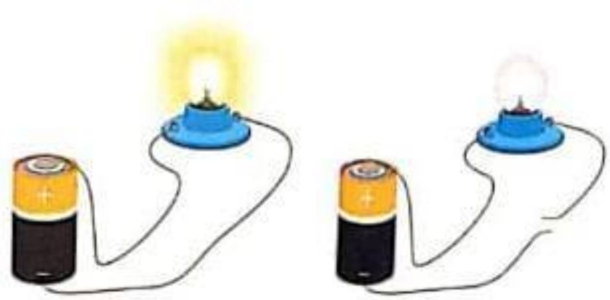
EX: batteries in flashlight use 1.5V, hairdryer use 120V.

- In a light bulb electric energy transformed into → light energy
  → thermal energy
- The amount of energy that transformed by the circuit depends on the battery's voltage.

EX: A **9 volt** "V" battery produces about **six times more light and thermal energy** than the light bulb with **1.5 V**.



A 1.5 V battery is connected to a light bulb with some wires. One of the wires is cut, breaking the circuit.



- **What is the electrical potential energy difference across the light bulb after the wire is cut?**
  A) 0.0 V
  B) 1.5 V
  C) -1.5 V
  D) Need more information.

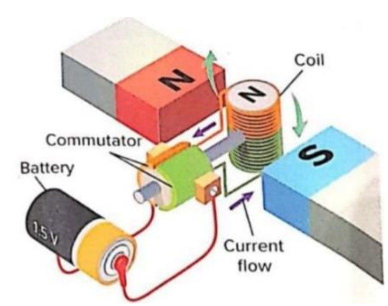
- **After the wire is cut what is the electrical potential energy difference across the two ends of the cut wire?**
  A) 0.0 V
  B) 1.5 V
  C) -1.5 V
  D) Need more information.

Lesson 4: Electromagnetism

Lab: - Motor ON https://youtu.be/OKpmp7R6vBU

Magnets and Electric Motors:

Power tools, electric fans, hair dryers, computers, and even microwave ovens use electric motors. An electric motor is a device that uses an electric current to produce motion. A simple electric motor has three main parts.



1. The main parts of an electric motor are a coil of wire connected to a rotating shaft
2. A permanent magnet
3. A source of electric energy, such as a battery.

Some electric motors require a commutator. A commutator is a type of electrical switch that reverses the current in the coil.

Using Electric Motors:

In an electric motor, electric energy is transformed to mechanical energy to produce motion. Electric motors are used in many devices from windshield wipers to CD players.

Almost any device that needs to produce motion uses an electric motor.

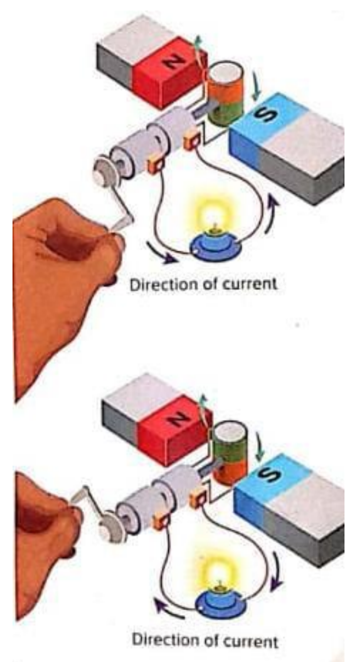
1. The strength of an electric motor depends on the strength of the permanent magnet.
2. The voltage.
3. The number of wire coils.

Electric generator

How can motion be used to produce electrical energy?

An electric generator is a device that uses a magnetic field to transfer mechanical energy to electric energy.

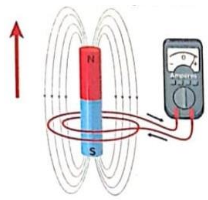
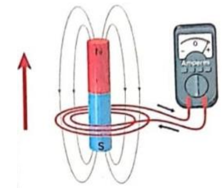
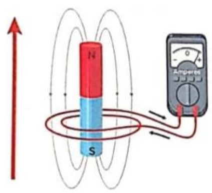
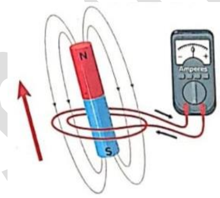
Electric Generators:



In a generator, the crank rotates a wire coil through the magnetic field of a small permanent magnet. This produces an electric current in the circuit. The current continues only as the crank rotates the coil within the magnetic field.

Types of Current:

Direct current	Alternating current
▪ The current produced by a battery flow in a circuit in only one direction. An electric current that flows in one direction.	▪ An electric current that changes direction in a regular pattern.

The strength of the current is proportional to the strength of the magnet. **Stronger magnet, stronger current** 	The strength of the current increases with the number of coils present in the wire or with the use of an electromagnet or coils around a magnetic core. **More coils, stronger current** 
The strength of the current can increase by increasing the speed of the magnet. **Faster motion, stronger current** 	The strength of the current can increase by making the magnet more perpendicular to the current. **Less perpendicular, weaker current** 

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Inspire science grade 8

Module: Introduction to waves

Lesson 1: Waves Properties

1) Mechanical Waves

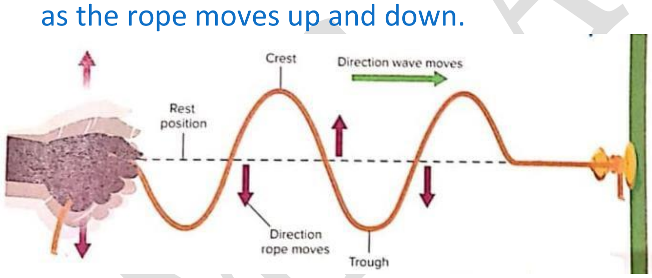
A Mechanical wave is a wave that travels only through matter. Mechanical waves can travel through solids, liquids, and gases, but not through a vacuum.
A material in which a wave travels is called **a medium**.

Two types of mechanical waves: **Transverse waves** and **longitudinal waves.**

Transverse waves

transverse wave is a wave in which the disturbance is perpendicular to the direction the wave travels.
Examples include a flag moving in the wind.

- Repeating pattern of crests and troughs as the rope moves up and down away from its rest position.
- The wave travels from the hand to the doorknob as the rope moves up and down.

