

|                                                                                               |                                                                                |
|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| <b>manure.</b><br>1. Very leafy<br>2. Rot easily<br>3. Grow fast<br>4. High nitrogen content. | decompose.                                                                     |
| Organic mulches                                                                               | Dry grass, leaves and plant steps spread on the soil and allowed to decompose. |

(ii) **Inorganic Fertilizers**

- These are fertilizers which are made from chemicals.
- These fertilizers are also called chemical or artificial fertilizers.
- Inorganic fertilizers are divided into two groups
  1. Straight fertilizers.
  2. Compound fertilizers.
- **Straight fertilizers** contain only one major plant nutrient. There are three types of straight fertilizers: Nitrogenous fertilizers, phosphatic fertilizers and potassic fertilizers.

**Examples:**

1. Nitrogenous – Urea, blood meal. C.A.N, ammonium sulphate.
2. Phosphatic – single super phosphate, double super phosphate, triple super phosphate, bone meal.
3. Potassic – morate of potash  
Potassium sulphate.

- **Compound fertilizers** contain two or more major plant nutrients.
- Examples of compound fertilizers are diammonium phosphate which contains nitrogen and phosphorous, NPK which contains nitrogen phosphorous and potassium.

**Advantages and disadvantages of Organic fertilizers**

(i) **Advantages**

1. They are easy to make.
2. They improve soil structure.
3. They are cheap to make.
4. They do not pollute the soil.
5. They do not burn the crops.
6. They are not easily leached.

(ii) **Disadvantages**

1. They take too long to decompose.
2. They contain low plant nutrients.
3. They are needed in large amounts.
4. They are bulky to transport.
5. They may contain crop pests.
6. Green manure is expensive to make.

**Advantages and Disadvantages of Inorganic Fertilizers**

(i) **Advantages**

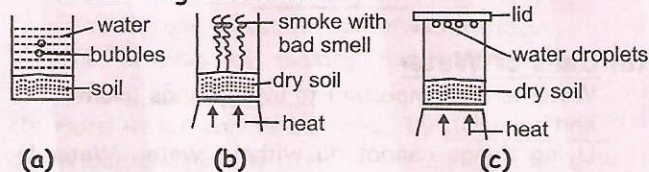
1. They are needed in small amounts.
2. They are easy to transport.
3. They contain specific plant nutrients.
4. They are easily absorbed by the plant.
5. They highly improve crop yields.

(ii) **Disadvantages**

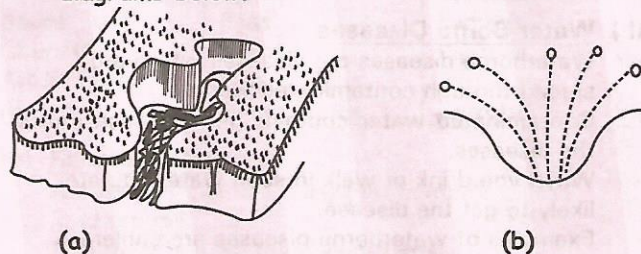
1. They pollute the soil.
2. They are easily leached.
3. They are expensive.

**STRUCTURED QUESTIONS ON THE TOPIC**

1. List down four components of soil.
2. Name the components of soil being investigated in the diagrams below.



3. Name the three types of soils.
4. Outline four characteristics of clay soil.
5. State four characteristics of sand soil.
6. Loam soil contains \_\_\_\_\_.
7. What is soil texture?
8. What is drainage?
9. Name all the materials needed when investigating drainage in soils.
10. Drainage in soils depends on \_\_\_\_\_.
11. Which soil has the highest drainage?
12. Which soil has the lowest drainage?
13. The ability of a soil to hold water is called \_\_\_\_\_.
14. Which soil holds a lot of water?
15. The rising of water in soils is called \_\_\_\_\_.
16. List down all materials needed when investigating capillarity in soils.
17. \_\_\_\_\_ soil has the highest capillarity.
18. \_\_\_\_\_ soil has the lowest capillarity.
19. What is soil erosion?
20. Name the agents of soil erosion.
21. State any three factors that increase the rate of soil erosion.
22. Name the four types of soil erosion.
23. Name the types of soil erosion shown in the diagrams below.



24. What is soil fertility?
25. List ways through which a soil loses its fertility.
26. Farmers use \_\_\_\_\_ to improve soil fertility.
27. What are organic fertilizers?
28. What are inorganic fertilizers?
29. Name four types of organic fertilizers.
30. Inorganic fertilizers that contain one major plant nutrient are called \_\_\_\_\_.
31. Name three categories of straight fertilizers.
32. State two advantages of organic fertilizers.
33. State two disadvantages of inorganic fertilizers.
34. State three advantages of inorganic fertilizers.
35. State two disadvantages of inorganic fertilizers.



## TOPIC 8

### WATER

#### **(a) Uses of Water**

- Water is very important to living things (plants and animals).
- Living things cannot do without water. Water is life.
- Water is used in different places.
- It is the largest component of the environment.
- The following places use water.

- (i) At home
- (ii) On the farm
- (iii) In industries
- (iv) For recreation

##### **(i) Uses of Water at home**

- At home water is used for drinking, washing, bathing and cooking.

##### **(ii) Uses of water on the farm**

- The following are ways through which a farmer uses water on the farm.
  - Watering crops (irrigation)
  - Watering animals (animals drinking)
  - Mixing farm chemicals
  - Cleaning farm tools after use

##### **(iii) Uses of water in industries**

- In industries, water is used for;
  - Cleaning raw materials.
  - Mixing different substances.
  - Cleaning machines.
  - Cooling engines and machines.
  - Beautification - making fountains.

##### **(iv) Uses of water for recreation**

- Recreation means enjoyment.
- Recreational uses of water include boat racing, surfing and swimming, water skiing.

#### **(b) Water Borne Diseases**

- Waterborne diseases are diseases which are spread through contaminated water.
- Contaminated water contains germs which cause the diseases.
- When you drink or walk in such water you are likely to get the disease.
- Examples of waterborne diseases are cholera, typhoid and bilharzia.

##### **1. Signs and symptoms of cholera**

- Violent diarrhoea that looks like 'rice water'.
- Vomiting.
- Severe abdominal pain.
- Dehydration of the body.
- Death within 24 hours if not treated.

##### **2. Signs and symptoms of typhoid**

- Abdominal pain.
- Pain in muscles and joints.
- Vomiting and diarrhoea at a later stage.
- Fever and skin rash.

##### **3. Signs and symptoms of Bilharzia**

- Skin rashes.
- Fever after some weeks of infection.
- Coughing and diarrhoea.
- Blood in stool and urine.

#### **Prevention of waterborne diseases**

- Waterborne diseases can be prevented by
  1. Drinking clean and boiled or treated water.
  2. Avoid bathing in water bodies (sources).
  3. Proper sanitation (use latrines and toilets).
  4. Washing hands after visiting the toilet/latrine.
  5. Washing hands before eating food.
  6. Washing fruits and vegetables before eating them.
  7. Covering food to avoid contamination.
  8. Wearing shoes and gloves when working in water.

#### **(c) Water Pollution**

- Water pollution means making water harmful to plants and animals.
- Water is polluted by harmful substances called pollutants.
- Pollutants of water are;
  1. Floods during heavy rains.
  2. Waste from animals and humans.
  3. Oil spillage from tankers.
  4. Farm chemicals such as fertilizers, herbicides, pesticides, fungicides.
  5. Acid rain.
  6. Disposal of raw industrial wastes.
  7. Disposal of raw wastes.

#### **Effects of water pollution**

- Polluted water affects animals, plants and soil.
- The following are effects of water pollution.
  1. During floods, siltation occurs in dams and rivers. This kills aquatic life. Siltation also lowers down generation of HEP.
  2. Oil spills block oxygen from getting into water. This threatens aquatic life as they lack oxygen for breathing.
  3. When farm chemicals are washed into rivers, they kill aquatic life.
  4. Domestic wastes when dumped into rivers may lead to spread of waterborne diseases.
  5. Industrial waste gases (sulphur dioxide and carbon dioxide) leads to acid rain which destroys aquatic life and iron roofing.
  6. Polluted water makes a soil to lose its fertility.

#### **Ways of Controlling Water Pollution**

- Factories should treat their wastes before discharging them.
- Accidental oil spills should be cleared immediately.
- Farmers should reduce the use of farm chemicals.
- Industrial effluent should not be discharged into rivers.
- Bathing and washing in water sources should be discouraged.
- People should practise proper sanitation.
- Domestic wastes (sewage) should not be discharged into rivers.

#### **(d) Water Conservation**

- Conservation means proper use and care of something.
- Water conservation is the proper use and care of water.
- When water is conserved, water can be used in future.



2. Recycling water.
3. Harvesting rain water.
4. Using water sparingly.
5. Mulching and shading crops.
6. Repairing leaking taps.

(e) **Hard and Soft Water**

- Hard water is water that contains calcium and magnesium salts.
- Hard water does not lather easily with soap. It forms scum with soap.
- Soft water is water that contains little or no salts of calcium and magnesium.
- Soft water lathers easily with soap. It forms foam with soap.

**Disadvantages of hard water**

1. Hard water wastes soap. A lot of soap is used when washing clothes with hard water.
2. Hard water makes clothes dirty. The scum produced makes clothes dirty.
3. Hard water makes plastics to have spots.
4. Hard water makes clothes lose their brightness.
5. Hard water reacts with water pipes forming fur that may block the pipes.
6. Hard water reacts with hot water pipes, kettles and showers forming scale hence blocking the pipes.

**NOTE:** Hard water is good for drinking. It contains calcium and magnesium salts that are needed for strong teeth and bones. Hard water also has a good taste.

**Softening Hard Water**

- This is the process of making hard water soft.
- Hard water can be made soft by boiling. Boiling only removes temporary hardness.
- To remove permanent hardness one has to use chemicals e.g. Magadi soda.

