# P.5 SCIENCE LESSON NOTES FOR TERM II

**THEME : THE ENVIRONMENT**

***SUB THEME* : SOIL**

***TOPIC* : *SOIL AND ITS TYPES***

CONTENT

## SOIL

Soil is the top most loose layer of the earth's surface.

### Importance of soil

- Soil is a home for organisms eg earth worms and squirrels
- For crop growing
- For building houses

### Importance of soil to crops

- Provides nutrients to growing crops
- Holds water for the crops

### Composition of soil (components of soil/ Parts of soil)

- ***Air – 25%***
- Water- 25%
- Humus – 5%
- Rock particle- 45%s
- Bacteria and fungi- varied

### Organisms in the soil

- Earth worms
- Rats
- Snakes
- Squirrels
- Termites
- Moles
- Mice

A nest for a squirrel is A drey

**HOW SOIL IS FORMED**

i) weathering
ii) decomposition

**a) Weathering**: this is the process by which rocks are broken down into smaller particles to form soil.

***b) Decomposition of dead` matter****: They rot and form humus/ soil by the action of bacteria.*

**Exercises**

1. Name two living components of soil.
2. How is soil useful to plants?
3. Which component of soil is used by plants to make food?
4. Name two non-living components of soil.
5. Which type of soil formation results into humus?

**LESSON II**

**Importance of humus in the soil**

- Humus holds soil particles together.
- Humus balance soil temperature
- Humus gives soil its colour dark which absorbs heat from the sun.
- Improves soil aeration.

**Note:**

- How is humus formed?
- Decomposition of dead matter.

**Water:**

**Importance of water**

- It dissolves mineral salts in the soil to be absorbed by plants
- It is absorbed by plants to make food during photosynthesis
- It dissolves food in the seeds during germination.
- It softens soil particles

**Air:**

Both air and water are found in soil particles called pore spaces.

**Importance of air in the soil.**

- Oxygen is used for respiration by organisms in the soil.
- Nitrogen improves soil fertility

**Note**

- During germination oxygen is used by the embryo for respiration
- Nitrogen is used by plants to make plant proteins

***EVALUATION:***

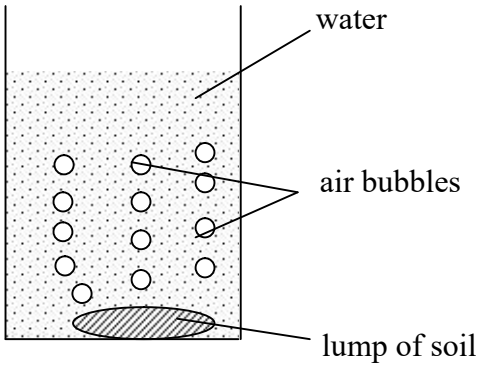
1. *Why is humus important to plant growth?*
2. *State the two ways in which soil is formed.*
3. *How is weathering different from decomposition in soil formation?*
4. *State the use of oxygen in soil.*

**LESSON III**

**Experiments**

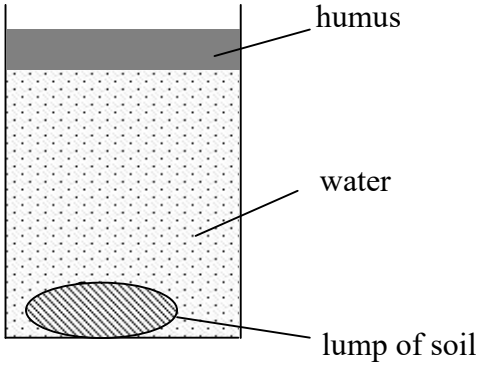
**PRACTICAL 2 – To show that soil contains air.**

- Get water and pour *it* in a beaker
- Get a lump of dirty soil and lower it into water in the beaker.




**.Practical III – To show that soil contains humus**

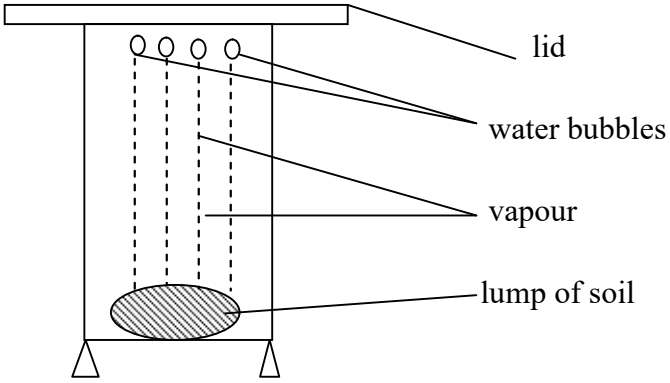
- Get a lump of soil and put in a beaker
- Add water to the lump of soil
- Stir and leave it to settle



**Observation**
Bubbles of air seen coming out
**Conclusion**
Bubbles of air seen coming out represent air in the soil and therefore *soil contains* air.

**PRACTICAL II – To show that soil contains water**
**Procedure**

- Get a lump of soil and put it in a beaker
- Put the beak on fire while covering it




**Observation**
Water droplets will be seen at the sides of the beaker.

**Conclusion**
Water droplets seen represent the water (moisture) evaporating from soil in form of water vapour and therefore soil contains water (moisture).

## PRACTICAL A

### Soil drainage

Soil drainage is the ability of soil to lose water.

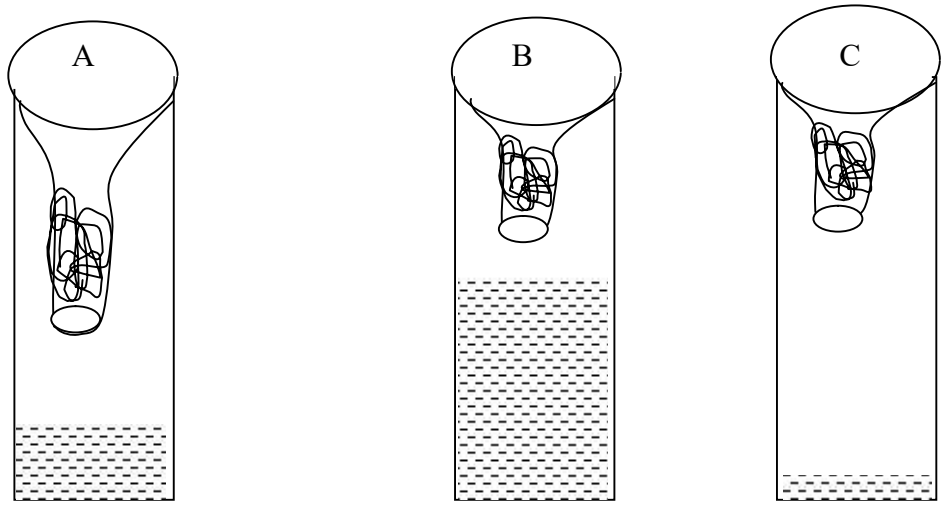
An experiment to find out the drainage or permeability of water through different soil procedure.

Get three glass jars

Get three glass funnels

Put loose cotton wool in each glass funnel

Half fill the funnels with equal volumes of dry sand soil, clay soil and loam soil as shown below.




loam sandy clay

Now pour equal volume of water in each funnel as shown above.

**Observation**

After an hour, more water is collected in the jar containing *sandy* soil followed by loam soil and little water is collected in clay soil.

**Conclusion**

- Sand, soil allows water to pass through easily(has a high drainage)
- Clay soil has the lowest drainage *because its particles are close to each other.*

EVALUATION

- *Why does sandy soil allow water to pass through it easily?*

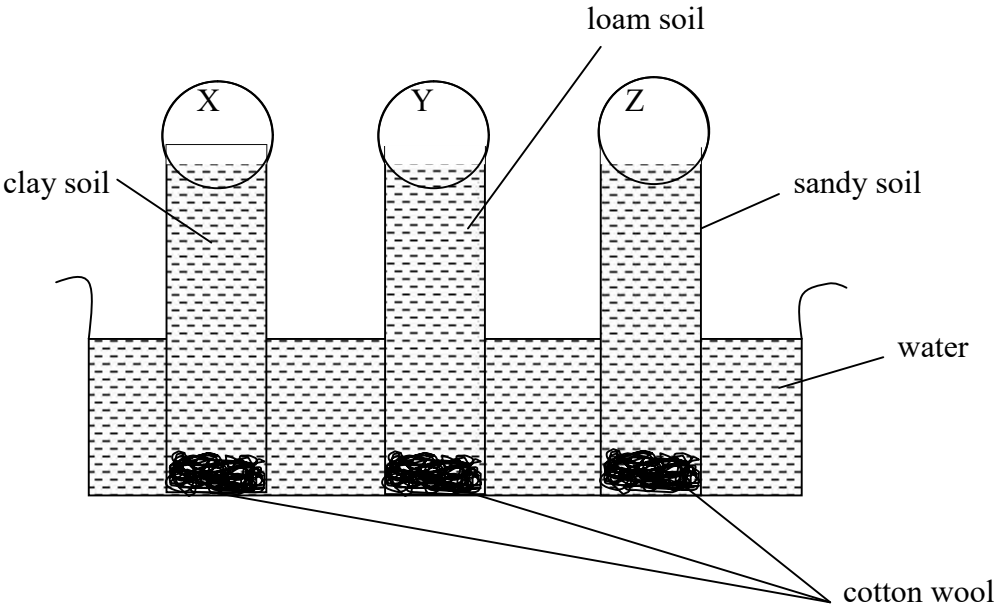
**PRACTICAL B**

**Soil capillarity**

**An experiment to find out capillarity of different soil type.**

Fill three long glass tubes (with open ends) with highly packed *sandy*, clay and loam soil and plug (cover) the lower ends with cotton wool.

Stand tubes in about 3cm of water in a trough or basin as shown.




**Observation**

After a few hours, it is found that water rises to be higher height in clay soil medium in loam soil and lowest in sandy soil.

**Conclusion**

- The rate by which water rises up is fastest in sandy soil.
- Clay soil has the highest capillarity
- Sandy soil has the tastest capillarity

**Soil exhaustion**

**<u>Soil exhaustion</u>**

This is the loss of soil fertility

**<u>Causes of soil exhaustion</u>**

- *Mono cropping*
- Bush burning
- Leaching
- *Soil erosion*
- Deforestation
- Over grazing
- Over stocking
- Over cultivation

**Note**

1. **Leaching of mineral salts**

- Leaching is the sinking of plant nutrient *to deeper soil layers* where plant roots cannot reach.
- It is caused by floods and stagnant water on the soil.

2. **Soil erosion**
   This is the removal of top soil by its agents.

**Agents of soil erosion**

These are the things that enable soil erosion to take place. *They* include:-

- Strong wind
- Flowing water
- moving animals

**Types of soil erosion**

- Sheet erosion
- Rill erosion
- Splash erosion
- Gully erosion

**Sheet erosion**: This is where soil is carried away uniformly without creating channels. It is caused by over cultivation and over grazing. Agents are strong mind and flowing water.

**Rill erosion**: This is when top soil is carried away by flowing water forming shallow channels (rills). It occurs in a ploughed field.

**Gully erosion**: This is when top soil is a carried away by flowing water creating deep channels *or trenches (Gullies*).

