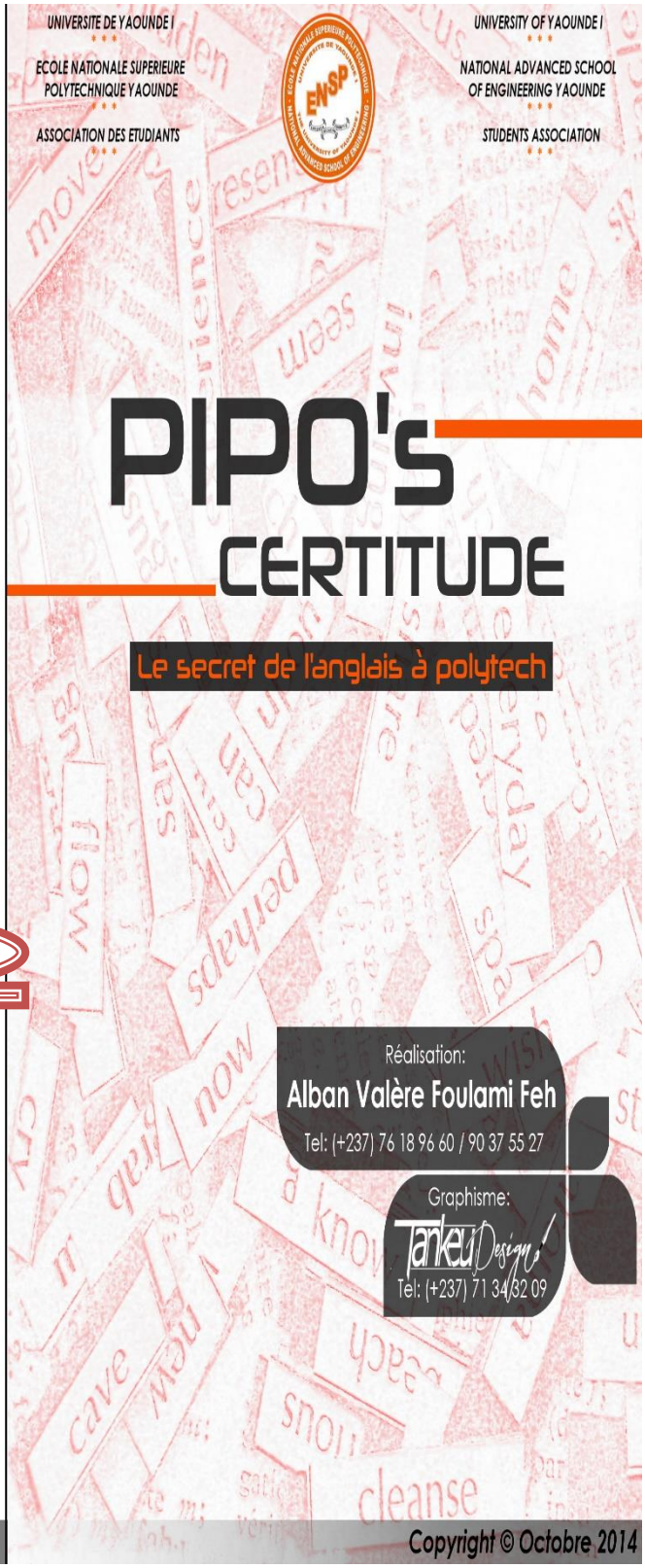
Niveau 2



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PROLOGUE

Une fois de plus je me présente à vous ! Cette fois si c'est sous une nouvelle forme, « **THE PIPO'S CERTITUDE** ». Ce document rendu du cours d'anglais du professeur constitue ce que j'ai appelé le secret d'anglais à POLYTECH. Il apparait dans le but de résoudre les problèmes des étudiants de MSP notamment en ce qui concerne les notes de cours qui sont déjà très difficile à assemblé et aussi, la facilité avec laquelle les cours sont énoncés est une certitude pour l'étudiants de maitriser la langue anglaise d'où le nom du document.
Ce document comporte :

- Les notes de cours de l'enseignant en charge de l'UE
- Les exercices d'application après chaque notion évoquée

Ainsi donc je vous prie de bien vouloir appréhender en profondeur et avec beaucoup d'attention toutes les notions évoquées dans ce manuel tout du moins conseillé et recommandé par la voie la plus autorisé des étudiants.