**STRUCTURED QUESTIONS ON THE TOPIC**

1. State three domestic uses of water.
2. State three uses of water on the farm.
3. Outline three recreational uses of water.
4. State two industrial uses of water.
5. Name three ways of storing water.
6. Diseases that spread through contaminated water are called \_\_\_\_\_.
7. Name three diseases that spread through contaminated water.
8. Outline four signs and symptoms of cholera.
9. Outline three signs and symptoms of typhoid.
10. Outline three signs and symptoms of bilharzia.
11. Explain four ways of controlling water borne diseases.
12. What is water pollution?
13. Name three things that pollute water.
14. Identify three things that are affected when water is polluted.
15. State any four effects of water pollution.
16. Explain four ways of conserving water.
17. What is hard water?
18. What is soft water?
19. \_\_\_\_\_ is formed when hard water mixes with soap.

20. \_\_\_\_\_ is formed when soft water mixes with soap.
21. \_\_\_\_\_ water lathers easily with soap.
22. Explain three disadvantages of hard water.
23. Identify one disadvantage of hard water.
24. The process of making hard water soft is called \_\_\_\_\_.
25. Hard water can be softened by \_\_\_\_\_.
26. Which chemical is used to soften hard water?

**TOPIC 9**

**FOOD AND NUTRITION**

(a) **Basic Food Groups**

- Food is anything we eat to
  1. Give us energy.
  2. Make us grow.
  3. Protect us from diseases.
- There are three basic food groups. These groups are;
  1. **Carbohydrates (energy giving foods).** These are foods that give us energy. This energy enables us to do work and walk.
  2. **Proteins (body building foods).** These foods enable us to grow. Repair worn out tissues and build the body.
  3. **Vitamins (protective foods).** These foods protect our body against diseases.

**Examples:**

| Energy giving foods | Body building foods | Protective foods |
|---------------------|---------------------|------------------|
| Cassava             | Meat                | Oranges          |
| Ugali               | Milk                | Kales            |
| Potatoes            | Eggs                | Spinach          |
| Bread               | Peas                | Lemons           |
| Chapatti            | Beans               | Pawpaw           |
| Arrow roots         | Fish                | Pineapple        |
| Rice                | Green grams         | Carrots          |

(b) **Balanced Diet**

- A balanced diet is a meal that contains all the food groups.
- This meal has energy giving foods (carbohydrates), body building foods (proteins) and protective foods (vitamins).

**Examples of a balanced diet (meal)**

1. **Breakfast**
  - (a) A cup of milk, bread and an orange.
  - (b) Tea, sausage, orange juice and mandazi.
2. **Lunch**
  - (a) Rice, bean stew and pineapple juice.
  - (b) Ugali, fish stew and spinach.
3. **Supper**
  - (a) Chapati, meat stew and cabbage.
  - (b) Rice, green grams and kales.

(c) **Deficiency Diseases**

- These are diseases which are caused by not eating a balanced diet.
- When one eats only one type of food, he is likely to suffer from these diseases.



| Name of disease | Cause                                    |
|-----------------|------------------------------------------|
| Kwashiorkor     | Lack of body building foods i.e proteins |
| Marasmus        | Lack of enough food                      |
| Anaemia         | Lack of iron                             |
| Rickets         | Lack of vitamin D                        |

| VITAMINS  | SOURCES                            | USE IN THE BODY             |
|-----------|------------------------------------|-----------------------------|
| Vitamin A | Vegetables, eggs, milk, oils, fat. | For proper eyesight.        |
| Vitamin B | Rice, millet, maize, wheat.        | Function of brain.          |
| Vitamin C | Fruits, vegetables, fish oil.      | Healthy teeth and skin.     |
| Vitamin D | Sunlight, milk, eggs, fish oil.    | Strong bones and teeth.     |
| Vitamin K | Green vegetables, liver, eggs.     | Helps in clotting of blood. |

### MINERAL SALTS

| MINERALS    | SOURCES                      | WORK IN THE BODY                                            |
|-------------|------------------------------|-------------------------------------------------------------|
| Iron        | Meat, vegetables, eggs, milk | Making blood                                                |
| Phosphorous | Groundnuts, peas, milk       | Combine with calcium, vitamin D for strong bones and teeth. |
| Calcium     | Sorghum, millet, eggs, milk  | Strong teeth and bones                                      |
| Iodine      | Iodized salts                | Proper growth<br>Prevent goiter.                            |

### (d) Food Preservation

- This is the process of storing food properly for future use.
- By preserving food, we prevent food from getting spoilt.
- There are different methods of preserving food.

### (i) Traditional methods of preserving food

#### 1. Smoking

- Smoking preserves foods like meat, fish, etc.
- Smoke coats food keeping off bacteria and fungi.

#### 2. Drying

- Drying preserves food like fish, meat, vegetables and grains.
- Drying removes water making food to go for a long time without going bad.

#### 3. Use of low temperatures

- This method preserves foods like vegetables, milk, meat, e.t.c.
- It keeps food cool by making bacteria less active.

#### 4. Use of ash

- This method preserves food like grains, tubers, e.t.c.
- When ash is used to preserve food, it acts as a pesticide.

#### 5. Salting

- Salting preserves food like meat, fish, etc.
- Salt dehydrates bacteria hence killing them.

#### 6. Use of honey

- Honey is used to preserve meat, fish.
- Honey prevents air and bacteria from reaching

### (ii) Modern methods of preserving food

- Modern methods of preserving food are
  1. Drying
  2. Refrigeration
  3. Freezing
  4. Canning
  5. Pasteurization
- In refrigeration, milk, fish, fruits, meat, etc are kept under low temperatures.
- In freezing, food is kept under very low temperatures i.e. below 0°C.
- In canning food is heated to kill germs and remove air. This food is then put in cans which are then sealed.
- Pasteurization - milk is heated to very high temperature, then cooled and then packed.

### (e) Proper Storage of Food

- When food is stored properly it can stay longer without going bad.
- Proper storage of food ensures that food is not contaminated.
- The following are ways of storing food properly.
  1. Keeping foods that go bad quickly in the refrigerator.
  2. Keeping foods in air tight containers.
  3. Keeping food in well ventilated rooms.
  4. Keeping dry foods such as sugar and flour away from dump places.

### (f) Nutritional needs for special people

- People in the family who need special food nutrients are called special groups.
- These groups of people include: expectant mothers, lactating mothers, infants and HIV and AIDS patients.

#### (i) Nutritional needs for expectant mothers

- An expectant mother is a pregnant woman.
- An expectant mother needs the following:
  1. Proteins for development of the foetus and for her growth.
  2. Carbohydrates to provide energy for growth and development of foetus.
  3. Calcium and phosphorous for development of strong teeth and bones of foetus.
  4. Iron for blood formation of the foetus and mother.
  5. Protective foods such as vitamins.
  6. Vitamin D for bone formation of the foetus.
  7. Vegetables and fruits to provide roughage that prevents constipation.
  8. They should avoid fatty and oily foods as they cause nausea and heart burn.

#### (ii) Nutritional needs for a lactating mother

- A lactating mother is a mother who is breast feeding.
- This mother is also called breastfeeding or nursing mother.
- A lactating mother needs the following:
  1. A balanced meal.
  2. Enough fluids that promote milk production.
  3. Foods rich in iron to replace blood of the mother lost during birth.
  4. Calcium and phosphorous that the baby needs for strong teeth and bones.

#### (iii) Nutritional needs for Infants

- An infant is a young baby between 0 years to 2 years



### Value of breast milk to an infant

1. Breast milk contains antibodies that boost the immunity of the baby. The antibodies are in the first yellow milk called colostrum.
2. Breast milk is readily available.
3. Breast milk is free from germs.
4. Breast milk has the right temperature.
5. Breast milk has no allergic reactions to the baby.
6. Breast milk bonds baby and the mother.
7. It is easily digested.

### (iv) Nutritional need for people with HIV/AIDS

- People with HIV and AIDS need a balanced diet.
- They need vitamins to boost their weak immunity.
- They should be given proteins for repair of worn out body tissues.
- They need carbohydrates to provide energy.
- They need plenty of fluids to replace water lost through diarrhoea.
- They should not eat foods with a lot of fats or oil.

### (h) Food Poisoning

- Food poisoning is the illness of the stomach caused by eating contaminated food.
- Food can be contaminated by chemicals and micro organisms.
- Chemicals which contaminate food include detergents, insecticides, soaps, pesticides, kerosene, e.t.c.
- Micro organisms which contaminate food are bacteria and fungi.

### Symptoms of food poisoning

- Diarrhoea
- Violent vomiting
- Severe stomach ache
- Weakness and dizziness

### Preventing food poisoning

- Keep chemicals away from food.
- Check expiry dates of foods
- Washing raw foods.
- Proper cooking.
- Proper storage.
- Observe hygiene.

### STRUCTURED QUESTIONS ON THE TOPIC

1. State three reasons why we eat food.
2. Name the three basic food groups.
3. Give three examples of each of the following.
  - (a) Energy giving foods
  - (b) Body building foods
  - (c) Protective foods
4. What is a balanced diet?
5. Give three examples of a balanced diet.
6. What are deficiency diseases?
7. List down any 5 deficiency diseases.
8. State the causes of the following deficiency diseases.
  - (a) Kwashiorkor -
  - (b) Marasmus -
  - (c) Rickets -
  - (d) Scurvy -

9. In each of the following deficiency diseases state three signs of
  - (a) Kwashiorkor
  - (b) Marasmus
10. State three uses of water in our diet.
11. To prevent constipation, we should eat foods that have \_\_\_\_\_.
12. What is food preservation?
13. State four traditional methods of preserving food.
14. \_\_\_\_\_ preserves food by dehydrating organisms that make food go bad.
15. \_\_\_\_\_ preserves food by removing water from food.
16. \_\_\_\_\_ preserves food by acting as a pesticide.
17. List down three modern methods of preserving food.
18. Name four people in the family who need special nutritional needs.
19. Who is an infant?
20. State four reasons why a child needs breast milk.
21. What is weaning?
22. To promote strong bones and teeth of a developing foetus mothers should eat foods rich in \_\_\_\_\_.
23. People suffering from HIV and AIDS should be given foods rich in \_\_\_\_\_.
24. People suffering from HIV and AIDS should avoid food that are rich in \_\_\_\_\_.
25. What is food poisoning?
26. What causes food poisoning?
27. Name the chemicals that can cause food poisoning.
28. Name three micro organisms that cause food poisoning.
29. State three signs and symptoms of food poisoning.
30. Outline four ways of preventing food poisoning.