**Causes of soil erosion**

- Deforestation
- Over grazing
- Bush burning
- Over cultivation (over tilling of land)
- *Over stocking of animals*
- Mono cropping

**Dangers of soil erosion**

- Leads to loss of soil fertility
- Destroys crops
- Destroys roads

**Prevention of soil erosion**

**NB**: The methods used to prevent soil erosion are the same methods used for soil conservation and controlling soil exhaustion. These include:-*terracing, contour ploughing, mulching, crop rotation, strip cropping, intercropping, planting cover crop, planting trees.*

**Terracing**: this when the slope is cut into steps (terraces) to reduce the speed of running water.

1. *Give the difference between soil exhaustion and soil conserved*
2. *Define soil erosion*
3. *How can soil be conserved?*
4. *State three agents of soil erosion.*
5. *Define deforestation*

**Soil conservation and fertility**

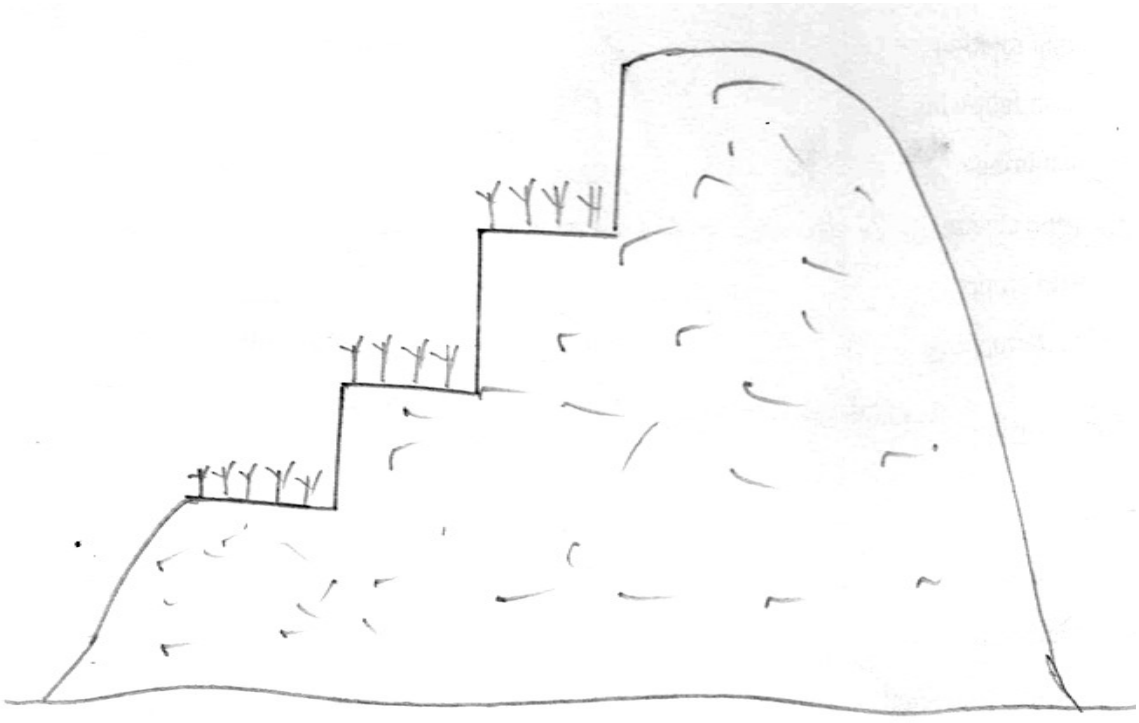
**Soil conservation -** The way of keeping soil fertile

**Soil fertility -** Soil fertility is the ability of soil to support plant growth.

**Ways of maintaining soil fertility**

- terracing
- mulching
- crop rotation
- bush fallowing
- manuring
- afforestation
- strip cropping
- inter cropping

**A diagram showing bench terraces.**



**Fertilizers**

These are substances that make the soil fertile.

**Types of fertilizers**

*i) Natural fertilizers / organic*
*ii) Artificial fertilizers / inorganic*

***Natural / organic fertilizers***
*These are fertilizers made from decomposing plants and animals.*

***Examples***
*i) Compost manure (got from house hold refuse/ rubbish)*
*ii) Farm yard manure (got from urine and dung of domestic animals)*
*iii) Green manure (got from rotting plants)*
*iv) Organic mulches*

***Activity***
1. *Define*
    a. *Natural fertilizers*
    b. *Compost manure*
2. *How is green manure different from organic manure?*
3. *Why is humus referred to as a natural fertilizer?*

***Advantages of natural fertilizers***

*i) They improve soil texture*
*ii) They improve the ability of soil to hold water*
*iii) They stay in the soil for a long time.*
*iv) They cannot spoil the soil.*

*NB: **Soil texture**. The different sizes of soil particles.*

***Disadvantages of natural fertilizers***

*i) They smell badly*
*ii) They are tiring to make*
*iii) Plant and animal wastes are not easily available*

***Artificial fertilizers***

*These are fertilizers made from factories.*

***Note:** They contain large quantities of plant nutrient*

**Types of artificial fertilizers**

- *straight / single fertilizers*
- *compound fertilizers*

**Straight / single fertilizers**

These are fertilizers that contain and supply only one major plant nutrient.

**Examples of straight fertilizers**

- nitrates (N)
- Phosphorus (P)
- Potassium (K)

**Compound fertilizers**

These are fertilizers that contain and supply more than one major plant nutrient.

**Examples of compound fertilizers**

- Combined Nitrates, Phosphorus and Potassium (NPK)
- Calcium. Ammonium and Nitrates(CAN)

**Advantages of artificial fertilizers**

- They react very fast especially those that dissolve in water.
- They have directions for use.
- They are made for a particular crop whose nutrients are known.

**Disadvantages of artificial fertilizers**

- Some have bad smell
- They kill some important organisms in the soil
- They stay in the soil for a short time.

**Methods of applying manure**

- Top dressing
- Spraying
- Broad casting
- Placement

***Harmful materials*** *are substances which make the soil lose its fertility.*

***<u>Examples of harmful materials</u>***

1. *Broken glasses / tins*
2. *Polythene papers*
3. *Used oil from engines*
4. *Pesticides*

5. *Artificial fertilizers*
6. *Scrap metals*

***Effects of harmful materials***

*i) Oils kill the micro organisms in the soil.*
*ii) Polythene papers prevent water and air from entering into the soil.*
*iii) Scrap prevent farmers from digging the soil*
*iv) Pesticides kill micro organisms in the soil*

***Revise***

*i) Differences between mass and weight*

***Topical tests***

**THEME: MATTER AND ENERGY**

***TOPIC*: HEAT ENERGY**

**MATTER**

Matter is anything that occupies space and has weight

**Examples of matter**

Air, water, cooking gas, animals, pasture, plants etc.

***Properties* of matter**

Matter occupies space

Matter has weight

Matter expands when heated

Matter exerts pressure

**States of matter**

Solid , liquid, gaseous state.

**SOLID STATE**

**Properties**

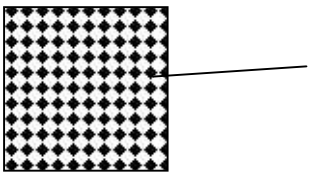
- *Particles are very closely packed together*
- *It has a definite shape*
- *It has a high force of cohesion*

***Note:***

*An atom - The smallest particle of matter that takes part in a chemical reaction.*

*A molecule – The smallest physical unit of a substance that can exist on its own.*

***Arrangement of molecules in a solid***




***Cohesion force***

*The force of attraction between molecules of this same substances*

***Application of cohesion force***

- *Brick making*
- *Making soft board*
- *Making books*
- *Making chalk*

***Examples of solids***

- *Wood*
- *Book*
- *Stone*
- *Iron*
- *Maize*

**Liquid state**

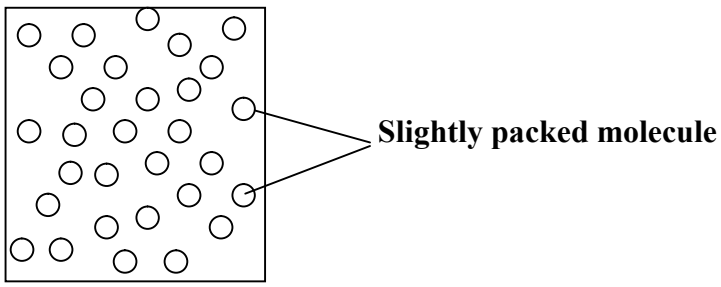
**Properties of a liquid**

- It takes the shape of a container
- Its molecules are slightly packed
- It has a low rate of cohesion i.e. a force of holding molecules

**Examples of liquids**

- Water
- Paraffin
- Diesel
- Milk
- Petrol

**Arrangement of molecules in a liquid**



**Note:**
Adhesion force : The force of attraction between molecules of different substance

**Application of adhesion force**

- Glue sticking papers together
- Paint on the wall
- Water drops from a glass
- Writing on the chalkboard

**Questions**

1. Which force binds soft board parts together ?
   Cohesion
2. Which force enables chalk to stick on the chalkboard?
   Adhesion

**Pressure in liquids**

- Pressure is a force acting on a unit area. i.e pressure $= \frac{force}{area}$
- The unit for pressure is pascal (pa)

**Properties of liquids – continuation**

**Liquids or water exerts pressure**

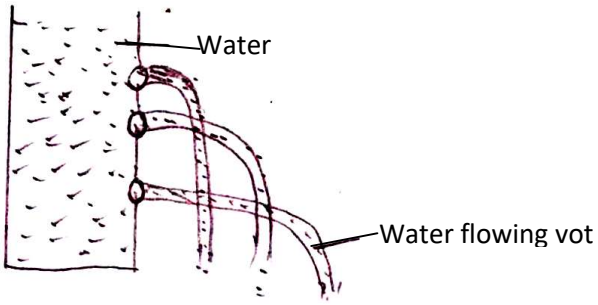
- Pressure in liquids increase with depth

**Note**

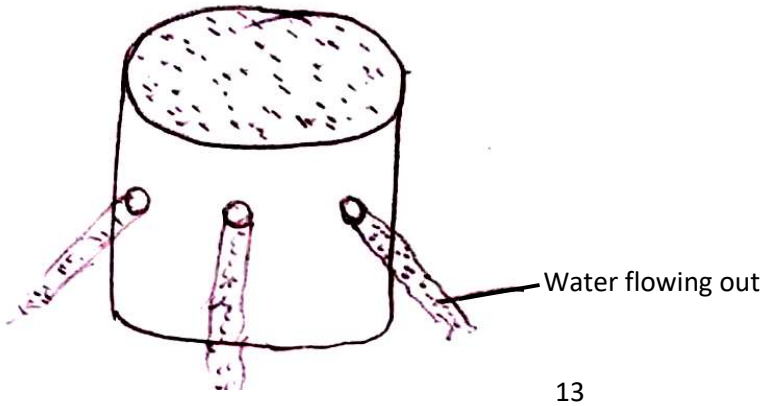
- This is because the farther down you go, the greater the weight of a liquid above

**Illustrations**

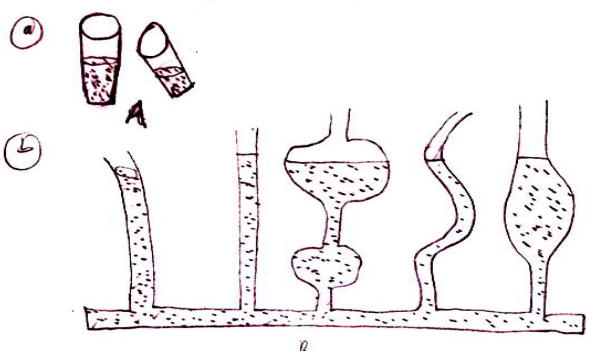
- Pressure at the bottom is greater




- Pressure is the same in all directions at the same level



- Liquids find their own level



**Examples of liquids**

- Water
- Milk
- Paraffin
- Petrol
- Diesel

**Note**

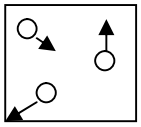
- Thick liquids are called viscous like mercury porridge, honey, glue and body lotion.

**Gaseous state**

**Properties of a gas**

- Its molecules move freely to different directions.
- Its molecules are far apart from each other.
- It does not take up the shape of the container.

**Arrangement of molecules in a gas**



**Examples of gases**

- oxygen
- nitrogen
- rare gases
- carbon dioxide

**Examples of rare gases**

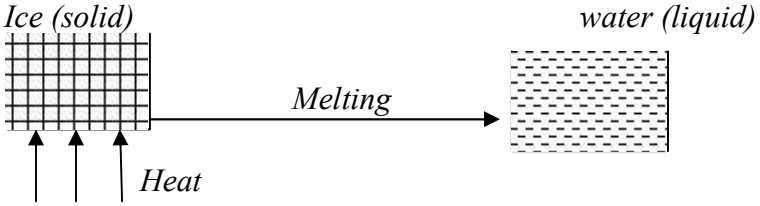
- Helium
- Neon
- argon
- Krypton
- -xenon

**Changes of states of matter.**

This takes place when there is a slight change in temperature.