Point n'est question pour nous d'encourager la facilite destructive du « FAX »-ce que nous déconseillons d`ailleurs aux pipos-mais la philosophie principale de ce document est d'une part de partager les difficultés que nous avons eu à rencontrer et d'autre part y proposer des solutions et donc aider l'étudiant à assimiler les enseignements reçus en classe.

Conscient par ailleurs de nos imperfections toute suggestion en vue de l'amélioration (en fond et en forme) de ce document sera la bienvenue.

Je remercie donc les amis qui n'ont ménagé aucun effort pour que ce document soit fait dans ses qualités les plus élogieuses. Il s'agit de :

KAMGA KAMDEM (2MSP)

TSE Ernest (3GM)

Merci à vous.

Valère FOULAMI

I. MATTER AND MEASUREMENT

Measurement is the noun form coming from the verb **to measure.**
Matter is **a substance that exists in the universe as a combination of elements or a single element/an object that has mass and occupies space.**

States of Matter

Matters exist in 3 main **states: solids, liquids and gas**. A substance can exists in all those different states or some of them. For example water (as matter) exists both in solid, liquid and gaseous state.

States	**Solid**	**Liquid**	**Gas**
Noun	Ice	Water	steam/vapour
Temperature	0°C	0-100 °C	>100 °C
	Melting →	Evaporation →	condensation ←
	← Freezing		

Definition:

- **The smallest particle of an element** is called **an atom**. e.g.***: the atom Zn is the smallest particle of the element "Zinc".***
- **Matter can either** exist **as an element or a compound**. **The smallest particle of a compound** is **called a molecule**. e.g.: ***the molecule HNO_3 is the smallest particle of the compound "Nitric acid".***

  *This compound **is made up of/consists of/comprises/has** three atoms of oxygen, an atom of nitrogen and an atom of hydrogen.*

Measurement

To measure means **to establish a relation between a quantity and another quantity of same type taken as unit**. So when we measure quantities the result is expressed in units.

Quantities	Units
Weight	Kg
Volume	cm^3
Density	g/cm^3
Height/Length	m
Area	m^2

Physical quantities of matter are also expressed in units. Units can either be **fundamental** (e.g.: meter) **or derived (e.g.: g/cm^3, m^3)**

Reading of derived units

g/cm³ - { *gram per cubic centimetre* / *gram per centimetre cubed*

m³ { *square metre* / *metre squared*

One important physical quantities of matter is **density. We can also** talk of the **Specific gravity (relative density)** of a substance**: It is used to indicate the density of a substance relative to the density of water.** These are some densities presented in a decreasing order.

Substance	Gold	Mercury	Aluminum	water	Ice
Density (g/cm³)	19.3	13.6	2.7	1.0	0.92

Example of the meaning of density: mercury
Concerning the density of Mercury we can said ***that a cubic centimeter of mercury*** *has* ***thirteen*** *point six times* ***the mass of a cubic centimeter*** *of* ***water (NB: Notice the use of American English in "centimeter". Never use British and American English in a test)***

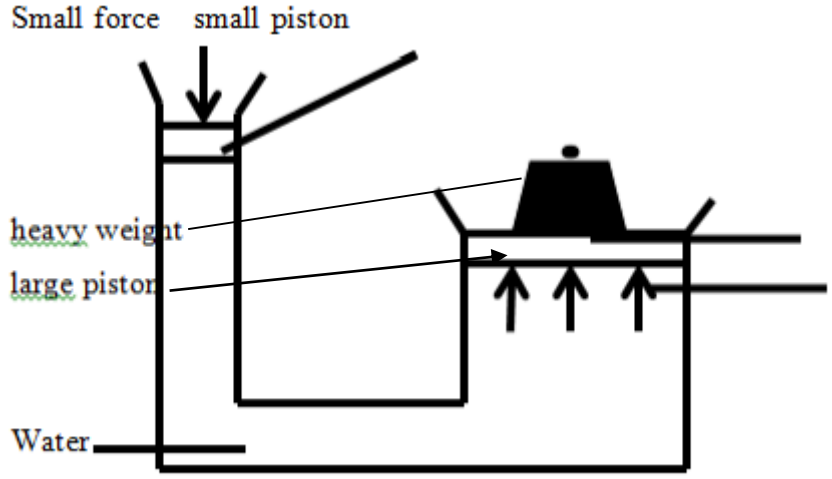
2. LIQUIDS

-A **Solid** is **matter** that has a **definite shape and a definite volume**
- **Liquids** are **matter** that **have/having** a **definite volume but haven't a definite volume.**
- Liquids are **incompressible.**
-**Gases** are **matter that have neither a definite shape nor a definite volume**.
Gases are usually **compressible**.
When a liquid finds itself in a container it exerts a force in different directions. In fact, it exerts **upward forces, downward forces and sideway forces.** So, **it pushes** (verb to **push**) upwards, sideways, and downwards.