## TOPIC 10

### PROPERTIES OF MATTER

#### (a) What is matter?

- Matter is anything that occupies space and has weight.
- Matter exists in three states. These states are solids, liquids and gases.
- Examples of solids are: stones, chalk dust, sand, nail, wood, glass, e.t.c.
- Examples of liquids are: water, ink, spirit, kerosene, petrol, e.t.c.
- Examples of gases are: water vapour, oxygen, carbon dioxide, nitrogen, e.t.c.

#### Some properties of Matter

##### 1. Solids



- Solids have a definite volume. The space a solid occupies is fixed.
- Solids have a definite size (mass).
- Expands when heated.

## 2. Liquids

- Liquids have a definite volume.
- Liquids do not have a definite shape. Liquids take the shape of a container.
- Liquids have a definite size (mass).
- Expands more when heated.

## 3. Gases

- Gases have no definite volume. Volume of gas keeps on changing.
- Gases have no definite shape.
- Gases have a definite size (mass).
- Expands the most when heated.

## 4. Weight

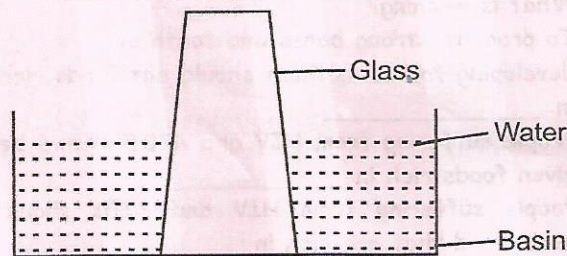
- Light objects floats while heavy objects sinks.

## 5. Density

- Objects with less density than the liquid floats while the one with high density sinks.

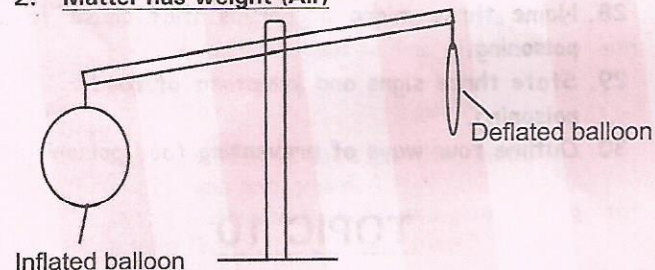
### Experiments that show some properties of matter

#### 1. Matter occupies space (Air)



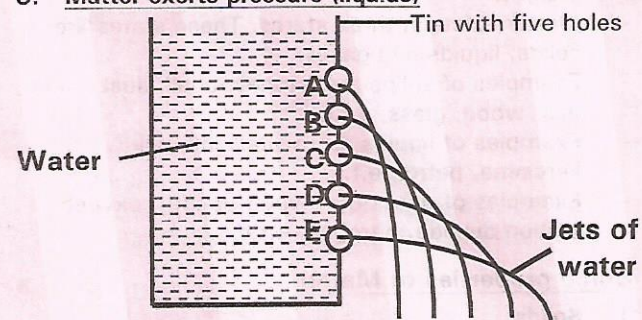
- In the above experiment, water does not enter the glass. This is because there is air which has occupied space in the glass.

#### 2. Matter has weight (Air)



- In this experiment, the inflated balloon has air; the deflated balloon has no air. The inflated balloon is heavier than the deflated balloon because it has air.

#### 3. Matter exerts pressure (liquids)

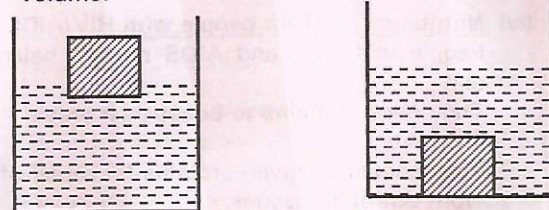


- In this experiment hole E throws water furthest

because pressure at E is greater than A. This shows that pressure in liquids depends on depth.

#### (b) Floating and Sinking

- Floating occurs when an object put in water stays on the surface of the water.
- Sinking occurs when an object put in water goes down to the bottom of a container with water.
- When an object floats, it displaces its own weight.
- When an object sinks, it displaces its own volume.



(a) A floating object

(b) A sinker

#### Factors that affect sinking and floating

##### 1. Size of object

- Size does not affect sinking and floating.
- If sticks of different size are put in water they will float.
- Pieces of wires of different sizes sink in water.

##### 2. Material of the object

- The material an object is made of determines its weight and density.
- When equal volumes of wood and iron are put in water, the wood floats while the iron sinks. This is because of difference in material.

##### 3. Shape

- When the surface area of a sinker is increased, the object becomes a floater. This is because the surface in contact with water is big. A bottle top floats because of shape. When crushed, it sinks.
- A metal ship floats because of shape.

##### 4. Weight

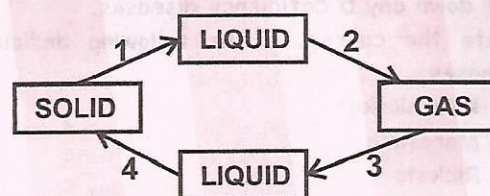
- Light objects floats while heavy objects sinks.

##### 5. Density

- Object with less density than the liquid floats while the one with high density sinks.

#### (c) Changes of State

- Matter exists in three states. These states are solid, liquid and gas.
- Changes of state occur when one state of matter changes to another state i.e. when a solid changes to a liquid and vice versa.
- Changes of state are caused by change in temperature and pressure.
- When some solids are heated (change of temperature) they change to liquids.
- When a liquid is heated it changes to gas.
- When a gas is cooled it changes to a liquid.
- When a liquid is cooled it changes to a solid.



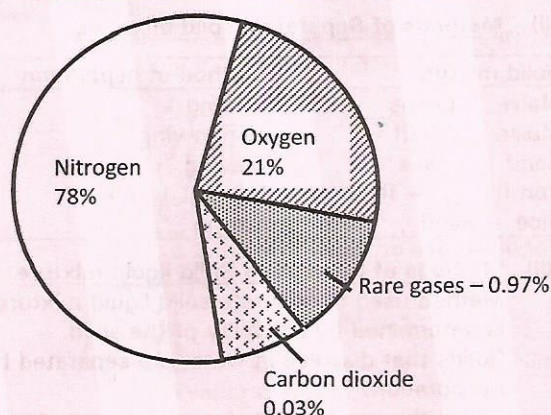


- Process 1 is known as melting. Melting occurs when a solid changes to liquid.
- Process 2 is known as evaporation. It occurs when a liquid changes to a gas.
- Process 3 is known as condensation. It occurs when a gas changes to a liquid.
- Process 4 is known as freezing. It occurs when a liquid changes to a solid.
- Melting, evaporation need increase in temperature (heating).
- Condensation and freezing need a decrease in temperature (cooling).

#### (d) Composition of Air

- Air is a mixture of gases.
- The gases that make air are Nitrogen, Oxygen, rare gases and carbon dioxide.
- Each gas has its fixed percentage.
- The table below shows the percentage composition of each gas.

| Name of gas       | Percentage composition |
|-------------------|------------------------|
| Nitrogen          | 78%                    |
| Oxygen            | 21%                    |
| Rare gases(inert) | 0.97%                  |
| Carbon dioxide    | 0.03%                  |



- When nitrogen and oxygen are put together, they form 99% of air by volume.
- When nitrogen and carbon dioxide are put together they form 78% of air by volume.
- When nitrogen and rare gases are put together, they form 79% of air by volume.
- When oxygen and rare gases are put together, they form 22% of air by volume.
- When oxygen and carbon dioxide are put together, they form 21% of air by volume.

#### NOTE:

- Water vapour and dust particles are also present in air. They are not components of air. They are just carried by air and their percentages in air keep on changing from time to time.

#### (i) Uses of Oxygen

1. Oxygen is used during respiration in plants and animals. Respiration occurs in body cells when food is burned to produce energy.
2. Oxygen supports burning (combustion). Fuels cannot burn in the absence of oxygen.
3. During germination oxygen is used up by the germinating seeds.
4. Oxygen is needed in rusting.

#### (ii) Uses of Carbon dioxide

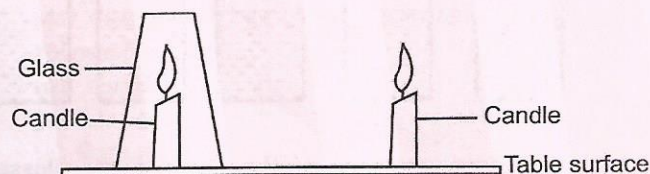
- Extinguishing fire
- Making dry ice used as a refrigerant

#### (iii) Uses of Nitrogen

- Used by leguminous plants to make pent proteins
- Making fertilizers
- Used as a refrigerant

#### Experiment to show that oxygen is used in burning

##### Activity A

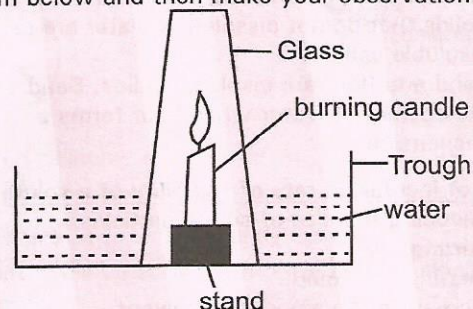


- In this activity, the candle that is covered with a glass goes off after sometime while the candle not covered continues to burn. This is because the covered candle uses all the oxygen present in the glass and no more oxygen needed for burning is present hence it goes off. The uncovered candle continues to burn because it has enough oxygen around it.

##### Activity 2

Materials needed are candle, water, trough and glass.