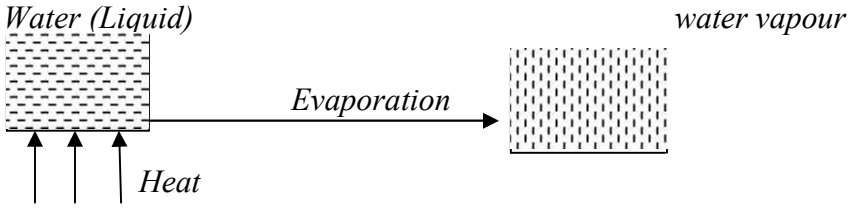
The following process are involved when matter is changing from one state to another:-

Melting: this is a process by which a solid changes to a liquid eg. When ice melt to water.



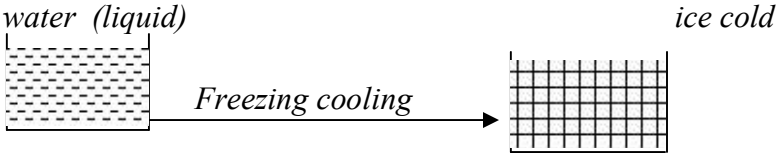

***When ice (solid) is heated, it melts to water (liquid)***

**Evaporation**: this is a process by which a liquid changes to a gas eg water when heated evaporates to water vapour. (Steam)

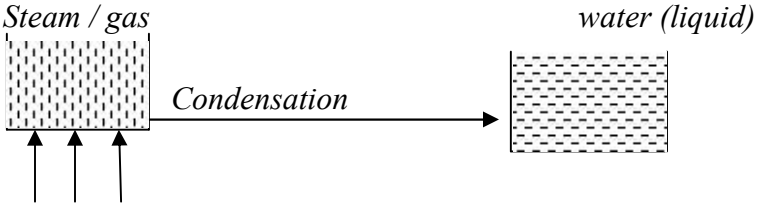



***When liquids are heated, they charge to water vapour (steam) which is a gaseous state.***

**Freezing**: this is a process by which a liquid changes to a solid eg when water is cooled to form *ice ( solid)*

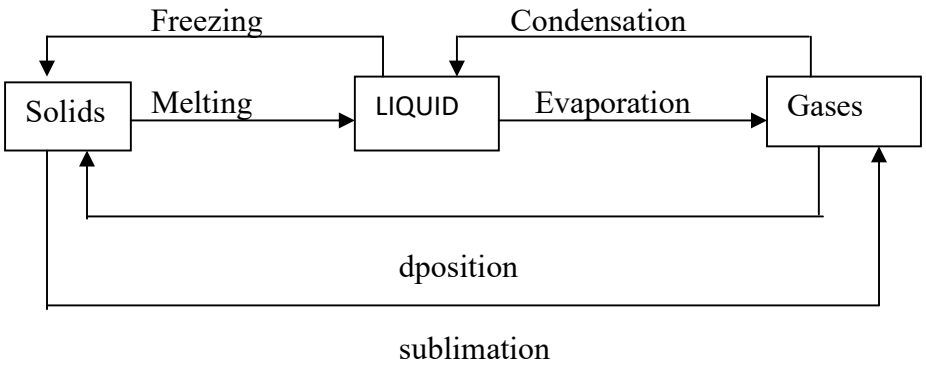



**Condensation**: This is a process by which a gas changes to a liquid eg when water vapour is cooled to form water (liquid).



**Sublimation**: this is a process by which a solid changes to a gas directly without passing through liquid state eg. When Naphthalene (moss balls) are heated or cooled. This can be *summarized as shown* below.

**Summary table for changes of states of matter**




**MIXTURE**

Mixture Practical 6

A mixtures is a combination of two or more substances.

**Examples of mixtures**

- Salt solution
- Salt and sand
- Beans and stones
- Flour and iron fillings
- Sugar solution
- Air

**Solution**

A solution is a uniform mixture of a solute and a solvent

**Examples of solutions**

- *Salt solution*
- *Sugar solution*
- *Salt sugar solution*

***Types of solution***

- *Dilute solution*
- *Concentrated solution*
- *Saturated solution*
- *Super saturated solution*

***Dilute solution***

*This is a solution that contains a small amount of solute in a large amount of solvent.*

***Note:***

*Dilution is the process of making of a concentrated solution week by adding water.*

***Concentrated solution***

*This is a solution that contains a large amount of solute in a small amount of solvent.*

***Saturated solution***

*This is a solution which cannot dissolve any more solute on stirring but only on heating.*

***Supper saturated solution***

*This is a solution which cannot dissolve any one solute even after heating it.*

***Soluble substances***

*These are substances which dissolve in liquids (water)*

***Examples***

- *Salt*
- *Sugar*
- *Glucose*
- *Milk powder*

***Note***

- *All soluble substances are solutes.*
- *A solute is a substance that dissolves in a solvent.*

***Insoluble substances***

- *These are substances that do not dissolve in liquids (water)*

***Examples***

- *Maize flour*
- *Cassava flour*
- *Tea leave*
- *Soil*

***Suspension***

*A suspension is a mixture of a solvent and an insoluble substance*

***Examples of suspension***

- *Mixture of maize flour and water*
- *Mixture of soil and water*
- *Mixture of cassava flour and water*

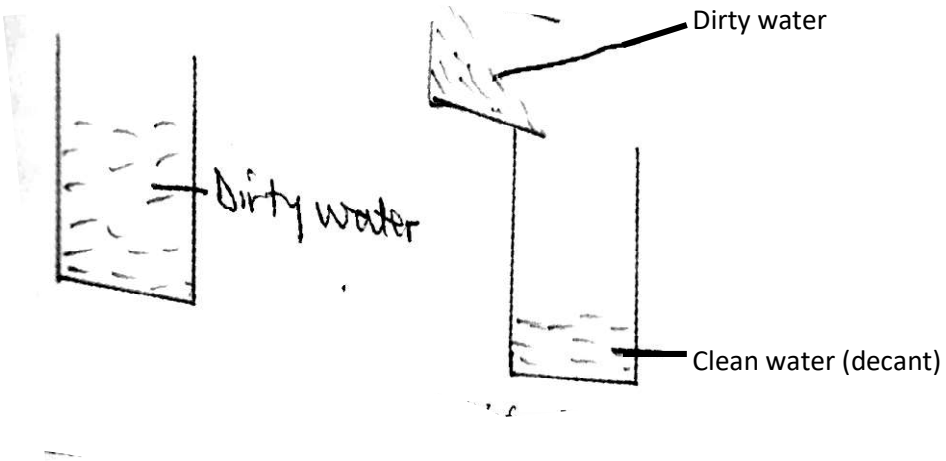
*Methods of separating mixtures*

*i) Using a magnet*
*ii) Decanting*
*iii) Filtration*

*iv) Floatation*
*v) Hand picking / sorting*
*vi) Evaporation / boiling to dryness.*

a) *<u>Decanting / Decantation</u> : This is separation of solid particles from liquids by leaving a residues to settle at the bottom of water*

***Diagram***

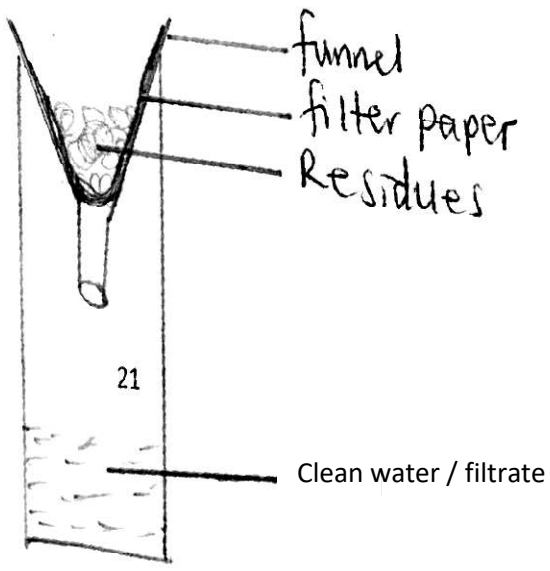



b) *<u>Filtering / Filtration</u> . This is separation of solids from liquids using a filter paper. i.e.*
c) *Solid particles remain on filter paper and the clear liquid passes through.*

***<u>Application of filtration</u>***

*i) To squeeze orange juice*
*ii) To squeeze passion juice*
*iii) To squeeze pineapple juice*
*iv) To get clean water for washing clothes*

***Diagram***



***Note***

*Filtered water is not good for drinking because filtration does not kill germs.*

d) *Distillation: It is the process of separating a liquid from a solid by evaporation and condensation.*

***Diagram***

***Separation of liquids***

*Two or more liquids mixed together can be separated by:*

*Fractional distillation: used to separate liquids of the same density but vapourize / evaporate at different temperature eg. water and alcohol.*

*It can also be used to separate liquids of different densities which do not mix easily eg. oil and water , petrol and paraffin.*

***SEPARATION OF SOLIDS***

*Two solids mixed together can be separated using the following methods:-*

a) *Floatation : This is separation of a mixture where one solid sinks and the other float eg. a mixture of saw dust and sand, a mixture of good beans and bad beans.*
b) *Using a magnet: This method is used to separate mixture of two solids where one is magnetic and the other is non-magnetic eg. a needle in as jar of maize, a nail in bricks.*
c) *Hand picking or sorting: It's used to separate big pieces from small pieces eg. stones from rice, soya, beans from peas.*

**Energy**

Energy is ability to do work.

***Types* of energy**

There are two ***types*** of energy these are:-

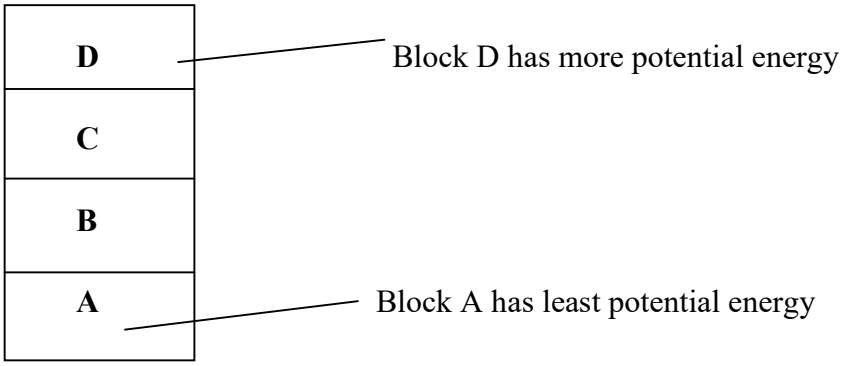
1. Potential energy
2. Kinetic energy

**Potential energy**

Potential energy is the energy possessed by an object at rest.

- A baby sleeping in a coat
- A car standing still at traffic light
- A pupil sitting still listening to the teacher.
- A stone, book, ruler resting on a table ground or cupboard

**Note**




**Why**

- Block D has more potential energy because it has more force of gravity acting on it than others.

**Kinetic energy**

This is the energy possessed by moving objects. It is referred to as energy in motion.

**Examples of kinetic energy**

A girl running along the road

An arrow flying up in air

A leaf falling down from a tree.

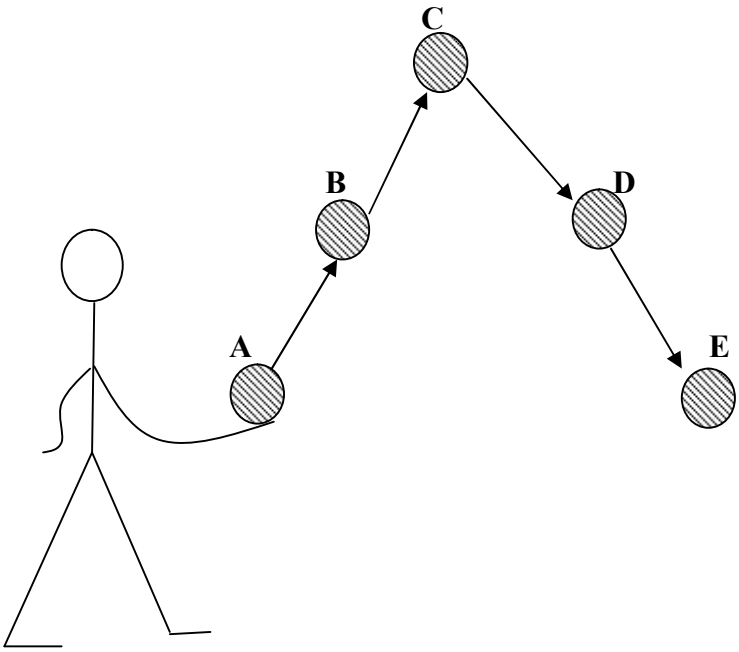
NB: A girl who runs with either a stone, bottle or book balancing on her head posseses kinetic energy while the stone bottle and book possesses potential; energy.