-All liquids exert an upward force. This phenomenon is called **buoyancy (the existence of an upward force when we put a liquid in a container)** and the force is a **buoyant force.** This phenomenon was discovered by **Archimedes.**
Archimedes' principle: When an object is immersed in a liquid, it appears to lose weight which is equal to the weight of the liquid displaced.
It means that an **object immersed in the liquid**, it **appears to lose an amount of weight equal** to the weight of the **liquid displaced**. We talk of **an apparent weight loss** (to lose, loss (noun) lost (adj)**)** (it's the weight that an object looks like having lost when it is placed in a liquid due to the buoyant force).
Then we have two cases:
- When the buoyant force **is less than** the weight of the object**,** the object will **sink.**
- In the opposite case the object will **float.**

Pressure is the quotient of the **force** and the **surface area** on which the force is applied.
In **liquids, the pressure is proportional to the depth of the liquid.**
When **pressure is applied at a confined area** of the liquid, that **extra pressure** is **transmitted evenly in the whole liquid**. This property is used for many applications, for example "the hydraulic press".

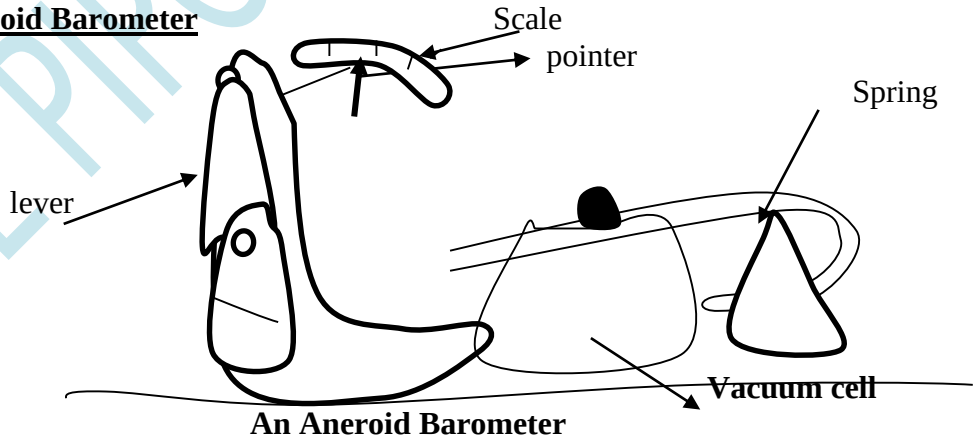
The Principle of hydraulic press



3. GASES

- The earth's atmosphere, the air we breathe consists of a mixture of gases.
- Air has mass and exerts pressure**; At sea level** (au niveau de la mer), this pressure **is sufficient** to support **a 76 cm column of mercury in a vacuum tube**.
- **A barometer** is used to measure **atmospheric pressure**.
- **Changes in weather** will bring about **changes in atmospheric pressure**.
- The most common type of barometer is the **aneroid barometer**. The principle is based on the previous point.
- **An aneroid barometer consists of a vacuum cell attached by levers to a pointer.**

An Aneroid Barometer



An Aneroid Barometer

(direct Proportion & Inverse proportion as in Gas laws)

DESCRIPTION: it consists of a vacuum cell which is attached by levers to a pointer. A change in the atmosphere pressure causes a small movement in the surface of the cell. The lever transmits this movement to the pointer which moves across a scale.

When we talk about a gas we think about:

- The volume of the gas
- The temperature of the gas
- The pressure of the gas

Those are main characteristics of gases. These three properties are linked by the "**BOYLE'S Law**": "***if the temperature of a fixed mass of gas remains constant, the volume of this gas is inversely proportional to the pressure:***

$$P_1/V_1 = P_2/V_2$$ "

CHARLES' LAW

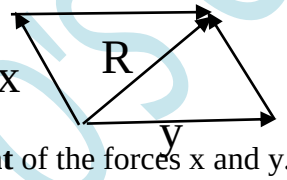
"The volume of a fixed mass of gas at constant pressure is directly proportional to the temperature"

$$V \alpha T$$

Gases are compressible: this allows a large quantity of gas in a small container.