**Procedure:** Arrange the materials as shown in the diagram below and then make your observation.



##### Observation

- The candle goes off after sometime.
- The level of water goes down in the trough.
- Water enters the glass.

##### Conclusion and explanation

- The candle goes off because it uses all the oxygen in the glass.
- Water enters the glass to occupy the space of the used up oxygen. This represents  $\frac{1}{5}$  of the glass.

##### (ii) Uses of Rare gases

- Examples of rare gases are neon, argon, helium and krypton.
- Argon is used in making electric bulbs. Argon prevents the filament from burning up.
- Neon is used in making coloured tubes for advertisement.
- Helium is used in making hot air balloons because it cannot explode.

#### (e) Making Mixtures

- A mixture is made by putting two or more things together i.e. putting maize and beans together, adding sugar in a cup of tea, e.t.c.

##### (i) Mixing solids and liquids (dissolving solids in water)

- Some solids dissolve in waters while others



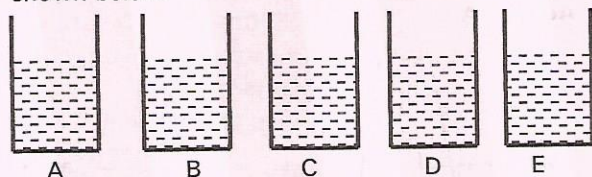
**To investigate solids that dissolve and solids that do not dissolve in water**

**Materials**

- Water, stirring rod, 5 glasses, sand, flour, salt, sugar and glucose.

**Procedure**

- Put equal amounts of water in the 5 glasses as shown below.



- Add equal amounts of the solids in the glasses one at a time and stir using sticks or spoons.
- Make your observations (which solids dissolve and which solids do not dissolve).

**Observation and Explanation**

- The solids that dissolve are salt, sugar and glucose.
- The solids that do not dissolve are sand and flour.
- Some solids dissolve while others do not.
- Solids that dissolve in water are called solutes (soluble solids).
- Salt, glucose and sugar are solutes. They dissolve in water forming a solution i.e. salt solution, glucose solution and sugar solution.
- Solids that do not dissolve in water are called insoluble solids.
- Sand and flour are insoluble solids. Sand settles at the bottom of water while flour forms a suspension.

**Ways of increasing rate of solubility of a solute**

1. Reducing the size of solute particles.
  2. Stirring.
  3. Heating the liquid.
  4. Increasing the amount of solvent.
- Stirring and heating makes a solid dissolve faster.
  - A liquid in which a solid dissolves is called a solvent.
  - Water is a solvent.

**Mixing Liquids**

- When a liquid is added (poured) in another liquid, it may mix with it or not.
- Liquids that mix are called miscible liquids.
- Liquids that do not mix are called immiscible liquids.

**To investigate miscible and immiscible liquids**

**Materials:**

- Test tubes or glasses, stirring rods, different liquids (water, spirit, ink, petrol, milk, kerosene, cooking oil and diesel).

**Procedure**

- Mix the liquids as shown below and make your observations. Which liquids mix and which do not mix?

| Liquid mixture      | Miscible | Immiscible | Layers |
|---------------------|----------|------------|--------|
| Water + ink         | ✓        |            | 1      |
| Water + cooking oil |          | ✓          | 2      |
| Water + fresh milk  | ✓        |            | 1      |
|                     |          | ✓          | 2      |

**(i) Magnetic and Non Magnetic Materials**

- A magnet is a piece of metal that attracts other metals. A magnet has a force called magnetism.
- Materials that a magnet can attract are called magnetic materials.
- Materials that a magnet cannot attract are called non-magnetic materials.
- The table shows magnetic and non magnetic materials.

| Magnetic materials | Non magnetic materials |
|--------------------|------------------------|
| Iron               | Plastic                |
| Steel              | Rubber                 |
| Tin                | Glass                  |
| Chromium           | Copper                 |
| Cobalt             | Aluminium              |
| Alnico             | Zinc                   |
| Nickel             | Wood                   |
|                    | Paper                  |

- Magnets are used in:

- (i) Electric bells.
- (ii) In radio speakers.
- (iii) Fridges.

**(j) Separation of Mixtures**

**(i) Methods of Separating solid mixtures**

| Solid mixture         | Method of separation |
|-----------------------|----------------------|
| Maize + beans         | Picking              |
| Maize + Chaff         | Winnowing            |
| Sand + beans          | Sieving              |
| Iron fillings + flour | Magnet               |
| Rice + sand           | Sifting              |

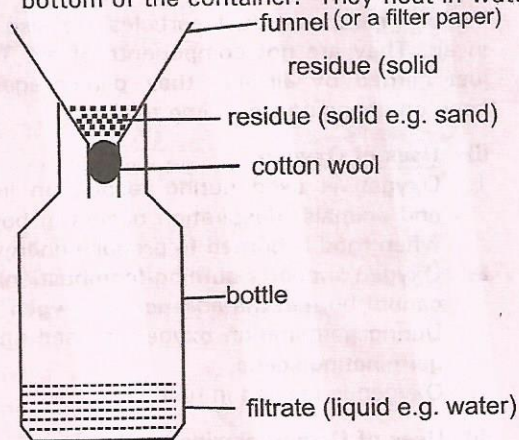
**(ii) Methods of Separating Solid liquid mixture**

- Method used to separate solid liquid mixture is determined by solubility of the solid.
- Solids that dissolve in water are separated by evaporation.
- Solids that do not dissolve are separated by decanting, filtration or sedimentation.

| Mixture       | Method of separation    |
|---------------|-------------------------|
| Salt + water  | Evaporation             |
| Sand + water  | Filtration/ Decantation |
| Flour + water | Filtration              |
| Sugar + water | Evaporation             |

**1. Filtration**

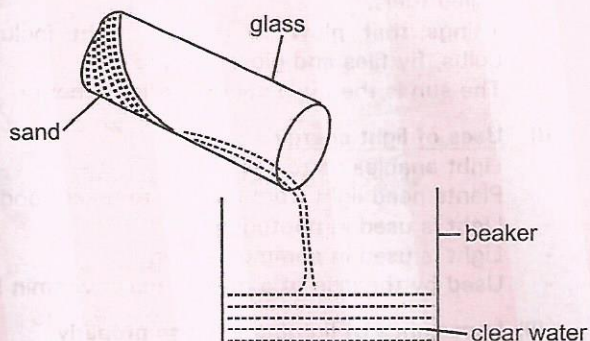
- Filtration can be used to separate solids that form a suspension in water e.g. flour, chalk dust, e.t.c. These solids do not settle at the bottom of the container. They float in water.





## 2. Decantation

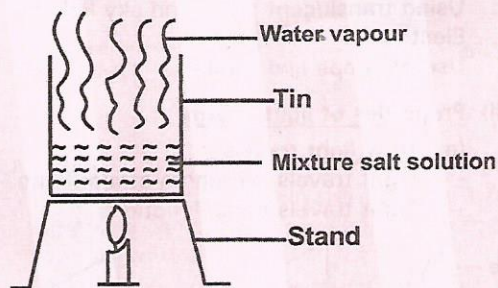
- Decantation best separates solids that settle at the bottom of the container.
- These solids are sinkers e.g. sand and iron fillings.
- The solids are allowed to settle and then the liquid (water) is poured out gently.



Decantation

## 3. Evaporation

- Evaporation is used to separate soluble solid from water.
- The mixture (solution) is heated until all the water evaporates leaving behind the solid (solute).
- Evaporation separates solids like sugar, glucose and salt from water.



Evaporation

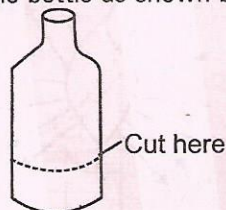
### How to make a simple water filter

#### Materials needed

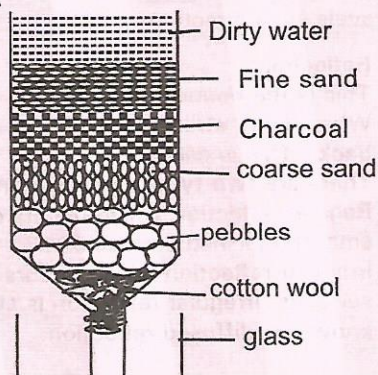
- Pebbles, coarse sand, fine sand, charcoal, plastic bottle and cotton wool.

#### Procedure

- Cut the plastic bottle as shown below.



- Arrange the materials in the bottle as shown below.

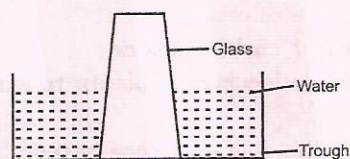


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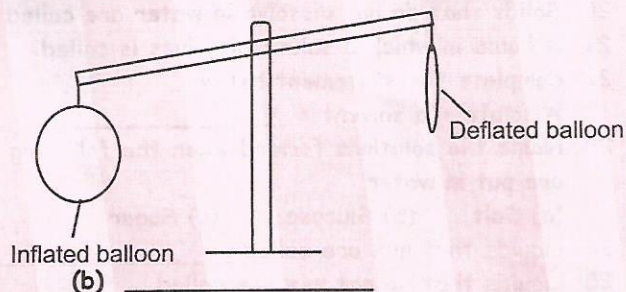
- The work of charcoal in the filter is to absorb dust and remove bad smell and colour.
- Filtered water is not safe for drinking. Filtering does not kill germs.
- Fine sand helps in filtering dirt.

## STRUCTURED QUESTIONS ON THE TOPIC

1. What is matter?
2. State the forms in which matter exists.
3. List down any three characteristics of the following.
  - (a) Solids
  - (b) Liquids
  - (c) Gases
4. In each of the following diagrams, identify the property of matter being investigated.

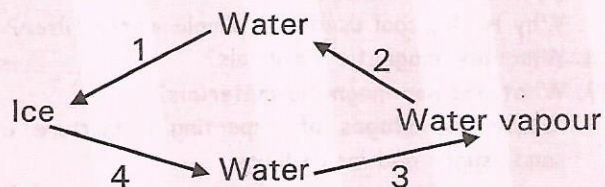


(a) \_\_\_\_\_



(b) \_\_\_\_\_

5. Pressure in liquids depends on \_\_\_\_\_.
6. What four factors that affect sinking and floating.
7. Changes of state are brought about by changes in \_\_\_\_\_.
8. Use the diagram below to answer the questions that follow.