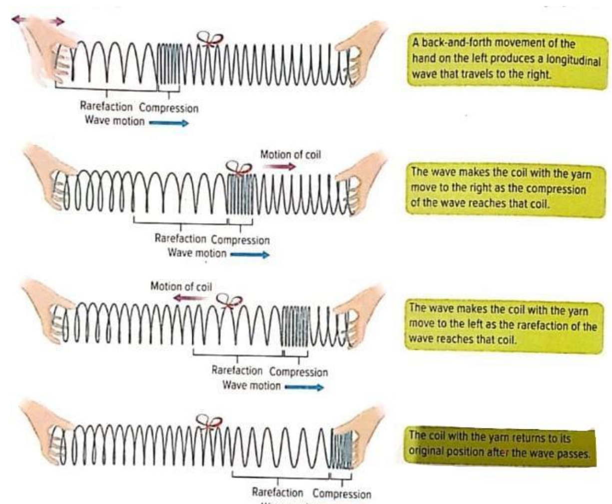


- As long as your hand keeps moving up and down, energy transfers to the coil spring and produces waves. When your hand stops, waves no longer are produced.
- However, the waves produced by the earlier movements of your hand continue to travel along the spring.
- This is true for any vibrating object. Waves can keep moving even after the object stops vibrating.

Lab: https://youtu.be/MrPTt3pv6xk

longitudinal waves.

longitudinal wave causes the particles in a medium to move parallel to the direction that the wave travels.
The sections of a longitudinal wave where the particles in the medium are closest together are **compressions.** The regions of a longitudinal wave where the particles are farthest apart are **rarefactions.**



Lab: https://youtu.be/3J6zWv2CqEY

Lab: https://youtu.be/7cDAYFTXq3E

An earthquake wave is called a **seismic wave**. Seismic waves are mechanical waves because they move through matter.

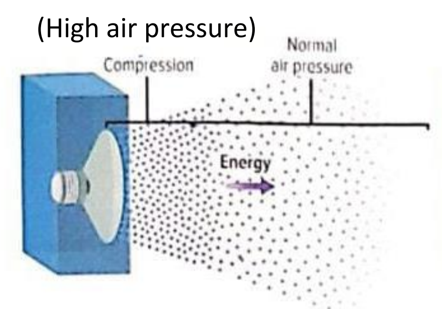
Sound Waves

One type of longitudinal wave is a sound wave. **A sound wave** is a longitudinal wave that can travel only through matter

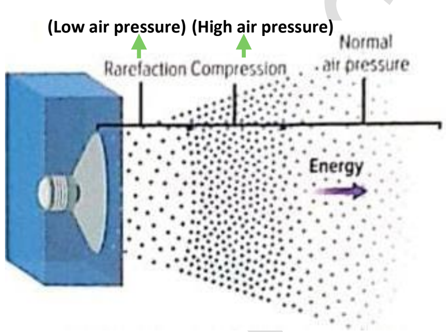
1- The sounds you might hear now are traveling through air-a mixture of solids and gases.
2- When swimming, you may have dove underwater and beard someone call to you. Then the sound waves travelled through a liquid.
3- Sound waves travel through a solid when you knock on a door. Sound is produced by a vibration.

Sound Wave Models

Show how the air particles move as the energy from the sound wave travels through the air.

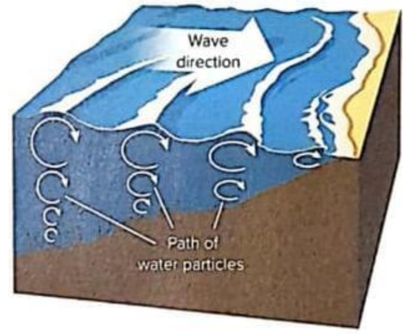


When the speaker cone moves out, it forces particles in the air closer together. This produces a high-pressure area, or compression.



When the speaker cone moves back, it leaves behind an area with fewer particles. This is a low-pressure area called a rarefaction.

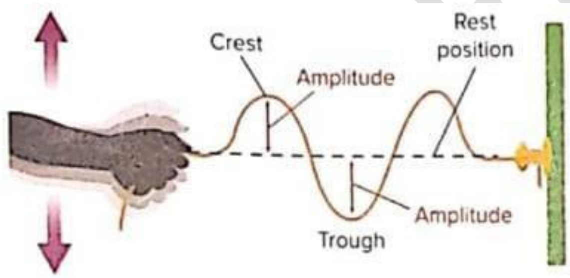
Water Waves



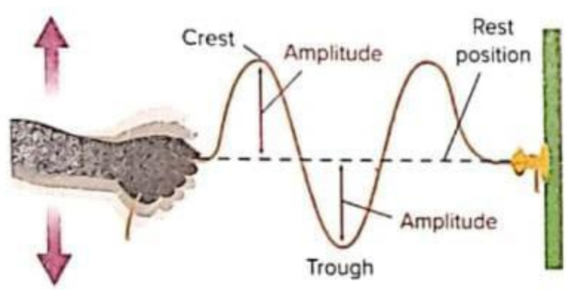
Friction between the wind at sea and the water forms water waves. Because the waves move only through matter, water waves are mechanical waves.
Water waves are a **combination of transverse and longitudinal waves.** Water particles move forward and backward. They also move up and down. The result is a circular path that gets smaller as the wave approaches land.

Proportional Relationships

The transverse wave produced on the top has a smaller amplitude and carries less energy than the wave on the bottom.
The amplitude of a wave is proportional to **the energy** that produces that wave.

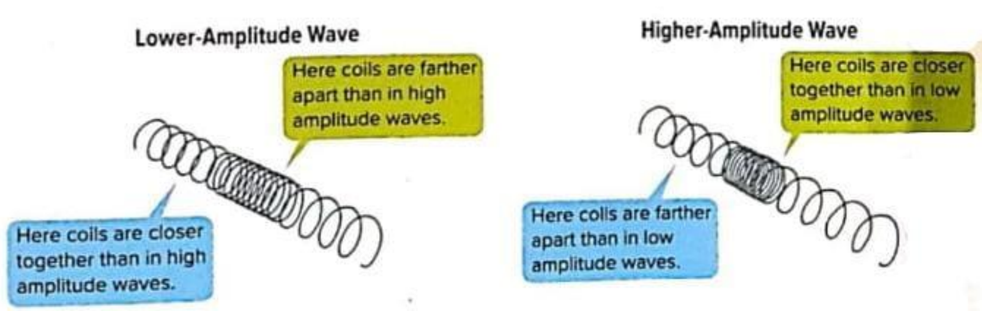


This wave has a smaller amplitude and carries less energy.