**Forms of energy**

- Light energy
- Heat energy
- Sound energy
- Electrical energy
- Mechanical energy
- Nuclear energy
- Chemical energy
- magnetic energy

**Energy chances / interventions**

**An experiment**




At; A - Potential energy

B - Kinetic energy

C - Potential energy

D - Kinetic energy

E - Potential energy

**Changes**: AB - Potential energy changes to kinetic energy

BC - Kinetic energy changes to potential energy

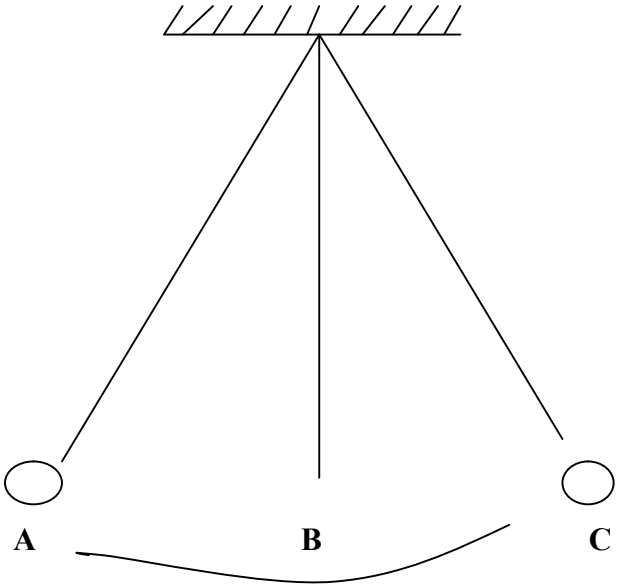
CD - Potential energy changes to Kinetic energy

DE - Kinetic energy changes to potential energy

**Forms of energy produced at E.**

- Heat energy
- Sound energy
- Light energy

**The swing**




**A** - Potential energy

B - Kinetic energy

C - Potential energy

1. *How is potential energy different from Kinetic energy*
2. *Give examples of each forms of energy*

**Force:**

This is a pull or push of an object.

**Examples of Force**

- Friction
- Gravity
- Inertia
- Buoyancy

**a) Friction**

This is the force that opposes motion between two surfaces.

**<u>Advantages of friction</u>**

- Enables man to walk
- Helps us to write on paper
- *Enabled early man to produce fire.*
- Helps objects to move and stop

**Disadvantages of friction**

- Produces heat in engines
- Causes wear and tear in machines
- Causes noise in machines
- Retards movement and delays work.

**b) Inertia**

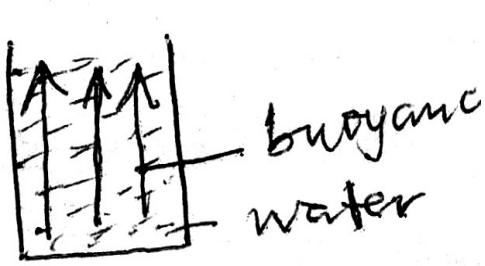
Inertia is a force that makes a body to rest in its state of steady motion.

**Types of inertia**

i) **Inertia at rest**
ii) **Inertia in motion**

**c) Buoyancy (up thrust force)**

This is the upward force in water.




**Heat energy**

This is a form of energy that increases temperature of a body or an object. Calorimeter measures heat energy.

**Source of heat**

These are things that produce *heat energy*. They include:-

- Stars
- Electricity
- The sun. This is the main source of heat
- Friction
- Candle flame
- ***Burning charcoal***
- ***Volcanic eruption***

***The main source of heat (light) or energy is the sun.***

***Uses of heat energy***

- *For cooking food*
- *For drying harvested crops*
- *For drying washed clothes*
- *For killing germs*
- *For preserving food*
- *Helps in rain formation*

***Dangers of heat***

- Burns people
- Destroy property
- Dries crops

***Effects of heat on matter***

- ***It expands matter***
- ***It rises temperature of matter***
- ***It leads to change in the states of matter***

**Natural sources of heat**

- Sun
- Stars
- Volcanic eruption

**Artificial sources of heat**

- Candle flame
- Burning charcoal
- Fire
- Electricity
- Friction

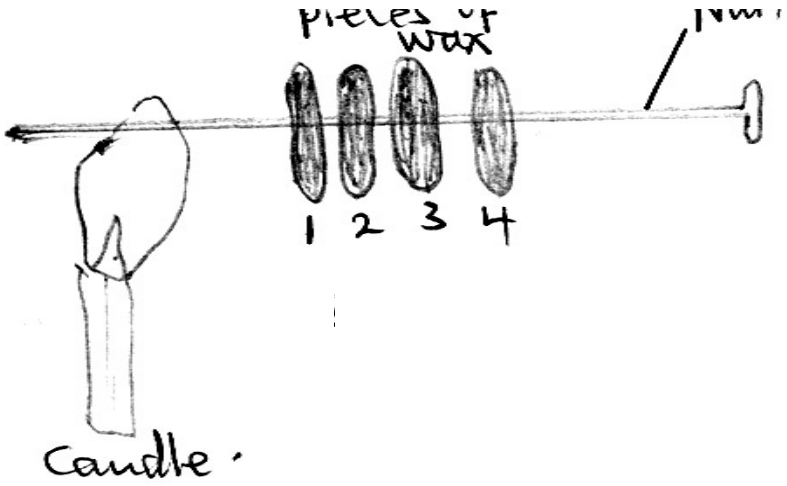
**Heat transfer**

Heat transfer is the movement of heat from one point to another.

Heat travels through 3 ways. These are

1. Conduction
2. Radiation
3. Convection

**a. Conduction**: this is the process by which heat travel through solids



**Note:**

a) Wax 1 melts first because heat reaches it first.
b) Wax 4 melts last because heat reaches it last.
c) **Burning**: heat will then travel through candle, the nail by conduction and the waxes will melt according to their position as shown above.

**b. Convection**: This is a process by which heat travels through liquids or gases. Convection in liquids or *gases travels* in form of convection current

**c.** Heat travels in liquids and gases because their molecules move while being heated.

**Note**

Why does heat travel through solids by conduction?

Molecules are closely packed which enables movement of heat from one point to another easily.

**Application / importance of conduction**

- For baking bricks
- For baking bread
- For cooking food
- For ironing clothes
- For roasting meat

**CONVECTION**

This is a process by which heat travels through liquids and gases.

**Note**

Convection in liquids and gases travels in form of convection current.

Why does heat travel in liquids and gases through convection?

Heat travels in liquids and gases by convection because their molecules move while being heated.

**Diagram**



**Importance / application of convection**

- Removes bad smell from VIP latrines through the vent pipe
- Removes smoke from kitchen through chimney
- Enables a lit cigarette to burn.
- Removes ***warm*** air through ventilators in a house
- Enables boiling of water
- Brings cool air into the house.

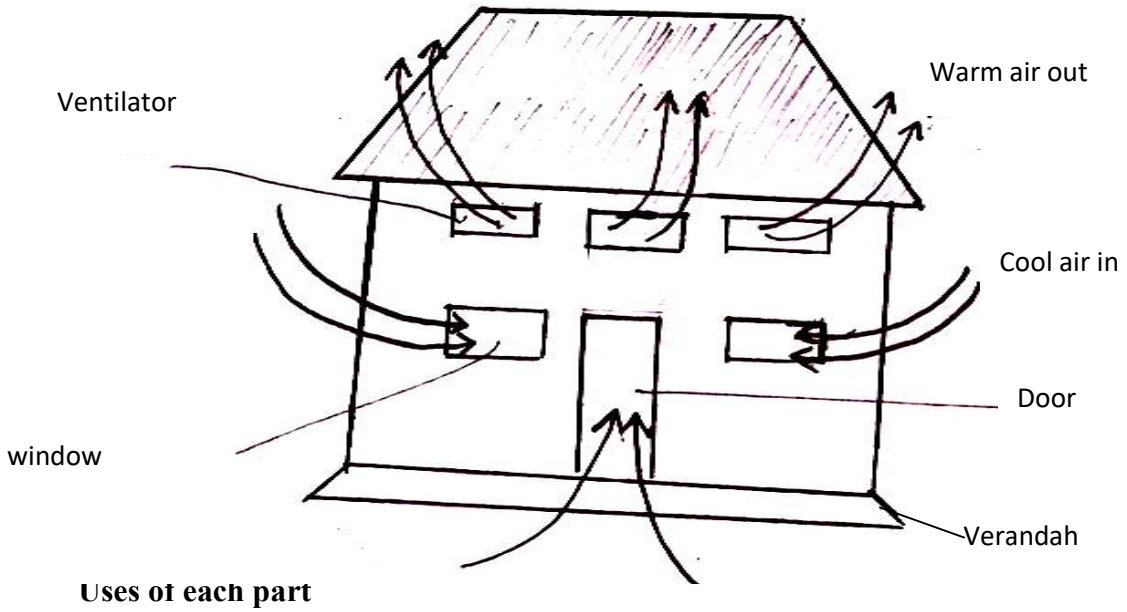
**Ventilation in a house**

These are doors, windows and ventilators in a house.

**Importance of ventilation**

It aids proper air circulation in a house

**Diagram of a house showing ventilation**




**Uses of each part**

**Roof**

- To protect people from rainfall and sunshine

**Ventilators**

- To take out warm less dense air

**Windows and doors**

- To take in cool air
- To allow in light

**Verandah**

- To prevent flowing water from entering the house

**Dump proof course (DPC)**

- To prevent water from rising up the wall

**Radiation**:

The process by which heat travels through space or vacuum.

**Examples of radiation in nature**

- Heat from the sun reaches the earth by radiation
- Heat from *fire place* reaches a person *seated* by radiation
- *Heat from the **sun** dries washed clothes by radiation.*

***Importance of radiation***

- For drying clothes
- For drying harvested crops
- For warming the body

**Comparison of heat transfer**

- Heat travels fastest in *solids* and slowest in *gases*
- Heat travels fastest by radiation and slowest by *convection*

**Note:**

- In radiation, heat is transferred from a hotter place to a cooler place and it does not need a medium.
- A medium is something that can carry heat from the place to another.
- Heat transferred by radiation is called radiant heat.