4. FORCE

- If a quantity **has both magnitude** (size) and direction, it is a **vector quantity**.
- But if a quantity **has magnitude & no direction** it is a **scalar quantity**.
- **Force is a vector quantity** and it is expressed in terms of its **magnitude and direction**.
- Many forces acting on a body can be represented by one force using the **« <u>parallelogram of forces rule »</u>**



- The line **R is the resultant** of the forces x and y.
- **The length** of the lines represents **the magnitude** and **the arrow** represents **the direction.**
- **A body is said to be in equilibrium** if **the resultant of forces acting on the body is zero**.
- The force of attraction that exists between the earth and any other body is called the **force of gravity.**
- **The force that exists between two objects on the earth's surface** is called gravitational **force**. It was descovered **by Sir Isaac Newton**.

« The force of attraction which exists between two bodies is directly proportional to the product of the masses and inversely proportional to the square of their distance of separation. »

$$F = \frac{G\, m_1 m_2}{r^2}$$

Gravitational forces are forces that exists between two bodies on the earth.

The force of the gravity pulls down on the particles of a body. The **center of gravity of a body** is the point **where all the weight** of the body **is concentrated**.

- ***Question1****: why is a ship more stable when it is loaded than when it is empty? Does the center of gravity always refer to a particular part of the body?*
- ***Question2:*** *why is the direction of a force represented by the arrow?*

5. MOTION

If a body is not in motion, it is at rest.

Speed: is the **rate at which a body is moving**. It is has only magnitude (Scalar).

$$\boldsymbol{Speed = \frac{distance}{time}} \quad (\boldsymbol{m/s})$$

Velocity: A speed with direction (Vector)

So the speed is the magnitude of the velocity.

If we want to obtain the speed of an object which covered a certain distance, we simply divide the distance covered by the time taken. The unit is the **metre per second.**

v = d/t

Momentum: It is the product of the mass and the velocity of a body.

$$\boldsymbol{Momemtum = mv}$$

Acceleration: It is the rate of increase of the velocity of a body with time.

Units: m/s^2.

- Acceleration due to gravity (g) = 9.8 m/s^2

- In practice, the value is not respected due to forces of resistance (**friction = force resisting to motion)**
- It can **be measured** using a simple **pendulum with the formula**

$$T = 2\pi.\left(\sqrt{l/g}\right) \qquad l = length\ of\ string$$

$$g = \frac{4\pi^2 l}{T^2}$$

6. WORK, ENERGY and POWER

- **Work** is done when a force moves a load over a certain distance

$$\boldsymbol{W = F.d}$$

- **Energy** is the capacity to do work
- **Energy** like work is measured in ergs or joules. So it has the same unit with Work.

$$\boldsymbol{1\ ergs = 10^{-7} j.}$$

$\boldsymbol{Kinetic\ Energy\ (K.E)}$

$\boldsymbol{Mechanical\ enery}$

$$Potential\ Energy\ (P.E)$$

- **K.E** is the energy a body possesses because it is moving
- **P.E** is the energy a body possesses due to its position or state.

Energy is a **scalar quantity** having **magnitude** but **no direction.**

There are many **types of energy** related to their source:

- **Mechanical energy**
  - **-kinetic energy** due to the speed
  - **-potential energy** due to the position.e.g.:

pe = mgh

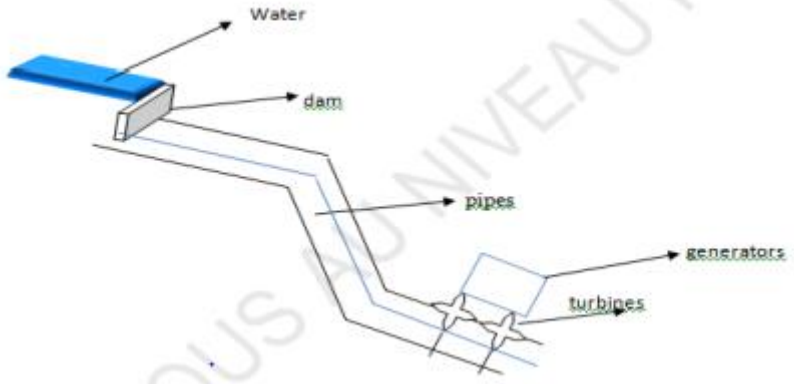
- **Thermal energy**
- **Solar energy**
- **Chemical energy**

Law of Conservation of Mechanical Energy

« In the absence of friction the total mechanical energy of a body remains constant »

- **Power :** It is **the rate** at which **work is done** $P = \frac{W}{t}$

The Hydroelectric Power Station is one of the main and important applications of work.