This wave has a greater amplitude and carries more energy.

the energy carried by a longitudinal wave increases as its amplitude increases. The amplitude and energy are proportional.



The relationship between **wave energy** and **amplitude** can be expressed with a mathematical model.

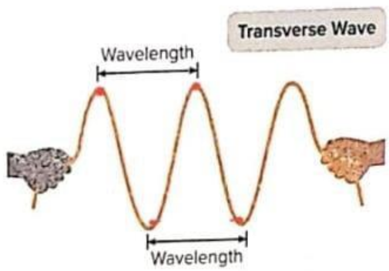
Energy α Amplitude²

$$E \propto A^2$$

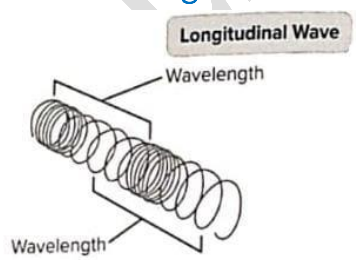
The energy of the wave is the square of the amplitude**. For example,** if the height is doubled, each wave will have four times the energy. If the height is halved, each wave will have a quarter of the energy.

Wavelength

The distance between one point on a wave to the same point on the next wave is the **wavelength**.
Longitudinal waves are measured from one compression to the next compression or from one rarefaction to the next rarefaction.
Transverse waves from one crest to the next and from one trough to the next.



Wavelength is the distance from one crest to the next crest or from one trough to the next trough.



Wavelength is the distance from one compression to the next compression or from one rarefaction to the next rarefaction.

Frequency

The frequency of a wave is the number of times the pattern repeats in a given time.

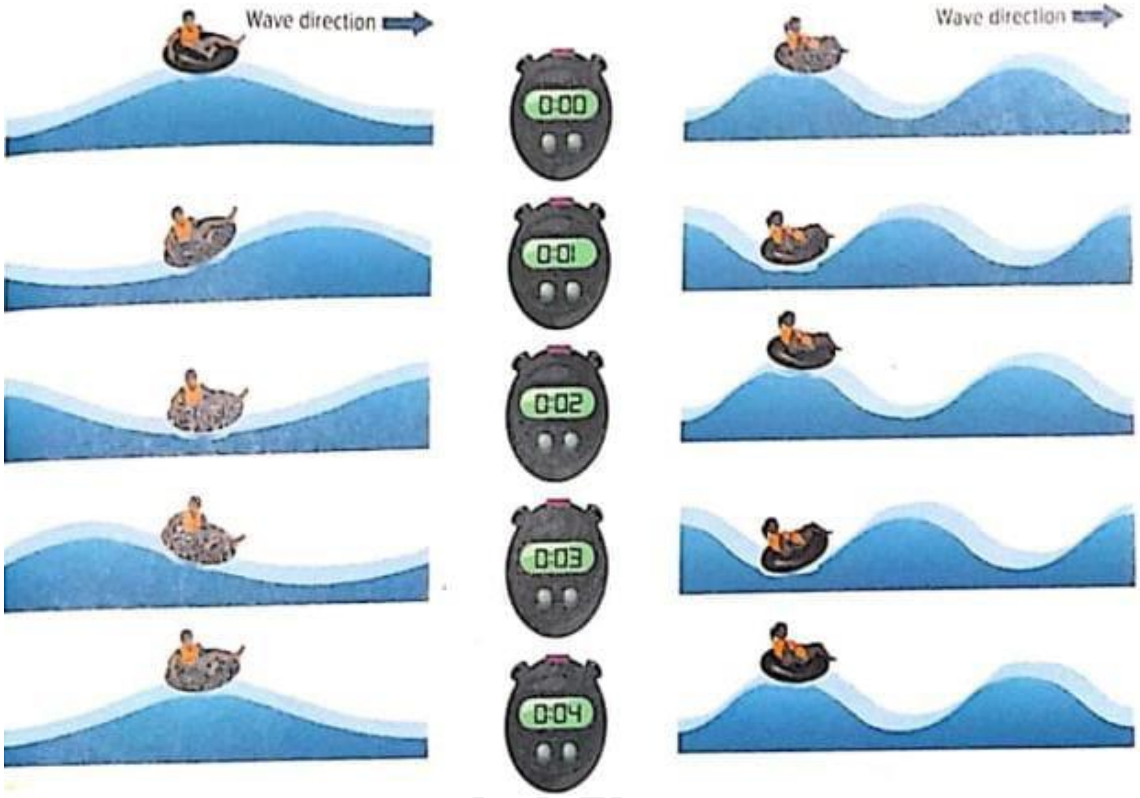
- Each vibration of the object produces one wavelength.
- The frequency of a wave is the same as the number of vibrations the vibrating object makes each second.
- The SI unit for frequency is hertz (Hz).
- A wave with a frequency of 2 Hz means that two wavelengths pass a point each second. The unit Hz is the same unit as 1/s.

The amount of energy transferred by waves in a given time is proportional to the wave's frequency. If the frequency of the waves doubles, the energy of the wave also doubles. Similarly, if the frequency decreases by half, the energy will also decrease by half.

$$(E \propto f)$$

Wavelength and Frequency

The **figure** shows how frequency and wavelength are related. The wavelength of the wave in the left column is longer than that of the wave in the right column.



- Longer wavelength
- Lower frequency
- One complete wave passes in four seconds

- Shorter wavelength
- Higher frequency
- Two complete wave passes in four seconds

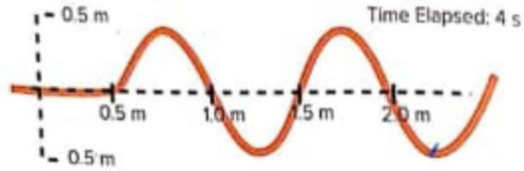
To calculate the frequency of waves, divide the number of wavelengths by the time. For the wave on the left, the frequency is 1 wavelength divided by 4s, which is 0.25 Hz. The wave on the right has a frequency of 0.5 Hz.

As the frequency of a wave increases, the wavelength decreases.

$$f = \frac{\text{Number of wavelength}}{\text{time}}$$

$$f = \frac{1}{4} = 0.25\ HZ$$

Determine the wavelength, frequency, and amplitude for each wave.