**Exercise**

1. *In which state of matter does heat travel fastest?*
2. *State two applications of radiation in man's life.*

***CONDUCTORS AND INSULATORS***

***Conductors** are substances / objects that allow heat pass through them **easily**. Some objects/ substances allow heat pass through them quickly and are called good conductors of heat.*

***Examples of conductors***

*Iron, copper, steel, aluminium, silver.*

***Name the best conductor of heat***

- ***Silver***

***INSULATORS***

*These are materials that don't allow head to pass through them easily.*

***Examples of insulators***

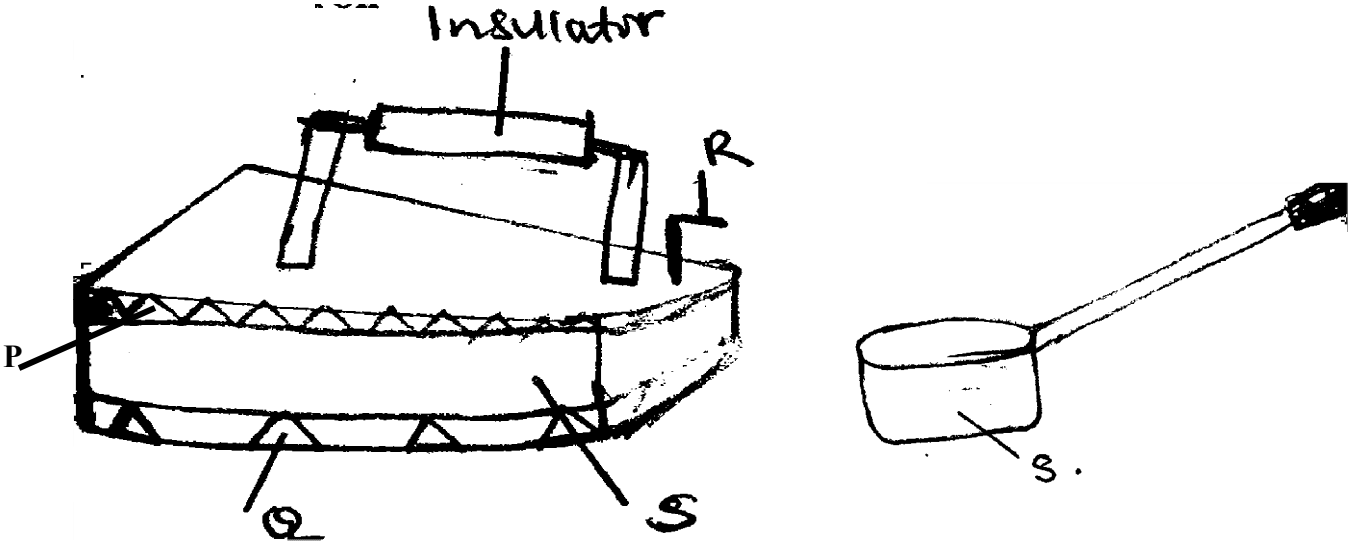
- *Wood*

- *Rubber*
- *air*
- *Plastics etc.*

***Application of insulators in daily life***

- *Handles of pans eg frying pans, source pans, electric kettles flat iron etc are covered with plastics or wood to prevent burning of users' hands.*
- *Woolen clothes used in cold weather*
- *Protective gloves used by firemen are made of asbestos which is a poor conductor of heat.*
- *Tea in a tea pot made from porcelain cools faster because of heat loss by convention radiation.*

**A structure of a Iron box / flying pan**




- Handles are made out of insulators to prevent heat from burning the user.
- Hole P allows warm air out
- Hole Q allows cool air in
- Part R is used for opening the iron box
- Part S is made out of iron to conduct heat.

**Materials for making S.**

- Aluminum
- Iron
- Steel

**Materials for making insulator**

- wood
- rubber
- plastic

**Diagram of a charcoal stove** **Diagram of a lantern lamp**



**Heat reflector**
These are surfaces that bounce heart back

**Examples of heat reflectors**

- Shinny surfaces
- White surfaces

**Heat absorbers**

- These are surfaces that take in and retain heat for some time.

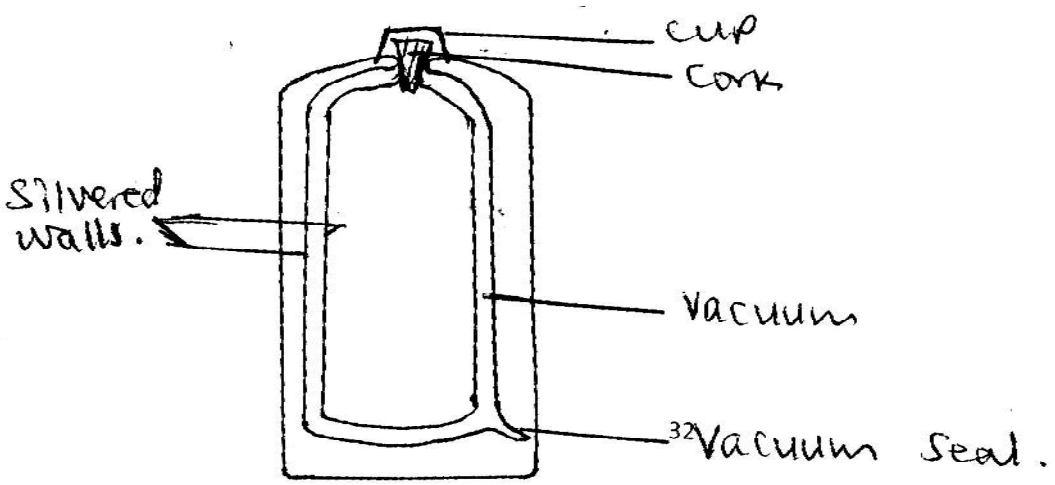
**Examples of heat absorbers**

- Dull surfaces
- Black surfaces

**A thermos flask**

- The main function (use) of *thermos* flask /vacuum flasks is to keep liquids at a constant temperature. It is not commonly used in villages because it is expensive.

**<u>Parts of the thermos (vacuum )flask.</u>**



**Functions of its parts**

1. **Cork**: To prevent heat loss *or gain* by conduction (because it is an insulator)
2. **Vacuum**: This is a place without air (matter)

This prevents heat loss in two ways ie.

**a.** It prevents heat loss by conduction because there is no heat conductors.
**b.** It also prevents heat loss or gain by convection because there is neither a liquid nor gas in the space

3. **Silvered surface**: this prevents heat loss *or gain* by radiation. (*It reflects heat back._*
4. **Metal case**: this protects the double walled glass and the vacuum.
5. ***Vacuum seal:*** *Prevents matter from occupying the vacuum space.*
6. ***Cork case:*** *Protects the vacuum glass from shocks by absorbing shocks.*

**Expansion and contraction**

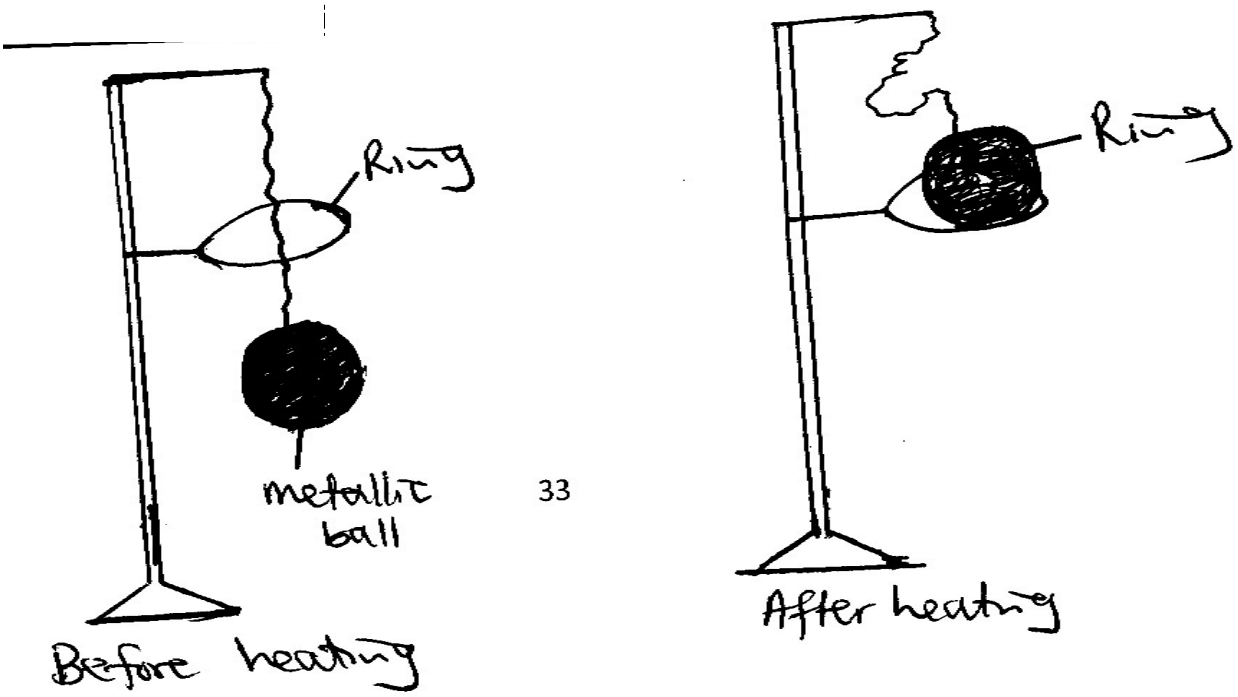
**Expansion**: This is an increase in size *or length* of a substance when heated.

**Contraction**: this is a decrease in size *or length* of substance when cooled.

***Expansion*** **of solids, liquids and gases**

Gases expand greatest or fastest followed by liquids *then* solids. This is because the molecules in gases are further apart and are free to move.

**Experiment to show expansion in solids**

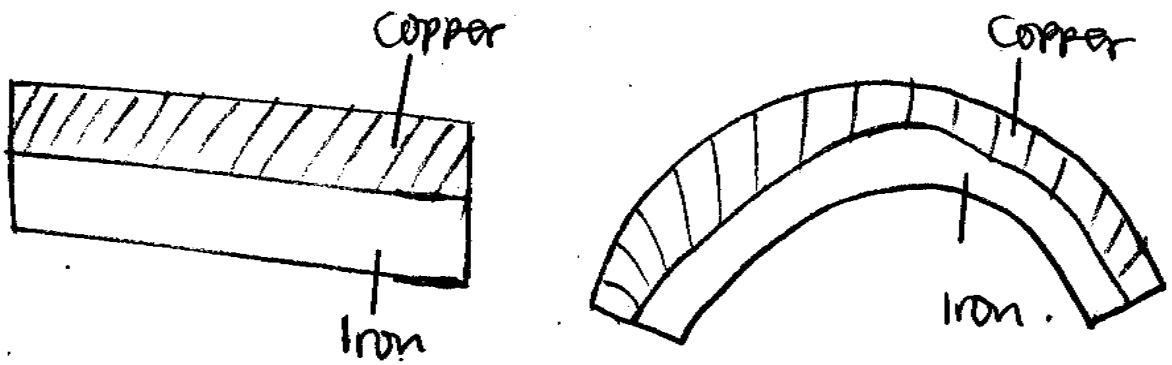



33

1. The copper and brass ball

When the ball is cold it passes through the ring as shown in *A above.*
When the ball is heated, it expands and it cannot pass through the ring as shown in *B above.*

**THE BI-METALLIC STRIP**



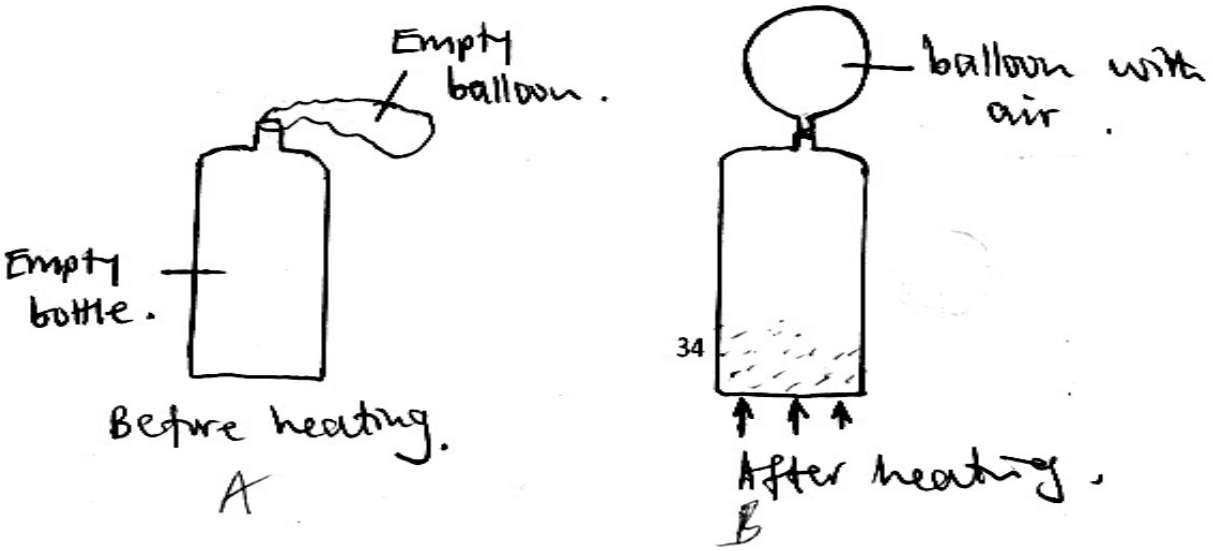

Copper expands quicker than iron, therefore the strip will bend towards iron

**Note**

**Application of a bimetallic strip**

- It is used in electrical breakers like kettles, water, heaters, flat irons.
- It is used in switches of fire alarms.