- **The dam is thicker at the base because the pressure of the water is higher at the base**

Principle

The potential energy of the water is converted to kinetic energy when it moves down the steel pipe. The water falls on the turbines with force (due to kinetic energy) causing the turbines to turn, thus, to produce electricity through a generator.

7. HEAT

Définitions

- **G**enerally, **when heat is applied** to a substance, its temperature **increases**
- **When heated**, most **substances expand** and **contract** when cooled. **This principle is applied in the fabrication of the thermometer**.
- **Radiation is the movement of heat in the form of waves**.
- **Its unit is J/Kg/°C**
- **When a substance is heated, it absorbs heat and becomes hot.**

1 calorie = 4.2 joules

Heating a substance does not always raise its temperature.

- Latent heat is the amount of heat required to change the state of a substance without a corresponding change in temperature.
- **The thermal capacity of a material** is the heat that is needed to change the temperature of one kilogram of that material by 1°C.

Pure substances change their states at fixed temperature. Then we can have these points:

- **Boiling point** : is the temperature at which a substance passes from the liquid state to the gas state
- **Freezing point**: is the temperature at which a substance passes from the liquid state to the solid state.
- **Sublimation point:** is the temperature at which a substance passes from the solid state to the gaseous state.
- **Condensation**: is the temperature at which a substance passes from the gaseous state to the liquid state.

When heated, **the temperature increases before the expansion of most substances.** Some material absorb heat more than others.
A material **absorbs heat to become hot** and **loses/gives up/sends out heat** to **become cool**.
The **rate at which iron will absorb heat** is **less than the rate at which lead will absorb it**.

PRINCIPLE

"When heat is absorbed, the temperature will expand and when the heating source is removed the temperature decreases and material is cooled (and may contract)"

Specific heat

It is **the heat** needed **by the material** to raise the **temperature of a unit of mass** of that material **by/through 1°c.**

Specific heat capacity

Water has a specific heat capacity of 4200 J/kg/°c

Substance	Specific heat capacity
Alcohol	2625
Aluminum	900
Water	4200
Glass	700
Steel	460
Copper	400
Mercury	140
Lead (plomb)	130

The **unit** of **heat** is the **joule in singular** and **joules in plural**. Before, the **formal unit** was the **"calorie".**

1 Calorie = 4.2 Joules

A Calorie is defined as: "**the amount of heat absorbed or given up by a gram of water when the temperature changes by 1°C."**

When we heat the water, at 100°C the temperature will not change. **So heat does not always increase the temperature of the substance but can rather change from one state to another.**

Latent heat

It is heat that is needed/required to change the state of a substance without a corresponding changing temperature.

8. WAVE MOTION AND SOUND

Sound **can travel through air, liquids and solids** but **cannot travel in a vacuum since it needs a medium for its transmission.** If we produce sound in a room, the person inside the room will take shorter times to hear it than a person outside. This is due to the fact that: sound moves in different media with different speeds.

Compressional waves are then **waves that need/require a medium to be transmitted** ***e.g.:- sound***

Electromagnetic waves ***do not need/require a material medium e.g. heat, radio waves.***

-When sound waves are passing through a substance, the particles of the substance oscillate (vibrate).

Relationship between wave, motion and sound

Sound moves in form of waves:
To Vibrate (verb) – vibration (noun)
To Oscillate (verb) – oscillation (noun)

Substance	Air	Hydorgen	Water	Granite	Iron
Speed$_v$ (m/s)	340	1330	1450	3950	5125

- The speed of sound waves increases as we move from gases through liquids to solids
- Sound waves have different speeds in different materials
- **Amplitude:** The highest displacement of a particle of a wave from the rest position.
- **Wave length:** The distance between two successive particles in the same state of compression.
- **Frequency:** It is the number of complete oscillations per second. Its unit is the hertz (Hz).
- The temperature of a medium affects the speed of Sound.