Wavelength: 1.5 – 0.5 = 1 m

Frequency: $\frac{2}{4} = \frac{1}{2} = 0.5\ HZ$

Amplitude: 0.5 m

Wavelength: 1 – 0.5 = 0.5 m

Frequency: $\frac{3}{3} = 1\ HZ$

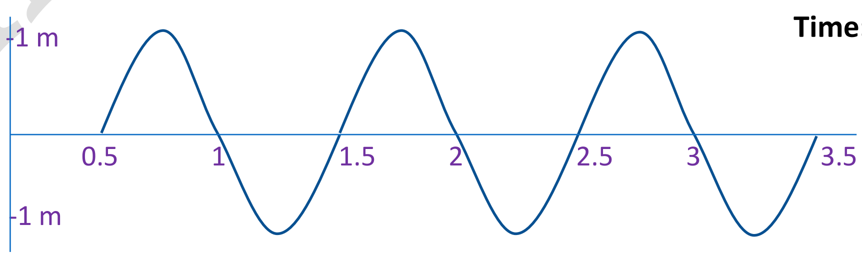
Amplitude: 0.5 m

Wave properties

Assessment

1- Determine the wavelength, frequency and the amplitude for each wave: -

Time: 3 s



- Wavelength =

- Frequency =

- Amplitude =

2- Human ear can detect sounds with frequencies between about ……………… HZ and ……………… HZ.

3- When the wavelength decreases, the frequency ………………

4- ……………… Us the amount of sound energy that passes through a square meter of space in one second.

5- When the energy spread out among more and more air particles, the intensity of the wave ………………

(Decreased – Increased)

6- As intensity increase, amplitude ………………, and loudness ………………

7- If the amplitude = (5m), each wave will have ……………… Energy.

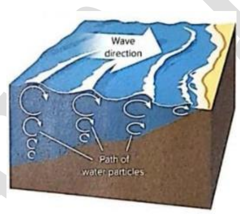
8- [✓ or ✗] Mechanical wave travels through matter and also through vacuum(   ).

9- The two types of mechanical wave are ……………… and ………………

10- The region in the longitudinal wave that particles are farthest apart is called ………………

11- Which type of waves it is?

………………



Answer

1- Wavelength = 1.5 -0.5 = 1 m

Frequency = $\frac{no.of\ waves}{time} = \frac{3}{3} = 1\ HZ$

Amplitude = 1 m

2- 20, 20.000 HZ

3- Increases

4- Intensity

5- **Decreased**

6- **Increases, increases**

7- **(5)2 = 25**

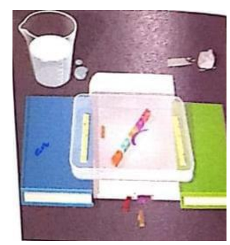
8- ✗

9- **Transverse wave and longitudinal wave**

10- **Rarefaction**

11- **It's a combination of transverse wave and longitudinal wave.**

Lesson 2: Mechanical wave interactions



How do waves interact with matter?

Lab: Crashing Waves https://youtu.be/Zf3vVfEC3FI

Interaction of Waves with matter

1) Reflection

Is the bouncing of a wave off a surface. All waves reflect. An echo is an example of a sound wave reflecting.

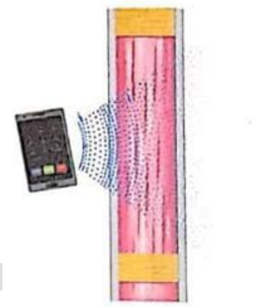
- When a wave reflects, it changes direction.
- When a wave is reflected from a surface, the angle of the reflection is equal to the angle the wave strikes the barrier.

2) Absorption

Is the transfer of energy by a wave to the medium through which it travels.

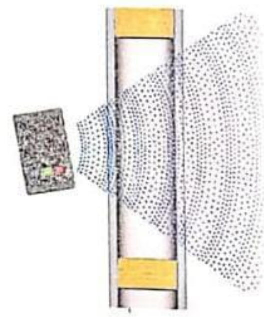
The amount of energy absorbed depends on:

- **The type of wave**
- **The material in which it moves.**



In the figure on the right the sound from the cell phone is absorbed by the insulation in the wall.

3) Transmission



Is the passage of a wave through a medium. The sound from a cell phone in the figure on the right transmits easily through an uninsulated wall.

Without transmission we would not hear sound waves on the other side of doors.

Speed of Sound

Two factors that influence the speed of sound waves are:

1. The density
2. The temperature of the medium.

1) Density:

Gas particles are far apart and collide less often than particles in a liquid or a solid. As shown in the table on the right, **a gas** takes **longer** to transfer sound energy between particles. **In a solid** where the particles are packed very close together, the particles collide and **transfer energy very quickly**. **The more dense a medium, the faster sound will travel through it**.

The Speed of Sound	
Medium	**Speed (m/s)**
Air (0°C)	331
Air (20°C)	343
Water (20°C)	1,481
Water (0°C)	1,500
Seawater (25°C)	1,533
Ice (0°C)	3,500
Iron	5,130
Glass	5,640

2) Temperature:

Particles move faster and collide more often as the **temperature of a gas increases**. This increase in the number of collisions transfers more energy in less time. **Temperature has the opposite effect on liquids and solids**. As **liquids and solids cool**, the molecules move closer together. They collide more often and **transfer energy faster**.

In liquids and solids, increasing temperature

↓

decreasing the speed of Sound

In gases, increasing temperature

↓

increasing the speed of Sound

4) Diffraction

The change in direction of a wave when it travels by the edge of an object or through an opening is called **diffraction.** Both water waves and sound waves diffract.

Speed of Sound in Different Materials	
Material (at 20°C)	**Speed (m/s)**
Air	343
Glass	5,640
Iron	5,130
Water	1,481

- **A sound wave takes about 0.03 s to move through a material that is 10.3 m long. What is the material?** $\frac{10.3}{.03} = 343 \text{ m/s}$

A) Air
B) Glass
C) Iron
D) Water

You are in a sound-proofed hallway. Someone standing around the corner from you speaks and you hear them. Which claim offers the best evidence and reasoning for this phenomenon?

A) Sound is not affected by types of materials, because sound can travel though solids, liquids, and gases
B) Sound waves are absorbed by the sound-proofed walls and then transmitted through the wall to your ear
C) Sound waves diffract so even though the walls do not reflect the sound wave, the sound wave can still travel to your ear.
D) Sound-proof walls allow sound waves to reflect all of the sound that is directed toward them. So, the sound must bounce off them and go to your ear.