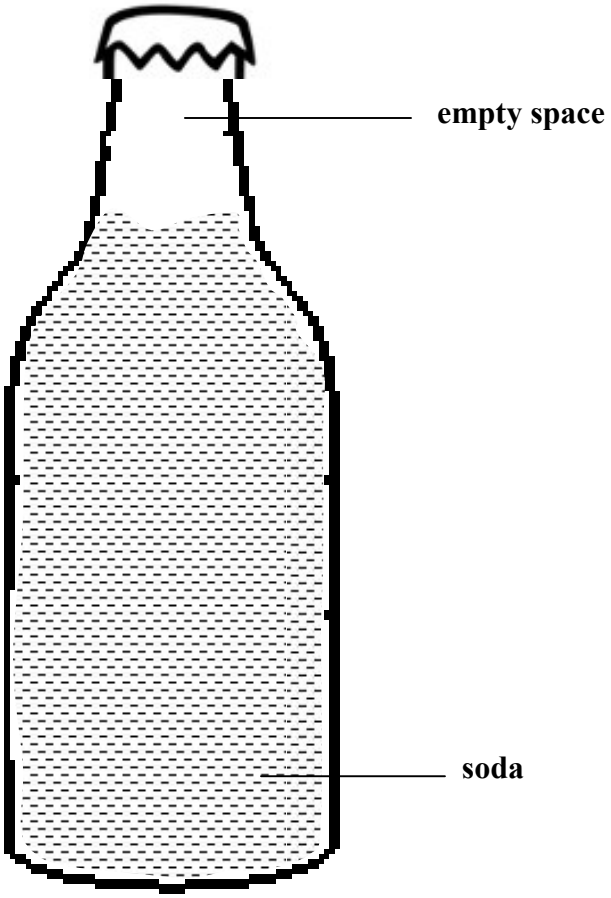
**Experiment to show expansion in gases**
**A bottle with a balloon**




In A the balloon on the bottle is empty and the water is cold

In b after heating the water heated the bottle and air inside it expands causing the balloon to swell.

**Expansion in liquids**

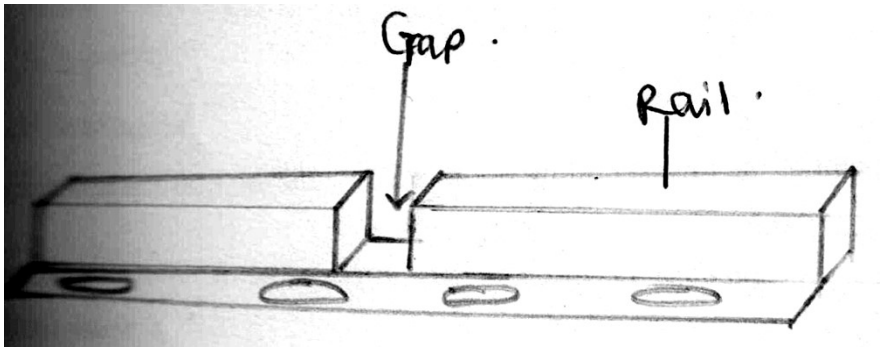



**Note**

- The space is left to leave room for expansion of soda during cooling
- The gas found inside the bottle is carbondioxide.
- Carbondioxide makes germs dormant

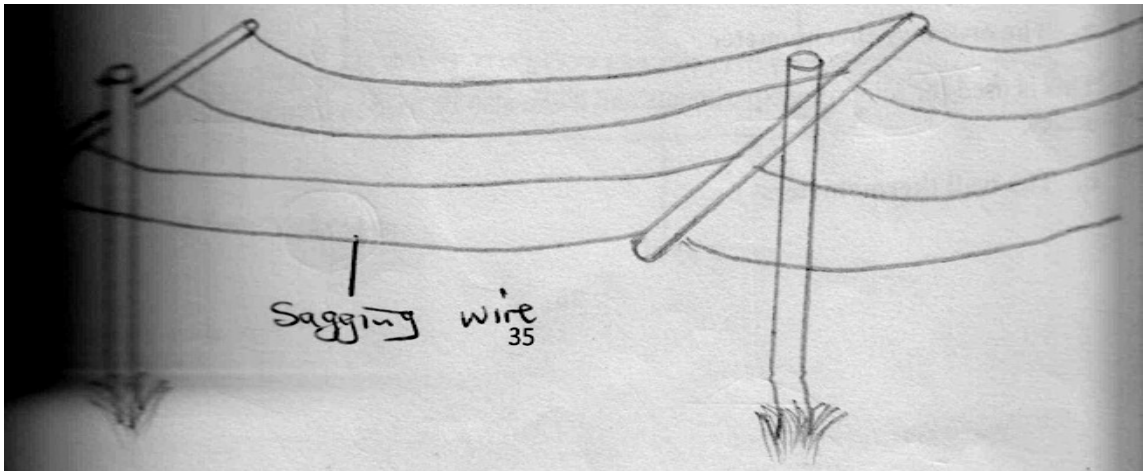
**<u>Effects of expansion and contraction</u>**

Gaps are left between railway lines to give room or space for expansion in hot weather this prevents the rails from breaking or bending. Even the holes in the rails are oval in shape to allow the rail line slip easily during expansion.



**Telephone and electricity wires**

These sag, become loose or become longer during *hot* weather due to expansion and become taut or tight in cold weather due to contraction. These wires are *fixed loosely* in order to allow contraction *to take place* on cold days *without wires will break*.




**TEMPERATURE**

Temperature is the degree of hotness *or* coldness of a body or an object. It is measured using an instrument called a thermometer in units' called degrees.

***Common*** **temperature scales *used***

There are two types of temperature scales *that are commonly used in thermometers.*

These are:-

**a.** The centigrade or ***celsius*** scale
**b.** The Fahrenheit scale

**The centigrade scale**

On this scale the freezing point or lower fixed point is $O^{o}$ c and boiling point at $100^{o}$c.

**The *fahreriheit* scale**

On this scale the freezing point or the lowest boiling point is $32^{0}$F and the boiling point or upper fixed point 212 $^{o}$ F (180 equalparts)

**TYPES OF THERMOMETERS**

**There are *four* types of thermometer V12**

- The ordinary scientific thermometer

- The wall thermometer
- The clinical thermometer
- *The six's* (*maximum and minimum)* thermometer

**a. The ordinary thermometer**

This is used for scientific experiments and it can also be used in incubation. It uses both scales.

**b. The wall thermometers**

This is hung in houses or offices in order to measure the room temperature in that time. It also uses both scales.

**c. The clinical thermometer**

It is used by doctors in hospitals to measure the human body temperature of a sick person.

The temperature of a human being is constant at $37^0$ c or $98.4^0$f except when the person is sick.

***Special features of a clinical thermometer***

- *Its scale runs from $34^0C$ to $42^0C$*
- *The bore is very narrow to have an accurate scale*
- *The kink prevents back flow of mercury before taking the reading.*

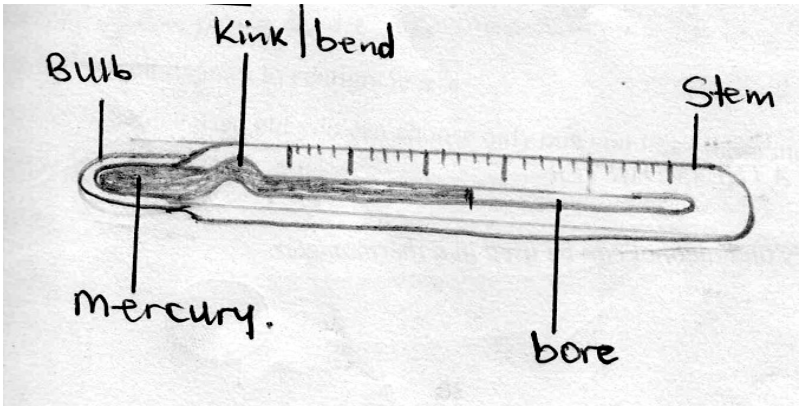
**<u>Places (parts) where a clinical thermometer is placed for body temperature is taken</u>**

- In the mouth under the tongue to avoid biting or breaking.
- In the anus
- In the vagina
- *Under* the armpits

**NB**: The thermometer must be disinfected or sterilized using the alcohol not by boiling because boiling can *burst* it.

The doctors shake the thermometer to force mercury to go to the bulb in order to take the correct temperature of a person.

**<u>Parts of a clinical thermometer</u>**



**Functions of the parts**

a. **Kink /*constrition* / narrow bend:**

This controls the backward *flow* of mercury before the reading is taken.

b. **Bulb**: This stores mercury
c. **Bore**: It is where mercury expands from.
d. **Stem**: This is demarcated in order to be able to take the reading.

***The six's thermometer (maximum and minimum thermometer)***

- *It records both the maximum and minimum temperature of the day.*
- *It is used by farmers and at weather stations.*
- *It uses both alcohol and mercury*
- *The left hand scale indicates the minimum temperature and right hand scale indicates the maximum temperature.*
- *Alcohol measures the minimum temperature of the day.*
- *Mercury measures the highest temperature of the day.*

***Note***

*The six's thermometer is reset using a magnet.*

*LIQUIDS USED IN A THERMOMETER*

- *Both mercury and alcohol can be used in a thermometer.*

*MERCURY*

***Reasons why mercury is used in a thermometer***

- It is easily seen (Opaque)
- It does not wet / stick on the walls of the glass
- Mercury is a good conductor of heat.
- Mercury has a uniform expansion.

**Advantages of using alcohol over mercury**

- Alcohol does not solidify *easily*, like mercury.
- Alcohol has a higher rate of expansion than mercury

**Note**

- Alcohol frees at $114.1^0$C and boils at $78.37^0$C
- Mercury frees at $38.83^0$C and boils at $356.78^0$C
- Alcohol expands by six times more than mercury

**Why water is not used**

- Water is colourless
- It wets /sticks on the walls of the glass
- It is a bad conductor of heat

***Disadvantages of alcohol***

- *It is colourless*
- *It sticks on the walls of the glass*
- *It is a poor conductor of heat*

**Calculations / temperature conversions**

Changing Fahrenheit degrees to centigrade's $^0$c

There are five formulae used but you can choose only one you like . these include:-

i. $5/9$ (F-32) = $^0$C

ii. 5(F-32) = 9C

iii. 5F -160 = 9C

iv. $9c + 160 = 5F$

v. $5/9^c$ + 32 = $^0$F

All the formulae come from $\frac{100}{180}$ (F32) = $^0$c 100 $^0$ comes from 100 parts in $^0$c and 100 comes from 180 parts in of

Example

Change $212^0$F to $^0$c

Solution $5/9$(F – 32) = $^0$c

$5/9$(212 -32) = $^0$c

$5/9$(180) = $^0$c

$5/9$ $x$ 180 = $^0$c

100 = $^0$c

212 $^0$F =100$^0$c

Changing $^0$c to $^0$F

There are five formulae used there are

i. $^9/_5\, c$ +32 = $^0$F
ii. 9c + 160 = 5F
iii. 5(F -32) = 9$^c$
iv. $5f - 160 = 9c$
v. $^5/_9$ (F-32)= $^0$c