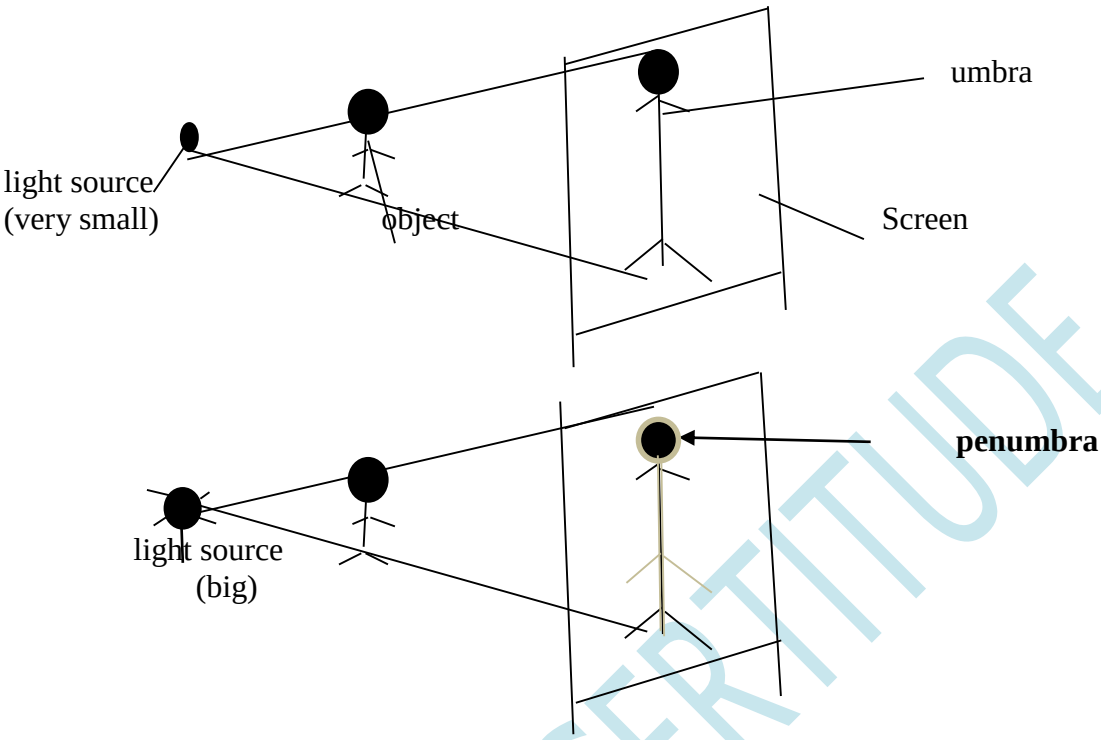
- **Question 1: How is the amplitude of a sound wave determined?**
- **Question 2: Explain how a sounding device is used to calculate the depth of the sea?**
- **Question 3: what is the distance needed to hear an echo after clapping your hand?**
- **Experiment to measure the speed of sound on the room and on the air.**

9. WAVE MOTION AND LIGHT

Light radiation, like the radiation of heat or radio waves, is an example of electromagnetic radiation. Light waves are much shorter than radio waves and have a much higher frequency. Light waves travel much faster than sound waves, at a speed of 300 000 km/s, and light rays travel in straight lines.

Definition

A ray a beam of light from a source
Light years: the distance covered by light in a year
Lunar eclipse: during a lunar eclipse, the earth cast its shadow on the moon.
If we have **a small light source**, we will have **a clear/a sharp shadow (umbra)** and if we have **a bigger one,** image will be **blurred** and we will have a **penumbra**

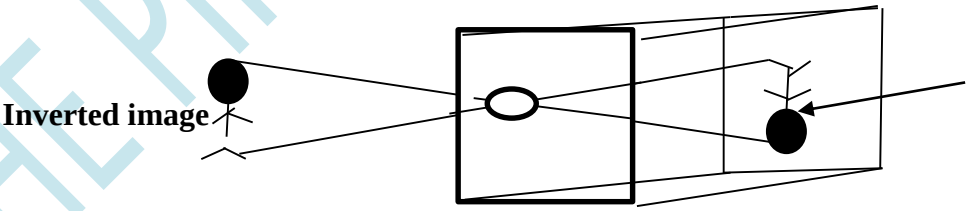


Applications of Movement of Light Rays in a Straight Line.