Questions!

1) This is the term that describes when light passes through matter.

A) Transmission
B) Transparent
C) Translucent
D) Opaque

2) Which of the following is NOT a cause of a wave changing direction?

A) Reflection
B) Transmission
C) Radiation
D) Absorption

3) When a wave bends or spreads past a medium, this is referred to as

A) Reflection
B) Refraction
C) Radiation
D) Diffraction

4) Sound travels faster in ---------- than in liquids

A) solids
B) gas
C) water
D) air

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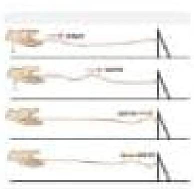
5) **Movie theaters use sound proofing to reduce echoes, Soundproofing materials are designed to the sound.**
   A) Absorption
   B) Transmission
   C) Diffraction
   D) Reflection

6) **Which of the following is NOT a way that waves interact with matter?**
   A) Waves can be reflected by matter.
   B) Waves are affected by gravity.
   C) Waves can transfer energy to the medium through which it travels.
   D) As waves pass through matter, some of the energy they carry can be transferred to matter.

7) **Which type of interaction is this?**
   A) reflection
   B) refraction
   C) diffraction

8) **Which type of interaction is this?**
   A) reflection
   B) refraction
   C) diffraction



9) **Which type of interaction is this?**
   A) reflection
   B) refraction
   C) diffraction

10) **Which type of interaction is this?**
   A) reflection
   B) refraction
   C) diffraction

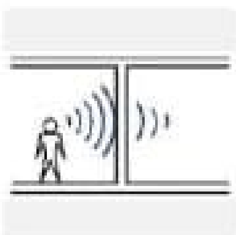
11) **Sound travels FASTEST through which of these materials?**
   A) Air
   B) Empty space
   C) Solid
   D) Water

12) Sound does not travel in space because

A) Space is too far away.
B) There is no matter in space.
C) The energy is too weak
D) The sound from our surrounding id too loud

13) Why is the school library covered with carpet?

A) So, everyone can make a lot of noise
B) to help absorb sounds to keep it quiet
C) because it looks good
D) to help absorb sounds so it can stay noisy



14) The image represents which of the following wave interations?

A) Reflection
B) Absorption
C) Transmission
D) Diffraction

Answer

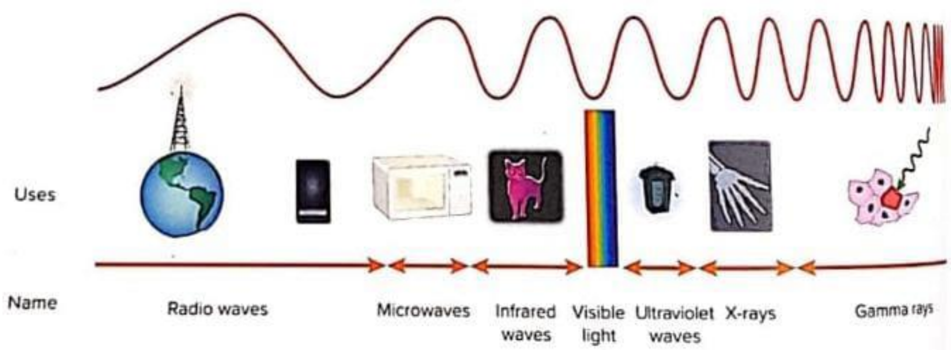
1. Transmission
2. Radiation
3. Diffraction
4. Solids
5. Absorption
6. Waves are affected by gravity.
7. diffraction
8. reflection
9. diffraction
10. reflection
11. Solid
12. There is no matter in space.
13. to help absorb sounds to keep it quiet
14. Transmission

Module: Light

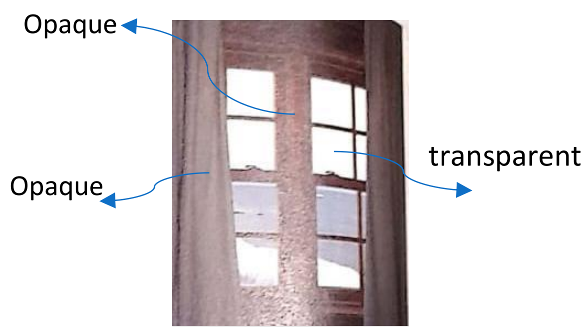
Lesson 1: How light travels

What is light?

Light is a type of wave. Light is electromagnetic radiation that you can see.
Electromagnetic radiation is a type of wave created by vibrating particles.
These waves radiate, or spread out, electric and magnetic fields in all directions from a source.
The energy carried by an electromagnetic wave is called **radiant energy**.
There are many different types of electromagnetic waves. These waves are classified by their wavelengths and frequencies in the electromagnetic spectrum.



How does light interact with matter?

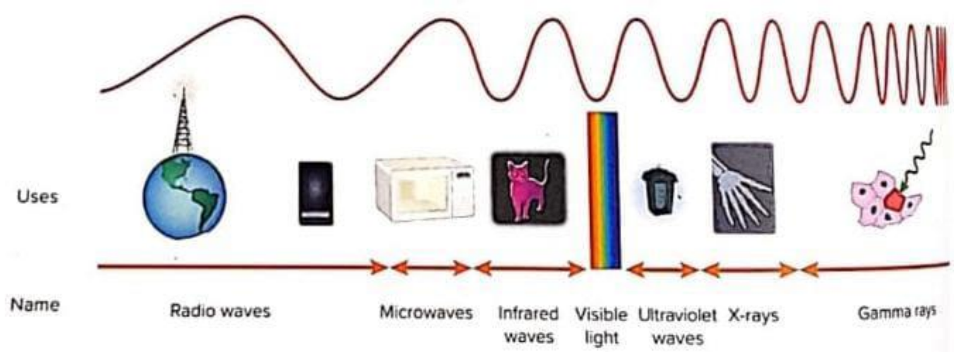
1) Transmission		2) Absorption
transparent(جسم شفاف)	**translucent**(جسم شبه شفاف)	**Opaque** (جسم معتم)
Air and clear glass transmit light with little or no distortion. A material that allows almost all of the light striking it to pass through, and through which objects can be seen clearly. 	Materials such as waxed paper or frosted glass also transmit light, but you cannot see through them clearly. A material that allows most of the light that strikes it to pass through, but through which objects appear blurry. 	Some materials absorb most of the light that strikes them. They transmit no light. Therefore, you cannot see objects through them. A material through which light does not pass. 