- (a) Name the processes marked 1 - 4.
  - (b) From the diagram which two processes need a decrease in temperature?
  - (c) From the diagram which two processes need an increase in temperature?
9. What is freezing?
  10. \_\_\_\_\_ is a mixture of gases.
  11. Name all the gases that make up air.
  12. State the percentage composition of the following components of air.
 

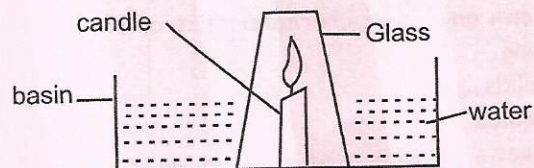
|                      |               |
|----------------------|---------------|
| (i) Rare gases       | (ii) Oxygen   |
| (iii) Carbon dioxide | (iv) Nitrogen |
  13. Complete the sentences below.



- (a) \_\_\_\_\_ and \_\_\_\_\_ form 21% of air when put together.  
 (b) \_\_\_\_\_ and \_\_\_\_\_ form 79% of air by volume when put together.  
 (c) \_\_\_\_\_ and \_\_\_\_\_ form 99% of air by volume when put together.

14. List down three uses of oxygen.

15. Standard 6 pupils carried out the experiment shown below.



- (a) What were the pupils investigating?  
 (b) List down three observations made by the pupils.

16. Outline three uses of carbon dioxide.

17. Which gas is used by leguminous plants to make proteins?

18. State the uses of the following rare gases.

- (a) Helium                      (b) Argon                      (c) Neon

19. Solids that dissolve in water are called \_\_\_\_\_.

20. Solids that do not dissolve in water are called \_\_\_\_\_.

21. A liquid in which a solute dissolves is called \_\_\_\_\_.

22. Complete the statement below:

A solute + a solvent = \_\_\_\_\_

23. Name the solutions formed when the following are put in water.

- (a) Salt                      (b) Glucose                      (c) Sugar

24. Liquids that mix are called \_\_\_\_\_.

25. Liquids that do not mix are called \_\_\_\_\_.

26. State the methods used to separate the following mixture.

- (a) Beans and maize  
 (b) Chaff and maize  
 (c) Flour and iron fillings  
 (d) Bean and sand  
 (e) Flour and water  
 (f) Cooking oil and milk

27. Why is charcoal used in a simple water filter?

28. What are magnetic materials?

29. What are non magnetic materials?

30. State the stages of separating a mixture of sand, sugar and iron fillings.

## TOPIC 11

### ENERGY

#### What is energy?

- Energy is the ability to do work.
- Energy enables us to do work. Without energy we cannot do work.
- There are different forms of energy. These forms of energy are:
  - Sound

- Electricity and
- Magnetism

#### (a) Light Energy

- Light energy is produced when things burn or glow.
- Things that burn to produce light energy are called fuels.
- Things that glow to produce light include bulbs, fly flies and glow worms.
- The sun is the main source of light energy.

#### (i) Uses of light energy

- Light enables us to see.
- Plants need light from the sun to make food.
- Light is used in photography.
- Light is used in communication.
- Used by the skin of a man to make vitamin D.

#### (ii) Importance of lighting a house properly

- A house can be lit by natural or artificial sources of light.
- In a well lit house we are able to see clearly.
- In a well lit house we avoid accidents.
- In a well lit house there are no pests.
- In a well lit house we are able to read carefully.

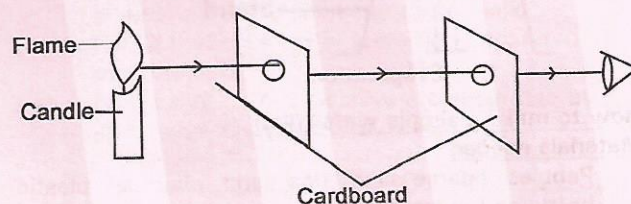
#### Ways of lighting a house

1. Using doors and windows.
2. Using translucent roofs and sky lights.
3. Electricity
4. Use of lamps and torches.

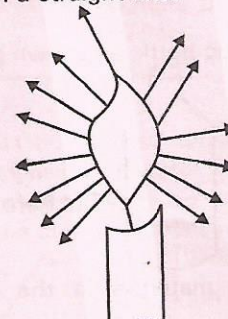
#### (iii) Properties of light energy

##### (a) How light travels

- Light travels through a straight line.
- Light travels in all directions.



(a) Light travels in a straight line.

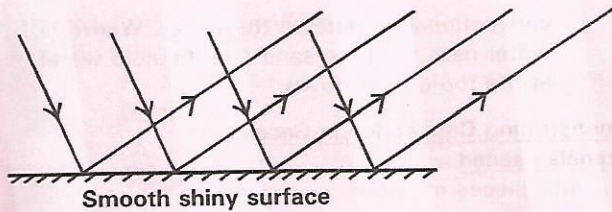


(b) Light travels in all directions

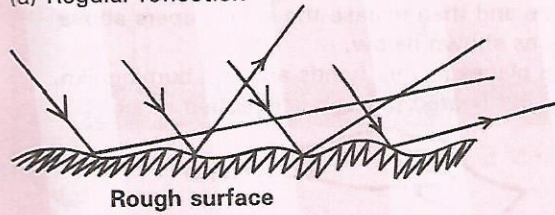
#### (b) Reflection

- This is the bouncing of light.
- When light strikes a surface, it is sent back. This is called reflection.
- There are two types of reflection.
  - (i) Regular reflection which occurs on smooth polished surfaces.
  - (ii) Irregular reflection which occurs on rough surfaces. Irregular reflection is also known as diffused reflection.





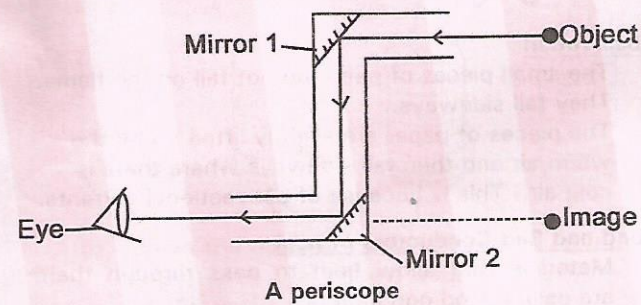
(a) Regular reflection



(b) Irregular reflection

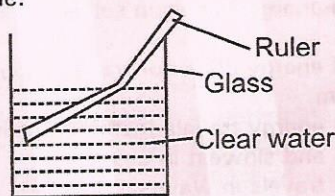
**Uses of Reflection**

1. Reflection enables us to see.
2. A periscope uses reflection. It is used to observe objects around corners.
3. Used in making solar cookers.



**(c) Refraction**

- Refraction is the bending of light as it moves from one transparent medium to another e.g. from air to water.
- The bending occurs because different media have different densities. This makes the light rays to change speed. As the light rays change speed, they bend.
- It takes place at the boundary of the two transparent media.
- To demonstrate refraction, a ruler is placed in a glass of clear water.
- The diagram below shows the observation made.



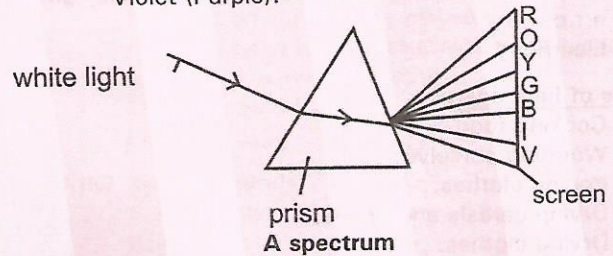
**Effects of Refraction**

- Refraction makes pools of water to appear shallow.
- Refraction makes a coin appear raised in water.
- Refraction produces a rainbow.
- Refraction makes a finger appear thick when placed in water.
- A ruler put in water appears broken
- Formation of mirage i.e virtual pools of water on roads.

**(d) Dispersion**

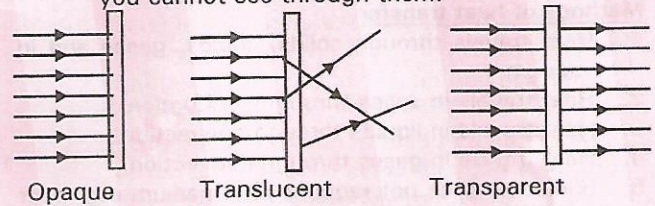
- This is the splitting of white light into seven

- The seven colours of the spectrum are Red, Orange, Yellow, Green, Blue, Indigo and Violet (Purple).



**(iv) Opaque, Transparent and Translucent Materials**

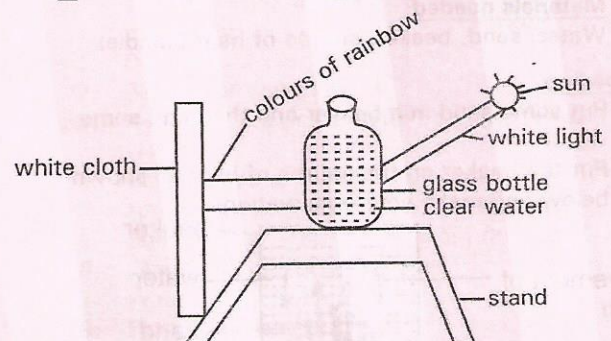
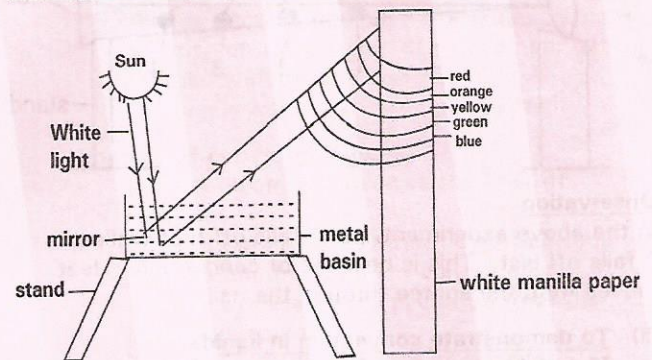
- Opaque materials are materials which do not allow any light to pass through them.
- Transparent materials are materials which allow all light to pass through them and we can see through them.
- Translucent materials are materials which allow some light to pass through them but you cannot see through them.



| Opaque materials | Translucent materials | Transparent materials |
|------------------|-----------------------|-----------------------|
| Wood             | Dirty water           | Clear water           |
| Mirror           | Frosted glass         | Clear glass           |
| Metals           | Oiled paper           | Air                   |
|                  | Tracing paper         |                       |
|                  | Tinted window         |                       |

**(e) Dispersion of light**

**A set up showing formation of a rainbow.**



**Note:** For a rainbow to be formed water and light should be present at the same time.

**(b) Heat Energy**

- Heat energy is produced when things are burned



### Sources of heat energy

- Sun
- Fuels such as charcoal, firewood, kerosene, gas, e.t.c.
- Electricity.