*all these come from*

$\frac{180}{100}$ (+32 = $^0$F

**Example**

Convert 75 $^0$c to $^0$f

***Solution***

$^9/_5$c+32) = $^0$f

$\left[^9/_5 x75\right]$ +32 = $^0$f

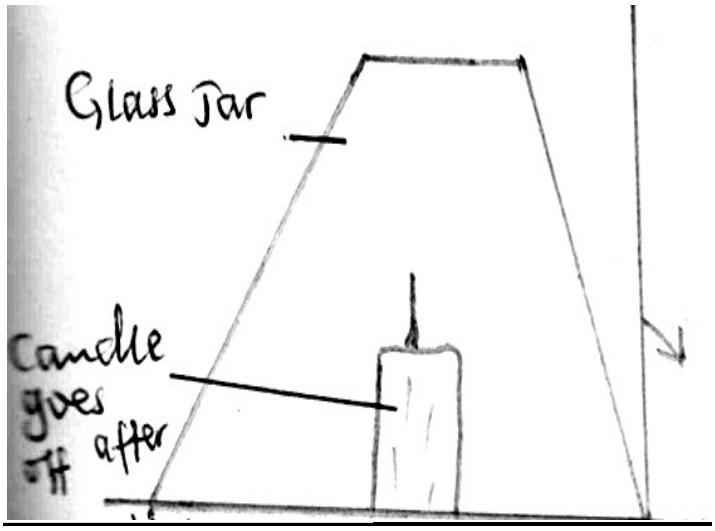
$135 + 32 = {}^0$f
$167 = {}^0$f
75 $^0$c=167$^0$c

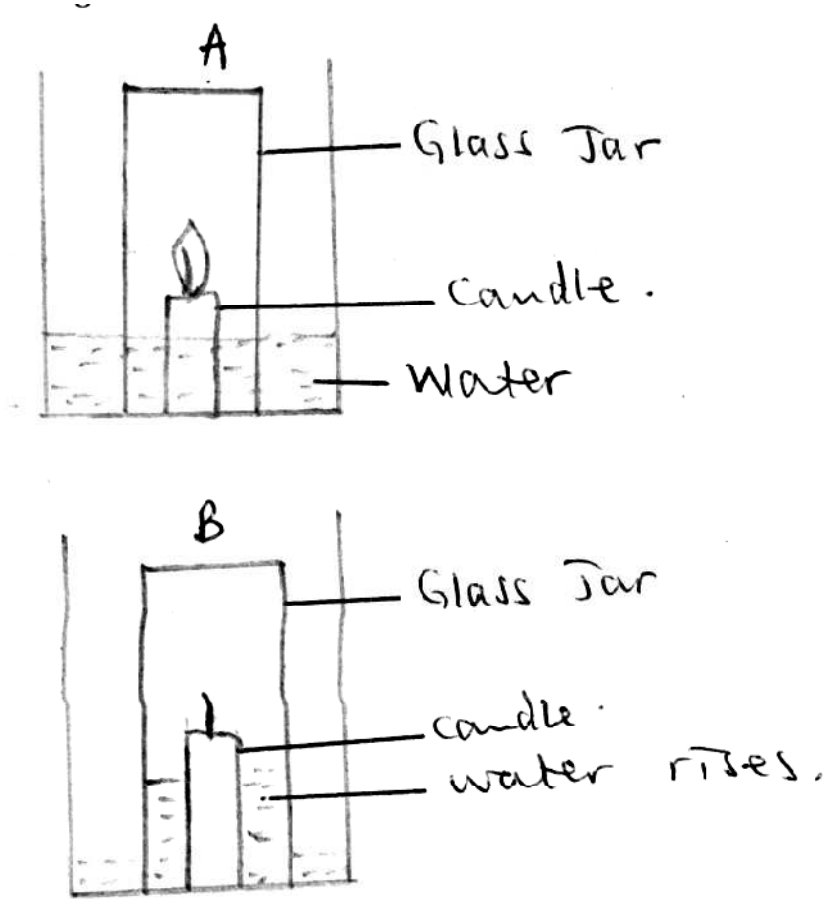
***Burning and Rusting***

***Burning is a chemical reaction in which heat and light are produced.***

- ***Combustion is the scientific name for burning.***
- ***The gas needed for burning to take place is oxygen.***
- ***The gas given out during burning is carbondioxide***

***Experiment to show that oxygen supports burning***




*Water rises in B after the candle had gone off to occupy the space for oxygen.*

***Putting off / out fire***

- ***Using fire extinguisher***
- ***Using water not petrol fire***
- ***Using sand***

***Reasons why water is not used to put out fire caused by petrol***

- ***Petrol is less dense than water therefore it floats on water and fire continues burning.***

***Rusting***

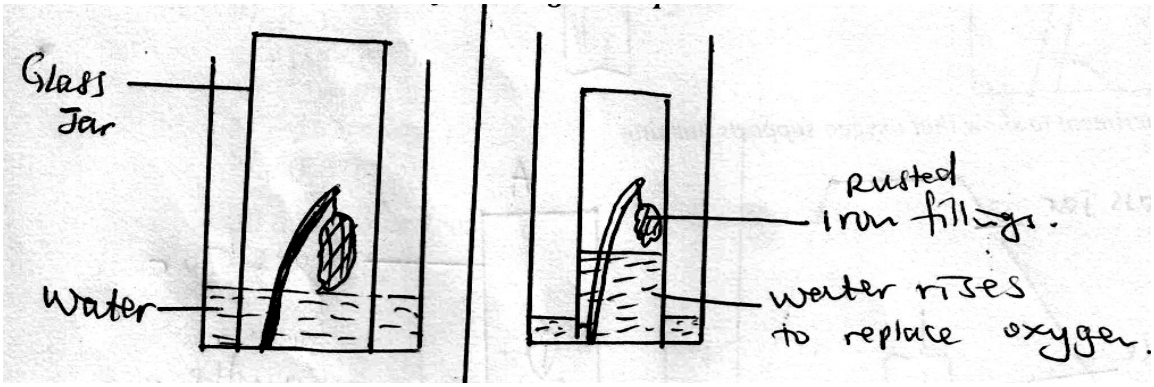
- ***Rusting is a chemical reaction which makes iron materials become reddish brown.***
- ***Rust is a reddish brown coating on iron materials.***

***Requirements for rusting***

- ***Oxygen***
- ***Water / moisture***

***Experiments on rusting***

- ***Oxygen is needed for rusting to take place.***




- ***Water is needed for rusting to occur***

***Disadvantages of rusting***

- ***Rusting makes metals weak***
- ***Rusting changes coulour of metals***
- ***Rusting contaminates water in rusted containers***
- ***It makes bolts hard to unscrew***
- ***It makes keys fail to fit in padlocks***
- ***It make cutting tools blunt***

***How to control rusting***

- ***By painting***
- ***By oiling and greasing***
- ***By galvanizing (with zinc)***
- ***By enameling (with enamel)***
- ***Using tar***

***Similarities between burning and rusting***

- ***They both require oxygen to take place***
- ***Both are chemical reactions***

***Differences between burning and rusting***

- ***Burning needs only oxygen while rusting needs both oxygen and moisture.***
- ***Burning produces heat and light while rusting does not produce heat and light.***

**Topic 3**

**GROWING CROPS**

**Review exercise on crop growing of P.4 work**

***PLANNING* A SCHOOL GARDEN**

A school garden

A school garden is a piece of land where learners carry out activities related to growing of crops.

**Importance of a school garden**

- It enables the children to learn how to dig
- It is a source of food to the school
- Children learn about crops and grow them
- It enables the school to get money after selling the crops
- Children learn practical skills on gardening.

**Factors to consider when planning a school garden**

- You should have garden tools.
- You should have enough money/capital
- You should have a well drained fertile site

- You should also consider the land make up (topography) should be flat.
- You should also have seeds of high quality.

**THEME: THE WORLD OF LIVING THINGS**

**TOPIC 4**

**BACTERIA AND FUNGI**

**BACTERIA**

What are bacteria?

These are tinny organisms made up of one cell. They can not be seen using our naked eyes. They can only be seen using a **Microscope.**

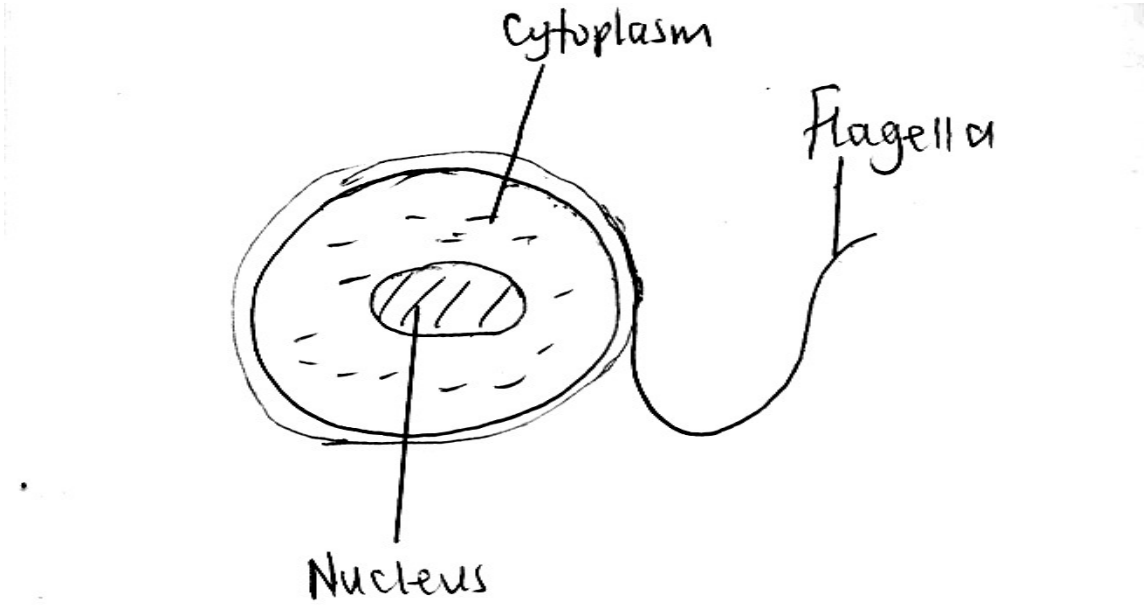
This instrument has a lens that magnifies they that is why they are called **Micro –organisms.**

**Conditions necessary for bacteria to reproduce**

These include

- Warmth
- Food
- Moisture
- Air

**THE STRUCTURE OF BACTERIUM**



## Characteristics of bacteria

- ***They reproduce by binary fission.***
- They exist as single cells
- They cannot be seen using our naked eyes/ they are microscopic

### *Habitats* of bacteria / Where bacteria are found

- In water,
- In air
- In our bodies,
- In soil
- Living animals and plants
- In animal wastes such as ***faeces*** and urine
- Decaying organic matter such as dead plants and animals or rotting food.
- In latrines
- In compost pits

## How bacteria reproduce

It reproduces by means of binary fission. This involves division of eggs of one cell into two daughter cells which also grow faster and in turn divide into two new daughter cells as shown below.