3) Reflection

When you look at a pane of glass, you sometimes can see an image of yourself. Light bounces off you, strikes the glass, and bounces back to your eye. Recall that the bouncing of a wave off a surface is called **reflection**. Reflected light allows an object to be seen.

Most types of matter interact with light in a combination of ways. **For example**, a window pane both **transmits** and **reflects** light. Some of the light that strikes an opaque object, such as a book, is **absorbed** and **reflected** at the same time.

- **Use the model below to answer questions.**



What pattern best describes the relationship between wavelength and frequency?

A. As frequency increases, wavelength increases.
B. As frequency decreases, wavelength decreases.
C. As frequency increases, wavelength decreases.
D. There is no relationship between wavelength and frequency.

- **Read the passage and then answer question.**

Stars and other objects in the universe give off, or emit, energy in the form of waves. Most stars emit energy in all wavelengths. But how much of each wavelength they emit depends on their temperatures. Hot stars emit mostly shorter waves with higher energy, such as X-rays, gamma rays, and ultraviolet waves. Cool stars emit mostly longer waves with lower energy, such as infrared waves and radio waves. The Sun has a medium temperature range. It emits much of its energy as visible light. These waves travel through vast regions of space and reach Earth.

Which argument is best supported by the passage?

A. The higher the temperature of a star, the more energy it emits.
B. Cool stars do not produce radio waves.
C. Visible light only comes from the Sun.
D. The amplitude of a light wave is determined by its energy.

Lesson 2: Reflection and mirrors

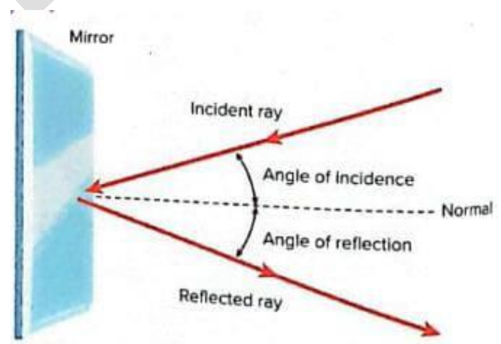
What happens when light reflects off a smooth, flat surface?

Reflection of Light

When you look at a pane of glass, you sometimes can see an image of yourself. Light bounces off you, strikes the glass, and bounces back to your eye. Think about a calm lake like the one on the right. You can see the reflection of the trees on the other side of the lake.

Law of Reflection

Light behaves in predictable ways when it reflects. The rays in the ray diagram show how light reflects. An imaginary line perpendicular to a reflecting surface is called **the normal**. The light ray moving toward the surface is the **incident ray**. The light ray moving away is the **reflected ray**.

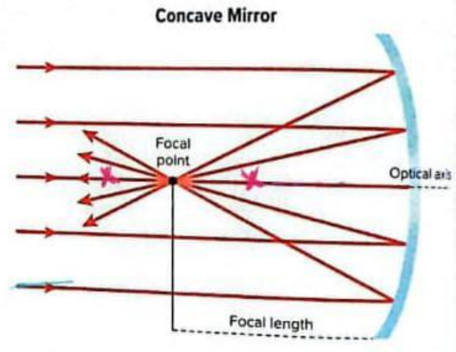
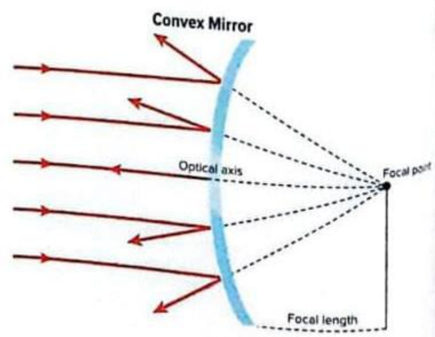


law of reflection, when a wave is reflected from a surface, the angle of reflection is equal to the angle of incidence.

(زاوية السقوط = زاوية الانعكاس)

What happens when light reflects off a smooth, curved surface?

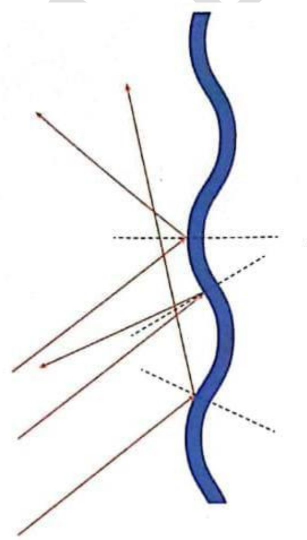
Concave Mirrors	Convex Mirrors
Not all mirrors are flat. A mirror that curves Inward is called a **concave mirror**. A line perpendicular to the center of the mirror is the **optical axis**. When rays parallel to the optical axis strike a concave mirror, the reflected rays converge, or come together.	The mirror enables someone to see places they cannot see with a plane mirror and around corners where someone else may be walking. A mirror that curves outward, like the back of a spoon, is called a **convex mirror**. Light rays diverge, or spread apart, after they strike the surface of a convex mirror.

Concave Mirrors	Convex Mirrors
	

https://youtu.be/EwBK_cXUTZI

- **Focal point:** The point where light rays parallel to the optical axis converge after being reflected by a concave mirror is the focal point.
- The distance along the optical axis from the mirror to the focal point is the **focal length**.
- The lesser the curve of a mirror, the longer its focal length.
- The position of an object compared to the focal point determines the type of image formed by a concave mirror.

➢ **Use the model below to answer questions.**



Which object has a surface structure that reflects light rays in the functional manner shown in the model above?

A. convex mirror

B. glass window.

C. polished silver spoon

D. pond with ripples

What type of reflection is modeled?

A. diffuse reflection

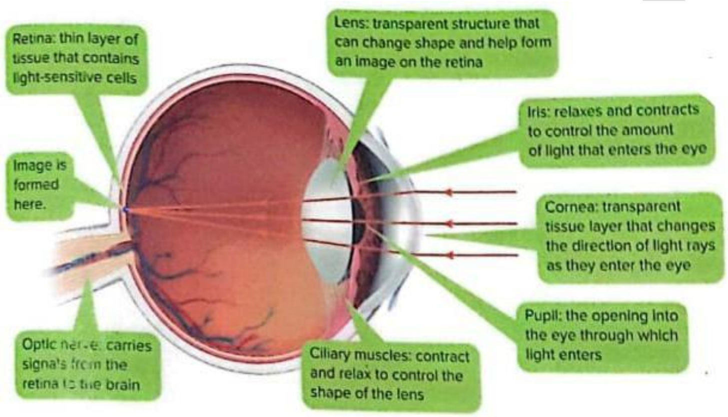
B. real image

C. virtual image

D. regular reflection

Human eyes contain lenses, as well as other tissues, that can enable a person to see:

1. Light waves first travel through the cornea. **The cornea** is a convex lens made of transparent tissue located on the outside of the eye.