### Uses of heat energy

- Cooking food.
- Warming ourselves.
- Ironing clothes.
- Drying cereals and grains.
- Drying clothes.
- Preserving food (drying food).

### Effects of heat on substances

1. Heat increases the temperature of a substance. Heat makes things hot.
2. Heat causes change of state i.e. melting and evaporation.
3. Heat causes expansion i.e. increases volume of a substance.

### Methods of heat transfer

1. Heat travels through solids, liquids, gases and in vacuum.
2. Heat travels in solids through conduction.
3. Heat travels in liquids through convection.
4. Heat travels in gases through convection.
5. Radiation does not require any medium e.g. heat from the sun in a vacuum.

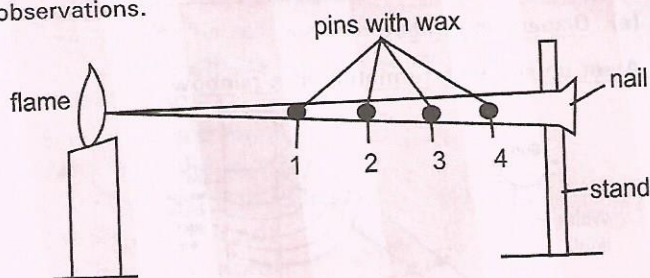
#### (i) To demonstrate conduction in solids

##### Materials needed

Nail, pin, wax, candle

##### Procedure

Arrange the materials as shown below and make your observations.



##### Observation

In the above experiment, pin 1 falls off first while pin 4 falls off last. This is because of conduction. Heat moves from the source through the nail.

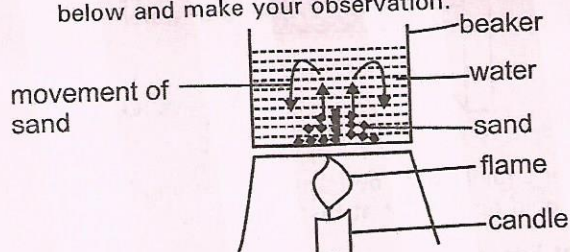
#### (ii) To demonstrate convection in liquids

##### Materials needed

Water, sand, beaker, source of heat (candle)

##### Procedure

- Put some sand in a beaker and then add some water.
- Put the beaker on the source of heat as shown below and make your observation.



convictional currents in the water. Warm water rises with the sand and the cold water at the top comes down.

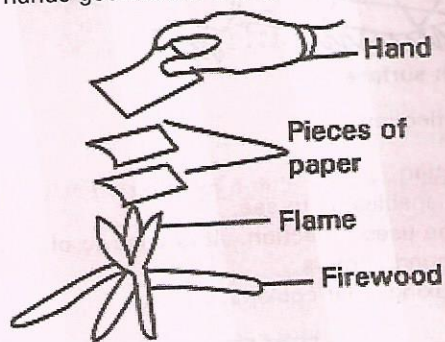
### Demonstrating Convection in Gases

##### Materials needed

Fire, small pieces of paper

##### Procedure

Make a fire and then release the small papers above the flame as shown below. When one places his/her hands above a burning jiko, the hands get heated through convection of air.



##### Observation

- The small pieces of paper do not fall on the flame. They fall sideways.
- The pieces of paper are slightly lifted up by the warm air and then fall sideways where there is cold air. This is because of convectional currents.

### Good and Bad Conductors of heat

1. Materials that allow heat to pass through them are called good conductors.
2. Good conductors of heat are iron spoon, steel, wool, aluminium foil, copper wire, silver coin.
3. Materials that do not allow heat to pass through them are called bad conductors.
4. Bad conductors of heat include water, rubber, plastic, wood and glass.
5. Bad conductors are used in making insulators.

#### (c) Sound Energy

- Sound energy is a form of energy produced when things vibrate. It is produced by hitting, blowing, shaking or plucking.
- Sound energy travels in all directions.
- Sound energy affects our sense of hearing.
- Sound energy travels in solids, liquids and gases.
- Sound energy does not travel through a vacuum.
- Sound energy travels fastest in solids, then liquids and slowest in gases.
- Sound travels in waves.
- Reflected sound is known as echo.

### Types of Sounds

- There are four types of sounds. These sounds are:-

- High or low
- Echo
- Special sound
- Loud and soft
- Noise

#### (i) High or low sound

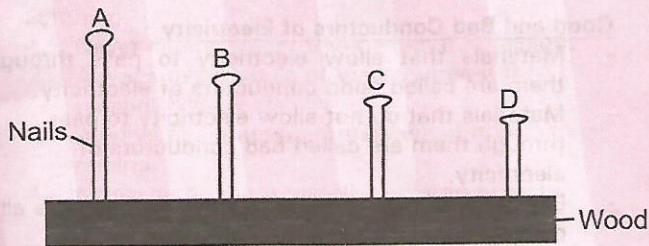
- Pitch is the highness or lowness of a sound.
- Pitch is determined by number of vibrations. The more the vibrations the higher the sound (pitch). The lesser the vibrations, the lower



## Demonstrating high and low sound

### (a) By using nails

- Fix four nails on a piece of wood as shown below.



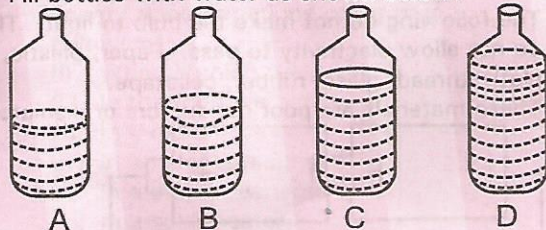
- Hit the nails one at a time and listen to the sound produced.

### Observation

- When the nails are hit, nail A produces the lowest sound while nail D produces the highest sound. This is because the longer the nail the lower the sound. The shorter the nail the higher the sound.

### (b) Using bottles with water

- Fill bottles with water as shown below.



- When the bottles are hit using a spoon, bottle A produces the highest sound while bottle D produces the lowest sound.
- When the bottles are blown across their mouths, bottle D produces the highest sound while bottle A produces the lowest sound.

## Factors that affect pitch of stringed instrument

- Length of a wire** – A short wire produces a high sound while a long wire produces a low sound. This is because there are more vibrations in a short wire than in a long wire.
- Thickness of a wire** – A thin wire produces a high sound while a thick wire produces a low sound. This is because a thin wire has more vibrations than a thick wire.
- Tightness of a wire** – When a wire is tight, it produces a high sound. When a wire is loose it produces a low sound.

### (ii) Loud and soft sound

- A loud/soft sound is determined by the force used to produce it.
- The loudness or softness of a sound is called volume.
- A loud sound is produced when somebody shouts. A loud sound can be heard by somebody who is at a distance.
- A soft sound is produced when somebody whispers. A soft sound can only be heard by somebody who is near the source of the sound.
- In a radio a loud and a soft sound is controlled by the volume knob.

### (iii) Noise

- Noise is a type of sound produced by irregular vibrations.

- Noise is unpleasant to our ears. It causes pollution.
- Noise can lead to discomfort and deafness.
- People working in noisy places e.g. in factories need to protect their ears to avoid losing their sense of hearing.
- They use ear plugs, ear defolders and ear muffs.

### (iv) Special sounds

- School bells
- Police cars
- Fire engine sirens
- Ambulance sirens
- Screaming
- Car hooting.

### (v) Echo

- Echo is reflected sound.
- When somebody talks and the sound hits a wall, it is sent back to the person. This sound that is sent back is called echo.
- Echo is used by a bat to locate food and direction.
- Captains use echo to find an obstacle ahead of a ship.
- Echoes are common in theatre halls because of the big walls. To avoid this, the walls are fitted with soft materials to absorb the sound.

## (d) Electricity

### Types of Electricity

- There are two types of electricity
- They are;
  - Static electricity
  - Current electricity

- Static electricity is produced when surfaces are rubbed together.
- When a plastic ruler is rubbed on the hair it able to attract small pieces of paper. This is because of static electricity. The ruler gets charged and attracts the papers.
- Lighting is a form of static electricity.

### Sources of current electricity

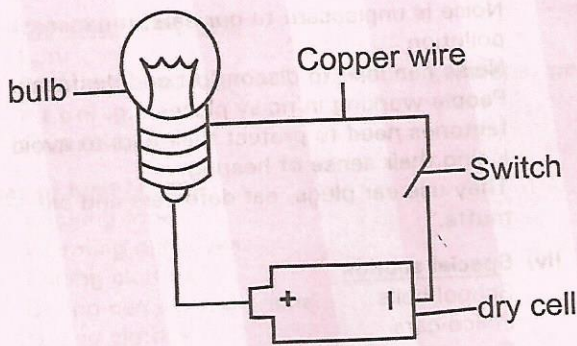
- Current electricity involves the flow of electrons.
- The type of electricity that flows from one point to another is called current electricity.
- This type of electricity is carried from the source using wires.
- The following are sources of current electricity.
  1. Dry cells
  2. Battery or wet cells
  3. Hydroelectric power (HEP) electricity from water
  4. Geothermal power – electricity from hot springs (underground).
  5. Solar energy – electricity from the sun.
  6. Petrol and diesel generators.
  7. Wind driven turbines.
  8. Bicycle dynamos.