- **Partial (lunar) eclipse**: when the earth partially casts its shadow on the moon.
- **Total (lunar) eclipse**

What is meant by a light year ?

Describe a pinhole camera & say how it work

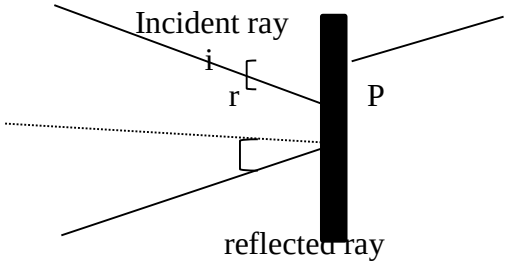


❖ **Question: What is penumbra & umbra ?**

10. Light: Reflection and Refraction

Reflection

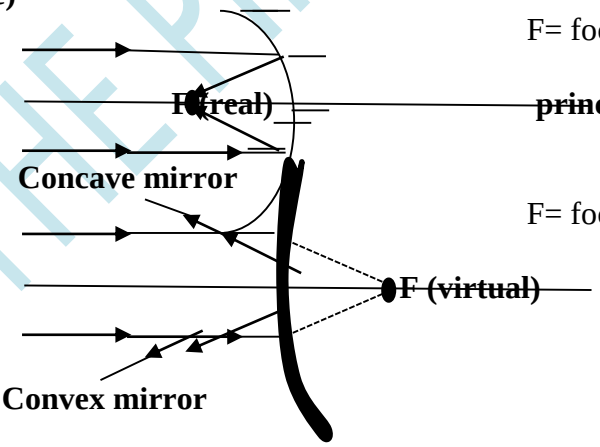
Reflect	reflected, reflective	reflection
Refract	refracted, refractive	refraction
Verb	**adjective**	**noun**



mirror

- **When an incident ray** strikes the Surface of the mirror, **the ray is reflected.**
- **The angle formed by the incident ray and the normal** is the same as the **angle formed by the reflected ray.**

It is virtual because the reflected rays appear to come from behind the mirror (reflective surface)



❖ **Questions:**

Explain why a stick placed in water appears to be bent?

- Why is a convex mirror used in a car?
- Why can a reflected image in a concave mirror be either erect or inverted
- What is meant by a virtual image?
  (Ans: An image which is formed by apparent reflection of light)
- Explain how a concave mirror could be used to light a fire.

FOCAL LENGTH OF A MIRROR

The **focal length** is the **distance between the focus and the center of curvature**

- **Question: During a total eclipse, the moon does not completely disappear. Explain**
  Will the image in a convex mirror be magnified or diminished?

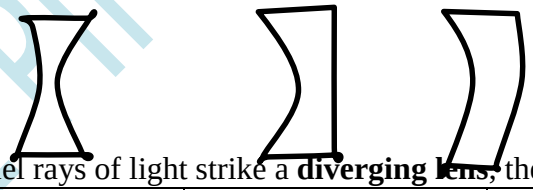
II. LIGHT: LENSES

- **Lenses are used to control the refraction of light.**
- **The refraction of light by a lens depend on the refractive index of the lens**
- There are 2 main types of lenses :

(i) Converging Lenses **:**

When parallel rays of light strike **a converging lens**, they are **brought together**.

(ii) Diverging Lens :



When parallel rays of light strike a **diverging lens**, they are caused to **spread out**

	Past Tense	**Past Participle**
Strike	Struck	Struck(stricken)
Spread	Spread	Spread

Any lens either converging or diverging has a **focal length.**

Focal length: It is the distance between the lens and the principal focus.

Lens Formula :

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

$$p = object\ distance, \quad q = image\ distance, \qquad f = focal\ length.$$

Applications

Instruments that contain lesnes are **optical instruments**
Location : synonyms : position, situation

- Reading glasses
- Lenses are used for the correction of eye-sight

(Myopia) Short-sight → Short-sighted
Long-sight → long-sighted

Adjective → ***nouns*** { *Short – sightedness* / *long – sightedness* } → Person

- A long-sighted person will require a converging lens
- A Short – sighted a diverging lens.

❖ **Question**
What is a converging lens?
It is a type of lens in which parallel rays of light **come together** when they pass through it .