(Convex lens)

(Convex lens)

2. Next, the light travels through the iris to the second lens, which is simply called the lens. It is made of flexible, transparent tissue. The lens enables the eye to form a sharp image of **nearby** and **distant objects.**
3. The image created by the light passing through these lenses is then projected on a thin layer of tissue at the back of the eye.
4. Special cells in this layer convert the image into electrical signals. Nerves carry these signals to the brain.

Some vision problems are caused by the cornea's structure. When the cornea fails to form an image on the back of the eye, corrective lenses can be worn to direct the light.

Focal Point and Focal Length

Similar to A mirror, the point where rays parallel to the optical axis converge after passing through a lens is the **focal point**.

The distance along the optical axis between the lens and the focal point is the **focal length** of the lens.

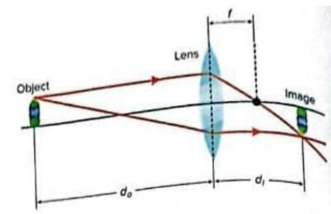
Because you can look through a lens from either side. a focal point is on both sides of the lens.

Types of Images

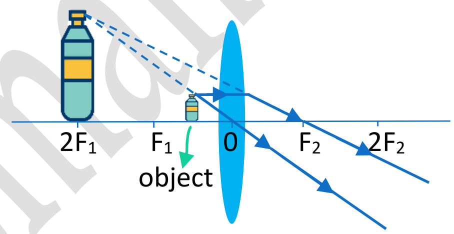
Like a concave mirror, the type of image a convex lens forms **depends on** the location of the object.

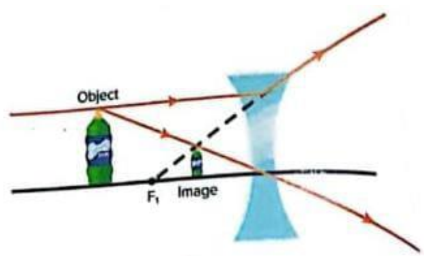
A convex lens can form both **real** and **virtual images**.

1. If you look through a magnifying lens at an object more than one focal length from the lens, the **image you see is inverted and smaller** (the image is real).

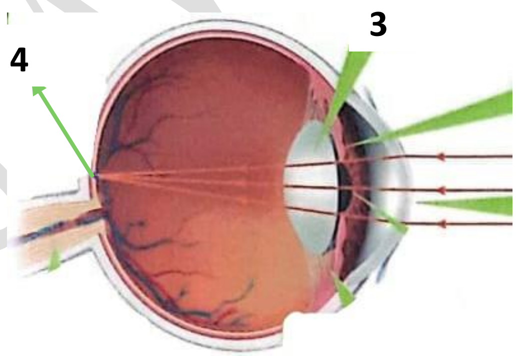


2. If you look at an object **less than one focal length** from the lens, the image you see is upright and larger. The image is virtual because your brain interprets the rays as moving in a straight line.





(Concave lens forms a virtual image)



Which part of the eye can change its structure as a function to form a focused image?

A) 1
B) 2
C) 3
D) 4

- **Which of the following arguments identifies the best explanation about a concave lens bring used to start a fire?**
  A) A concave lens will focus the Sur's light into a point that will cause a piece of paper to catch on fire.
  B) Because the Sun's light comes from all directions, a concave lens will straighten the light onto the paper causing the paper to catch on fire.
  C) Because a concave lens diverges the light, the Sun's light will not focus on the paper and no fire will occur.
  D) A concave lens will focus the Sur's light before the light can reach the paper, and no fire will occur.

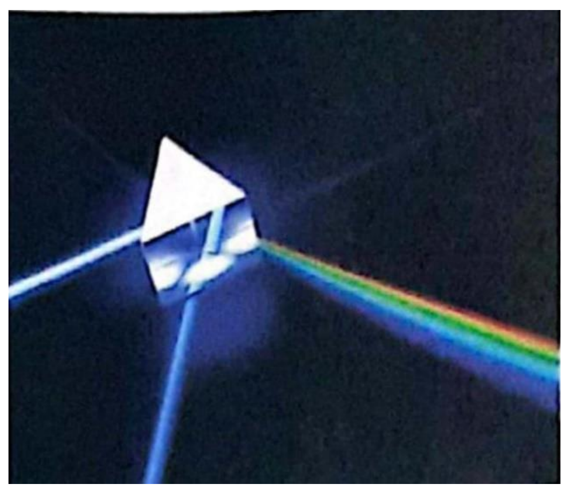
Lesson 4: Color of Light

Separating Colors of Light

White light is made up of different colors → Each color has a different range of wavelengths and frequencies.

Waves with longer wavelengths and lower frequencies travel at **greater speeds** in a medium than waves with shorter wavelengths and higher frequencies.

When entering a medium, light with **lower** frequencies **travels faster** and **refracts less** than light with **higher** frequencies.



Violet wavelengths refract the most because their frequencies are the highest.

Red wavelengths have the lowest frequencies and refract the least.

This causes the colors of light to spread out when they are refracted though a prism.

Pigments

Each color of paint in a set of watercolors contains different pigments, or dyes → Each pigment absorbs some colors of light and reflects other colors.

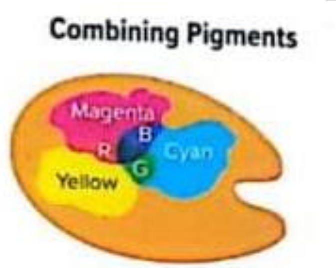
- Mixing pigments produces many different shades
- As you add each color of pigment, the mixture gets darker and darker because more colors are absorbed (**Cyan**, **magenta**, and **yellow** are the primary pigments) Combining equal amounts of these pigments makes **black.**

Light

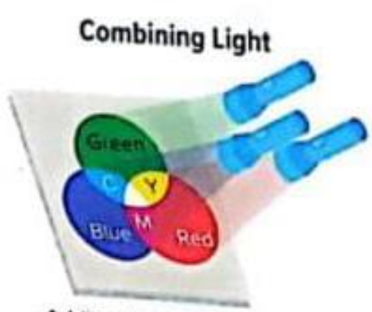
(**Red**, **green**, and **blue** are the primary light colors) If you shine equal amounts of red light, green light, and blue light at a white screen, each color reflects to your eyes.