### Producing current electricity from dry cells

**Materials:** Dry cell, bulb, copper wire.

**Procedure:** Arrange the materials as shown below.



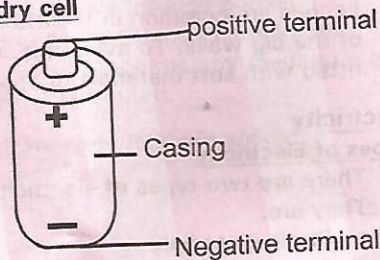


**Observation and Explanation**

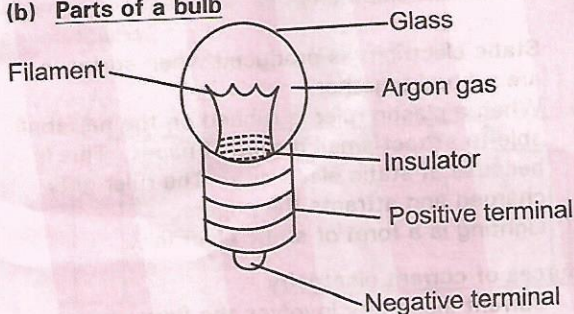
- When the switch is completed, the bulb lights.
- The dry cell produces current electricity which lights the bulb.
- The current electricity passes through the wires to the bulb.
- The path through which current electricity passes is called a circuit.
- The switch completes the circuit.
- The bulb changes current energy to heat and light energy.

**Identifying conduct points of a dry cell and a bulb**

**(a) Parts of a dry cell**



**(b) Parts of a bulb**

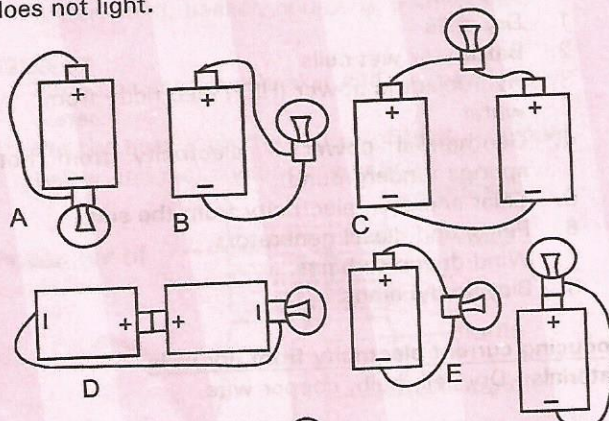


**Ways of lighting a bulb using dry cells**

**Materials:** Bulb, dry cells and copper wires.

**Procedure:**

Make the arrangement shown below and observe which arrangement the bulb lights and the one that does not light.



**Observation**

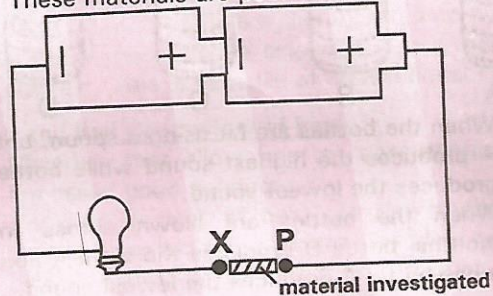
- In the above arrangements bulb lights in arrangements A, B, F and G.
- Bulbs do not light in arrangement C, D and E.

**Good and Bad Conductors of Electricity**

- Materials that allow electricity to pass through them are called good conductors of electricity.
- Materials that do not allow electricity to pass through them are called bad conductors of electricity.
- Examples of good conductors of electricity are all metals, carbon rod and graphite.
- Examples of bad conductors of electricity are rubber, glass, wood, paper, plastic, etc.

**Investigating good and poor conductors of electricity using set up below.**

- The following will make the bulb to light, because they will allow electricity to flow. Copper coin, silver coin, nail, office pins, staples, aluminium foil, graphite, carbon rod.
- These materials are good conductors of electricity.
- The following do not make the bulb to light. They do not allow electricity to pass. Paper, plastic, cloth, thread, glass, rubber, cellotape.
- These materials are poor conductors or insulators.



**Electrical appliances at home**

- These are devices that use electricity at home.
- These devices are used for a specific task.

| Name of appliance | Use               |
|-------------------|-------------------|
| Electric heat     | Heating water     |
| Electric iron box | Ironing clothes   |
| Blender           | Making juice      |
| Hair clipper      | Shaving           |
| Refrigerator      | Preserving food   |
| Fan               | Cooling the house |
| Electric kettle   | Making coffee/tea |
| Microwave         | Warming food      |

**Safety when dealing with electricity**

- Electricity is very dangerous when poorly handled. It can cause death and serious injuries.
- We should be careful when dealing with electricity.
- The following are safety precautions when dealing with electricity.
  1. Never touch switches with wet hands.
  2. Do not insert objects in the socket.
  3. Do not overload sockets.
  4. Never touch naked wires.
  5. Never play near electric mains.
  6. Naked wires should be repaired or replaced.
  7. Electric wires should not run under carpets.
  8. Never repair electrical appliances when



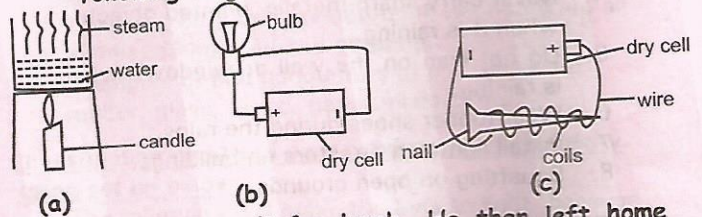
- Renewable sources of energy never get finished. They include solar, wind, water, plants and animals.
  - Non renewable sources of energy get finished. They are also called exhaustible. They include coal, petrol, kerosene and diesel.
  - We need to conserve energy so that we can have it in future.
  - The following are ways of conserving sources of energy.
    1. Using energy sparingly.
    2. Using energy efficient devices such as the improved jiko. The improved jiko conserves heat energy because of the clay lining.
    3. Using renewable sources of energy.
- Renewable sources never get finished. They can be renewed or made new again.  
E.g. wind, sunlight, biogas, forests, water.

### STRUCTURED QUESTIONS ON THE TOPIC

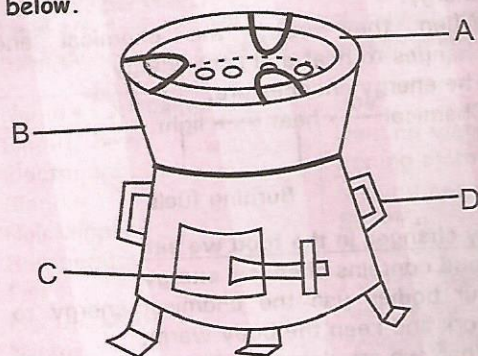
1. What is energy?
2. List down four types of energy.
3. Which forms of energy are produced when fuels are burned?
4. List down three uses of heat energy
5. List down two ways of lighting a house.
6. Outline three reasons why we should light our house properly.
7. State two ways through which light travels.
8. Explain the following words:
  - (a) Reflection
  - (b) Refraction
  - (c) Dispersion
9. What are opaque materials?
10. Materials that allow light to pass through them are called \_\_\_\_\_.
11. Materials that we can see through them are called \_\_\_\_\_.
12. \_\_\_\_\_ energy is produced when things vibrate.
13. The highness or lowness of sound is known as \_\_\_\_\_.
14. State two factors that affect the pitch of a sound.
15. What is volume?
16. Reflected sound is called \_\_\_\_\_.
17. What is noise?
18. The form of energy which increases the temperature of a body is called \_\_\_\_\_.
19. Outline three effects of heat on substances.
20. Explain how heat travels through the following:
 

|            |            |
|------------|------------|
| (a) Solids | (b) Water  |
| (c) Gases  | (d) Vacuum |
21. Name the two types of electricity.
22. Static electricity is produced when things are \_\_\_\_\_.
23. What happens when two balloons filled with air are rubbed in the hair and brought near each other?
24. Current electricity is produced when \_\_\_\_\_.
25. List down four sources of current energy.

28. List down any four electrical appliances at home.
29. List down four safety precautions when dealing with electricity.
30. State any three safety measures during lightning.
31. What is energy transformation?
32. State the energy changes that occur in the following diagrams.



33. John ate ugali for lunch. He then left home running to school. What were the energy changes that took place?
34. State the energy changes that occur in a radio from broadcasting station to the listener.
35. A bicycle dynamo produces electrical energy from \_\_\_\_\_.
36. What is energy conservation?
37. List down three ways of conserving energy.
38. Outline three ways that show using energy sparingly.
39. What are renewable sources of energy?
40. List down four sources of renewable energy.
41. Name three devices that use solar energy.
42. What are non-renewable sources of energy?
43. Name the two sources of non renewable sources of energy.
44. Name the parts of the improved jiko shown below.



45. Outline three advantages of using an improved jiko.

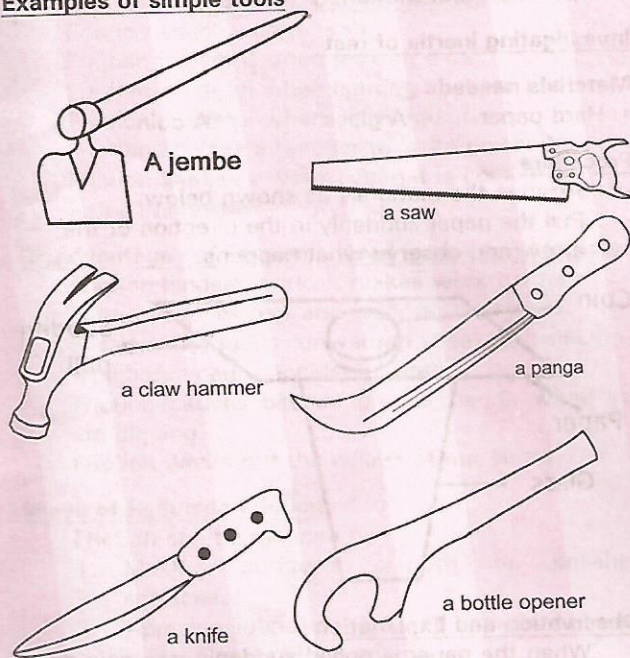
## TOPIC 12

### MAKING WORK EASIER

- (a) Simple tools
  - Simple tools are used to make work easier.
  - Simple tools are used on the farm, in the workshop, etc.