## Structure



## Types of bacteria

Bacteria are grouped according to shape. There are *three* types of bacteria namely:-

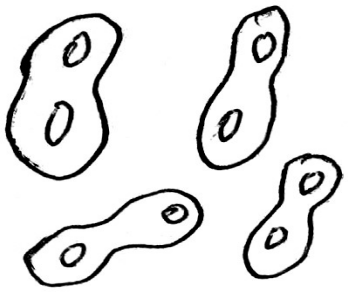
- Cocci
- Bacilli
- Spirilla

***a) Cocci****: Are spherical in shape*

***Examples of cocci***

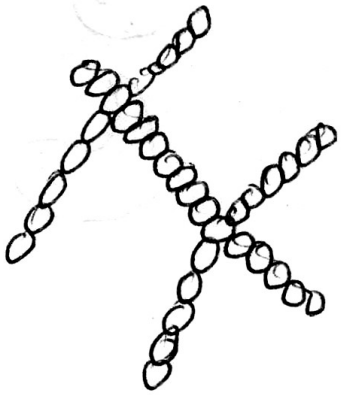
*i)* *paired (diplococcic)*

***Structure of diplococcic***



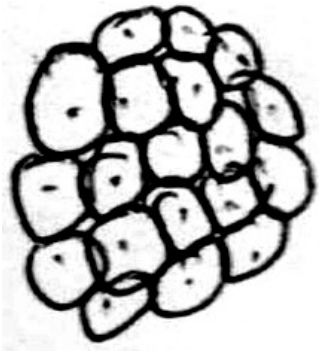
*Cause gonorrhea, pheumonia*

*ii)* *chained (**strepto** cocci)*



*Causes sore throat*

*iii)* *clustered (staphylococci)*

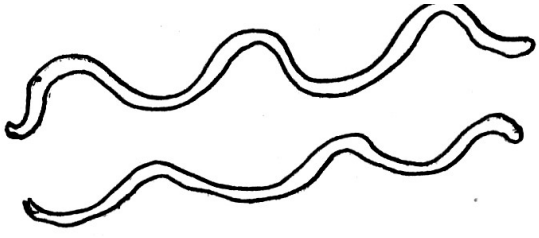


*Cause pus in wounds, boils*

**b)** Spirilla: These are spiral shaped bacteria.

**Examples of spirilla**

i) Treponema pallidum – causes syphilis



ii) Vibrio cholerae – causes cholera

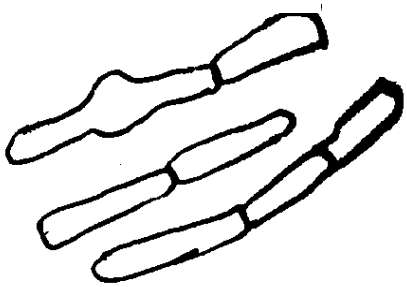


is comma shaped

**c) Bacilli**. These are rod shaped and cylindrical bacteria.

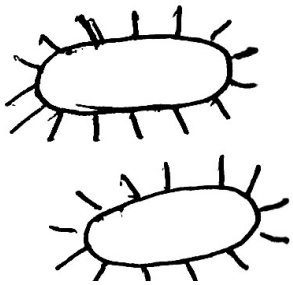
**Examples of bacilli**

**i) <u>Bacillus anthrasis</u>**



It causes anthrax

**ii) Salmonella typhi**



It causes typhoid

**NATURE OF BACTERIA**

i) Useful bacteria
ii) Harmful bacteris

**Useful bacteria**

**i)** **Bacteria** break down faeces in toilets or latrines.

**Note:** It is therefore dangerous to pour any chemical into the toilet or latrine because it will kill the bacteria and maggots

**ii)** Some bacteria are used in making of vitamin B and K

**iii)** Bacteria help in the making of cheese and yoghurt by fermentation of milk.

**iv)** Nitrogen fixing bacteria found in root nodules of legumes fix nitrogen *in* the soil (rhizobium).

**v)** They help in decomposing dead matter to make humus (putrefying bacteria)

**vi)** Bacteria help in digestion of food.

**Question:**

Name the two examples of useful bacteria

i) Rhizobium
ii) Putrefying

**Harmful bacteria**

a) Bacteria make our food go bad (which makes it toxic to our bodies.)
b) Bacteria causes diseases to people e.g. Gonorrhea, syphilis, anthrax. e.t.c.
c) Bacteria causes diseases to plants.
d) Bacteria make wounds become septic.

**Ways of prevention and treatment of bacterial diseases.**

- By immunization to prevent childhood immuniseable diseases.
- By eating clean and well cooked food
- Proper disposal of human wastes
- By washing hands with soap and clean water after visiting a latrine /toilet
- Washing hands before handling or preparing food.
- Washing fruits and vegetables before eating
- Re-heating leftover food before eating

**Treatment**

This is done by use of anti-*biotics*

**FUNGI**

**Characteristics of fungi**

i) They are unicellular or *multi* cellular organism
ii) They don t have chlorophyll
iii) They feed saprohytically or parasitically
iv) They have nuclei in the cells

**Examples of fungi**

- Yeast.
- Moulds
- Mush room.
- Toad stool
- Puffballs
- Moulds
- Bracket fungi

**Importance of fungi**

- Mushrooms are eaten.
- Yeast is used to ferment alcohol
- Moulds used to make penicillin medicine (penicillium moulds)

- Yeast is used in the making of bread and cake

**Note**

- Yeast raised dough

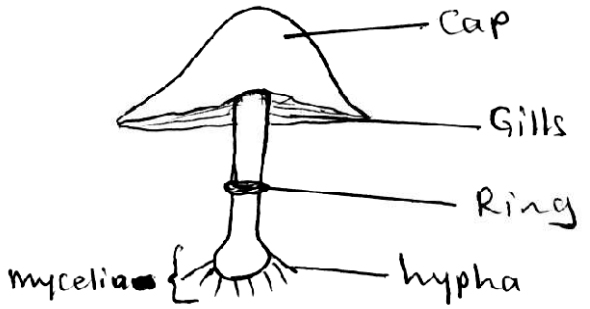
***Disadvantages of fungi***

- *Some make food go bad.*
- *Some cause diseases to people e.g. ring worms (dhobi itch), candidiasis, jork itch, athletes foot*
- *Some causes diseases to plants eg. rust, blight*

**Mush room**

These are common fungi that grow during rain season. They grow on pieces of cow dung, and on other dead matter.

**The structure of a mush room**




**Function of the parts**

**i)** **Cap**: this protects the gills from damage

**ii)** **Stalk**: conducts the *absorbed* food, water and mineral salts up the gills and cap.

**iii)** **Mycelium**: It absorbs water and mineral salts from the soil.

***iv)*** ***Gills:*** *Produce and store spores.*

Reproduction

Mushroom reproduce by means of spores.

**Feeding**

Mushrooms feed saprophytic ally

**Similarities between fungi and bacteria**

- Both cause diseases to man and crops
- Both spoil food

**Differences between fungi and bacteria**

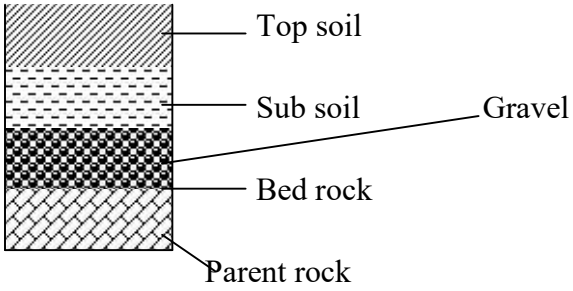
- Fungi have many cells while bacteria have one all.
- Fungi are seen while bacteria cannot be seen with naked eyes.

# REVISION WORK

**LESSON 4**

**Soil profile**

This is  natural vertical arrangement of soil layers (horizons). It is made up of 3 layers ie. Top layer, sub layer and bed rock.




**Importance of top soil**

- It has plant nutrients
- It is  more fertile
- It has a lot of humus

Soil structure- the arrangement of soil particles

**Types of soil:-**

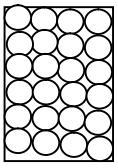
- Loam soil
- Clay soil
- *Sand* soil

1. **Loam soil**

**Properties of loam soil**

- It has a lot of humus
- It is more fertile
- It is well drained
- It has average water holding capacity
- It is well aerated.

**Arrangement of particles in loam soil**



**Uses of loam soil**

- For growing crops

2. **Clay soil**: this is an example of heavy soil

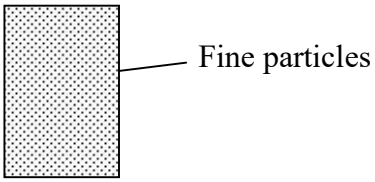
**Characteristics/ *properties***

- It has fine particle
- It retains a lot of water
- It has poor drainage
- It is sticky and heavy when *wet*
- It has a high rate of capillarity
- It is poorly aerated

**Use**

- It is suitable for pottery *and brick making*
- *For making ceramics*

**Arrangement of particles**

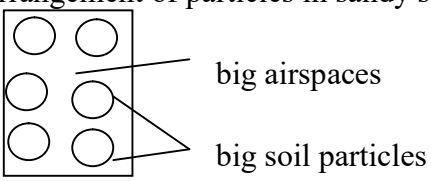



**3. *Sand* soil**

**<u>Properties</u>**

- It has a very good drainage
- It feels rough when touched
- It has large particles of soil.
- *It has large air spaces*

Arrangement of particles in sandy soil




**Uses of sandy soil**

- for making glass
- for building houses

**Activity**

1. Which type of soil is for making ceramics|?
2. Why is clay soil not good for crop growing?
3. Why is sand soil not good for crop growing?

# Word bank

**Soil**

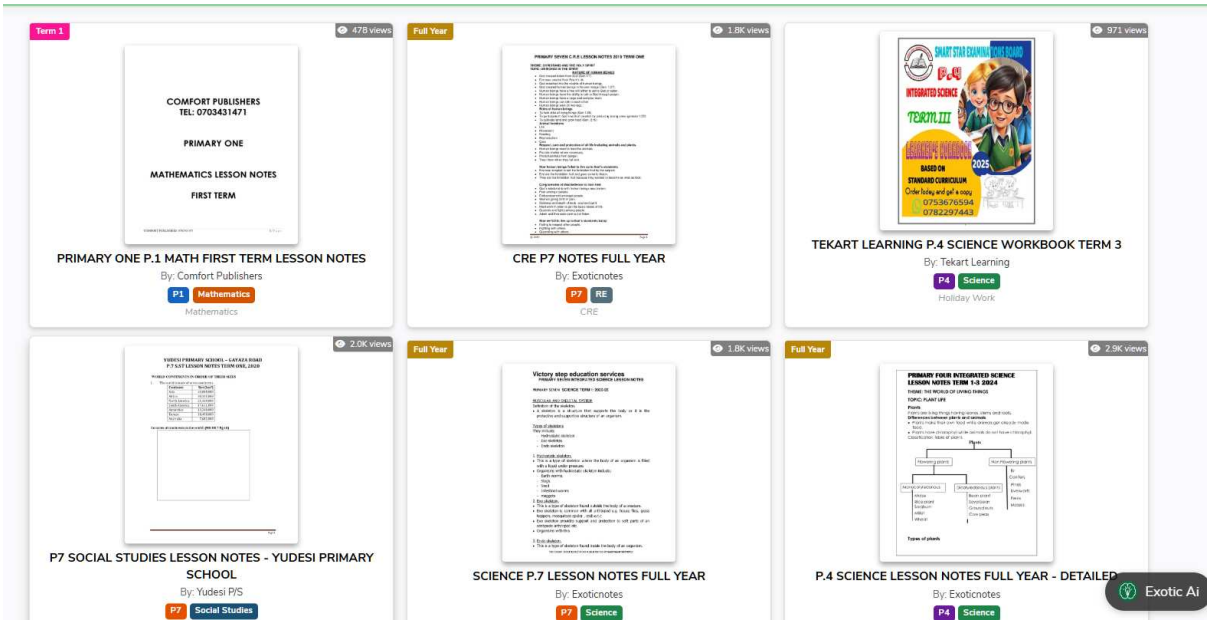
| | | |
|---|---|---|
| Weathering | Aeration | Germination |
| Loose | Mineral salts | Nutrients |
| Decomposition | Absorbs | Fertile |
| Components | Softens | Drained |
| Humus | Respiration | Particles |
| Moisture | Fertility | Capillarity |
| Modeling | Rough | Pottery |
| Erosion | Gully | Exhaustion |
| Cenervation | Fertility | Gulley |
| Bush following | Afforestation | Fertile |
| Organic | Manure | Fertilizer |
| Polythene | Plastic | |

**Matter and energy**

**Heat energy**

| | | |
|---|---|---|
| Energy | Viscious | Suspension |
| Weight | Xenon | Concentration |
| Occupies | Krypton | Dilution |
| Exerts | Sublimation | Solution |
| Gaseous | Freezing | Solvent |
| Definite | Condensation | Solute |
| Cohesion | Evaporation | Magnet |
| Adhesion | Immiscible | Decantation |
| Quarks | Gravity | Flotation |
| Possess | Nuclear | Evaporation |
| Potential | Friction | Intertia |
| Kinetic | Cocci | Conduction, |
| Rhyzobuim | Microscope | convection, |
| Putrefying | Jock itch | radiation |
| Spirilla | Dhobi itch | Filtration |
| Treponema pallidum | Vibrio cholerae | Athletes foot |

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