Where **two of the colors** overlap. both wavelengths reflect to your eyes and **you see a third color.**

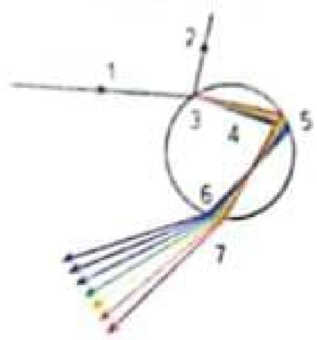
Where the **three colors overlap**, all colors reflect and you see **white light**.



Each primary pigment subtracts color by absorption. Mixing all three pigments equally produces black.



Adding the three primary colors of light produces the colors of the primary pigments and white.



What produced the light represented by ray 2?

A) It was absorbed by the drop.
B) was reflected from the drop
C) it was refracted by the drop.
D) it was transmitted by the drop.

What caused the spread of the colors at point 7?

A) absorption
B) reflection
C) refraction
D) transmission

What colors of light make up ray 1?

A) the primary colors of light-red, blue, and green
B) the secondary colors of light-cyan, magenta, and yellow
C) C No colors. The ray is black.
D) All of the colors. The ray represents white light

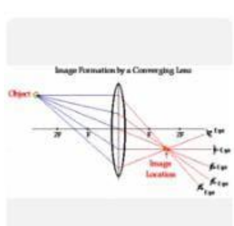
Questions!

1) What type of image is formed when rays of light actually intersect?

A) real
B) virtual
C) projected
D) curved

2) This image is-------------

A) inverted and smaller
B) inverted and larger
C) not inverted and smaller
D) not inverted and larger



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3) An image that you can see, but does not really exist is called which of the following?

A) Real Image
B) Fake Image
C) Virtual Image
D) Digital Image

4) a real image -------------

A) is produced by virtual rays and can be projected on a screen
B) is produced by real rays and cannot be projected on a screen
C) is produced by virtual images and cannot be projected on a screen
D) is produced by real rays and can be projected on a screen

5) **Convex lenses can produce** -------------

A) Real, erect images
B) Virtual, inverted images
C) Real, inverted images
D) no images form

6) Which describes a convex lens?

A) triangular in shape
B) more transparent in the middle
C) thicker on the edges than in the middle
D) thicker in the middle than on the edges

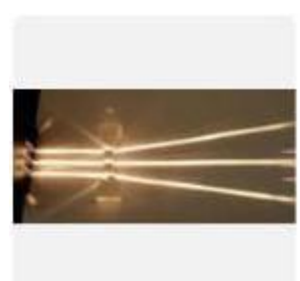
7) Which lens is used to magnify objects and refract light. This type of lens is curved outward.

A) convex
B) concave

8) ------------- **is a lens that is thicker in the middle and makes an object appear bigger.**

A) prism
B) convex lens
C) concave lens
D) mirror

9) ------------- **is a lens that is thicker on its edges and makes an object appear smaller?**



A) mirror
B) convex lens
C) concave lens
D) prism
E)

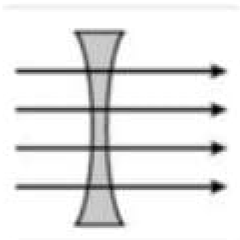
10) What Does a Concave Lens Do?

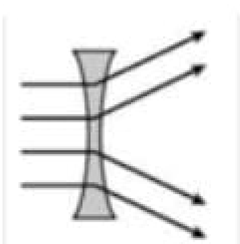
A) Make things bigger
B) Make things smaller
C) Make things closer
D) Make things happy

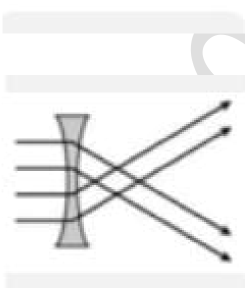
11) What Does a Convex Lens Do?

A) Make things bigger
B) Make things smaller
C) Make things closer
D) Make things sader

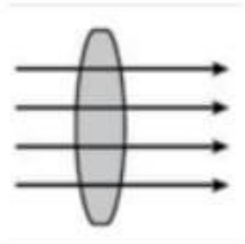
12) Which lens represents the path light takes through a concave lens?

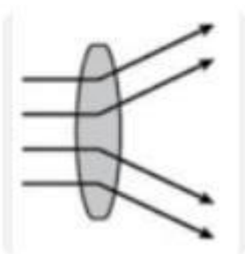
A) 

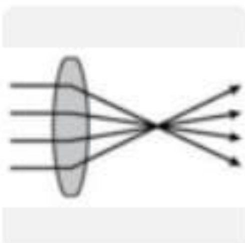
B) 

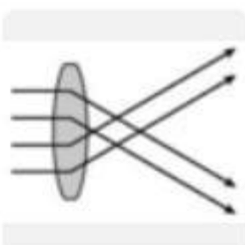
C) 

13) Which figure represents the path light takes through a convex lens?

A) 

B) 

C) 

D) 

14) When an object is placed at 2f in front of a convex lens, the image will be-------------

A) real, reduced, and inverted
B) real, true, and inverted
C) real, enlarged, and inverted
D) virtual, enlarged, and upright

15) Because the light rays never meet, a concave lens can produce -------------

A) No image
B) Both real and virtual images
C) Only a real image
D) Only a virtual image

16) What kind of lens curves outward from the center of the lens

A) Glass
B) Concave
C) Convex
D) Water

17) What kind of lens curves inward toward the center of the lens

A) Glass
B) Concave
C) Convex
D) Water

Answer

1. Real
2. Inverted and smaller
3. Virtual image
4. is produced by real rays and can be projected on a screen
5. Real, inverted images
6. Real, inverted images
7. convex
8. convex lens
9. concave lens
10. Make things smaller
11. Make things bigger
12. B
13. C
14. real, true, and inverted
15. Only a virtual image
16. Convex
17. Concave