### Examples of simple tools



| Name          | Use                                    |
|---------------|----------------------------------------|
| Jembe         | Digging                                |
| Claw hammer   | Driving and removing nail.             |
| Panga         | Cutting wood                           |
| Knife         | Chopping/ cutting vegetables and meat  |
| Bottle opener | Opening bottles.                       |
| Saw           | Cutting wood                           |
| Rake          | Gathering rubbish and leveling ground. |
| Spade         | Mixing sand and cement.                |

### (b) Using simple tools safely

- Simple tools should be used safely to avoid accidents.

#### (i) Using a hammer safely

- When using a hammer you should hold it properly and firmly. This will make you avoid hitting your hand.
- When removing a nail from wood you should hold it firmly.

#### (ii) Using a saw safely

- When using a saw always hold it firmly.
- You should also keep your other hand away from the cutting point.

#### (iii) Using a panga safely

- When cutting wood, your hand should be away from cutting point.
- You should also carry the panga well to avoid injury.

#### (iv) Using a knife safely

- When using a knife you should hold it firmly.
- When cutting vegetables or meat, always use a chopping board to avoid cutting your fingers.

#### (v) Using a Jembe safely

- When using a jembe, you should hold it firmly.
- You should also not use it near your feet.
- When digging make sure you are not near other people.

#### (vi) Using a bottle opener safely

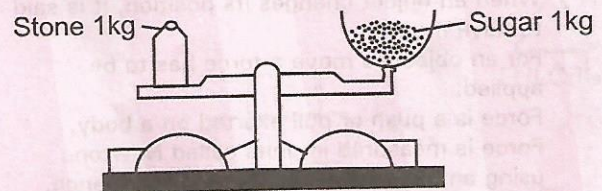
prevents the bottle from breaking and hurting yourself.

### (c) Care and Maintenance of Simple tools

- Care and maintenance of simple tools is very important.
- The following are reasons for maintaining simple tools.
  1. It makes tools to last longer.
  2. It prevents tools from being stolen.
  3. It prevents tools from rusting.
  4. It prevents accidents when using them.
  5. It improves the efficiency of the tools.
- The following are ways of maintaining simple tools.
  1. Sharpening cutting tools when blunt.
  2. Using tools for the right purpose.
  3. Cleaning tools after using them.
  4. Oiling iron tools to prevent rusting.
  5. Storing tools properly after using them.
  6. Replacing broken handles.

### (d) Balancing and Weighing

- Balancing objects enables us to know their mass.
- Mass is the quantity of matter in an object.
- Mass is measured in units called kilograms or grams using an instrument called a beam balance.
- A beam balance is used in butcheries and in shops.



#### Making a simple beam balance

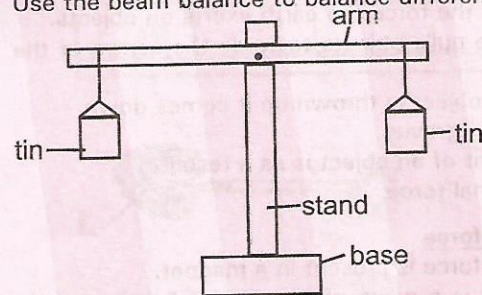
Materials needed:

- Pieces of wood
- Tins
- Nails
- Wire/strings
- Ruler

#### Procedure

1. Make a base, a stand and the arm.
2. Suspend the arm to find balance point and mark.
3. Fix the stand and the arm to the base.
4. Suspend the tins on both sides of the arm using strings.

Use the beam balance to balance different objects.



#### Making a see saw

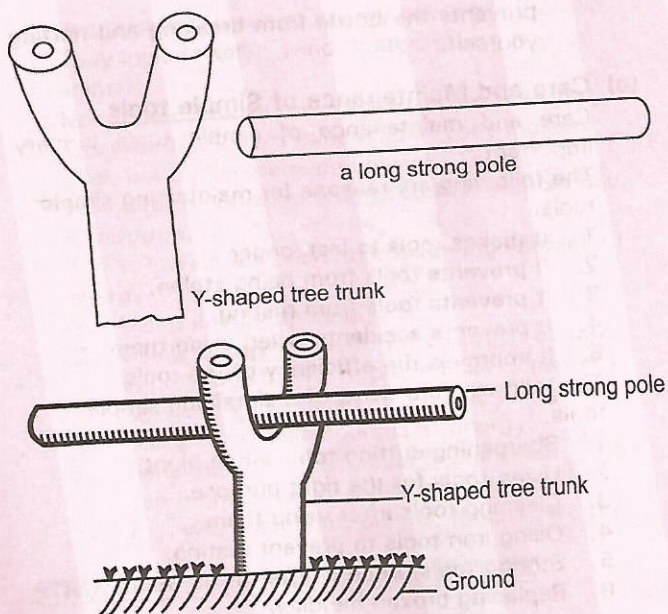
Materials needed:

- A long strong pole.
- A Y shaped tree trunk.

#### Procedure

- Dig a hole in the ground.
- Fix the Y shaped tree trunk in the hole firmly.
- Put the long pole across the Y shaped tree trunk.
- Use it to balance your friends.





**NOTE:**

When balancing your friends you will notice that the heavier person sits near the turning point i.e. near the Y shaped tree trunk while the lighter one sits away from the turning point i.e. away from the Y shaped tree trunk.

**(e) Movement and Motion**

- When an object changes its position, it is said to have moved.
- For an object to move a force has to be applied.
- Force is a push or pull exerted on a body.
- Force is measured in units called Newtons using an instrument called a spring balance.
- Examples of forces are:
  - Gravity
  - Friction
  - Magnetism
  - Inertia

Force can

- (i) Start motion
- (ii) Speed up motion
- (iii) Slow down motion
- (iv) Stop moving body
- (v) Changed direction of a moving body.

**1. Gravity – also known as weight**

- Gravity is the force the earth exerts on objects.
- This force pulls objects towards the centre of the earth.
- When an object is thrown up it comes down because of gravity.
- The weight of an object is as a result of gravitational force.

**2. Magnetic force**

- Magnetic force is present in a magnet.
- A magnet is a piece of iron or steel that attracts things made of iron or steel.

**3. Inertia**

- What is inertia?
- Inertia is the tendency of an object to remain in its state of motion or stationary.
- An object will continue moving unless force acts on it. Likewise it will remain stationary unless a

(ii) Inertia of motion

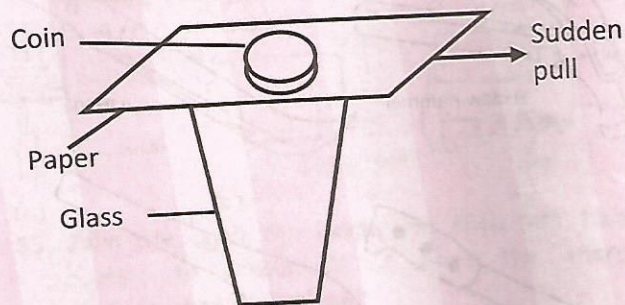
**Investigating inertia of rest**

**Materials needed**

- Hard paper
- A glass
- A coin

**Procedure**

- Arrange the materials as shown below.
- Pull the paper suddenly in the direction of the arrow and observe what happens.



**Observation and Explanation**

- When the paper is pulled suddenly, the coin drops in the glass. This is because of inertia of rest. The coin resists movement, it does not move with the paper.
- Inertia of rest is also experienced in a car, when the driver starts the car. The passengers are pushed backwards.

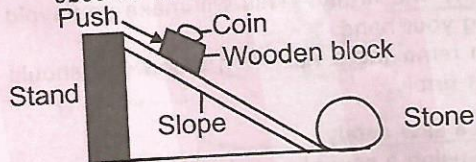
**Investigating inertia of motion**

**Materials needed**

- Piece of wood
- Stone
- Coin
- Wooden block
- A stand

**Procedure**

- Arrange the materials as shown below then push the block of wood as shown by the arrow and observe what happens.

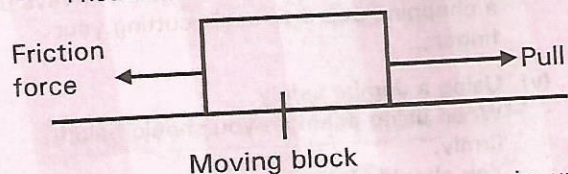


**Observation and Explanation**

- When the wooden block is pushed, the wooden block moves along the slope and stops when it reaches the stone but the coin continues to move. This is because of inertia of motion.
- Inertia of motion is experienced in a car when the driver applies brakes suddenly. Passengers are pushed forward as a result of inertia of motion.

**(4) Friction Force**

- Friction is a force that opposes motion.
- Friction force acts in the opposite direction.



- Friction being a force is measured in units called Newtons using an instrument called a spring balance.
- Friction force has advantages and



### Advantages of Friction - Used in scating

- Friction enables us to walk.
- Friction is useful when braking a car.
- Friction is useful when lighting a match stick.
- Friction is useful when cleaning sufuria.
- Friction enables a teacher to write on the board.
- Friction keeps us warm when it is cold.
- Helps in crasing

### Disadvantages of Friction - used in sharpening tools

- Friction hinders work. It makes work harder.
- Friction causes tear and wear of machines.
- Friction produces unwanted heat in machines which can cause accidental fires.
- Friction causes blisters on our hands when you are digging.
- Friction wears out the collars of our shirts.

### Ways of Reducing Friction

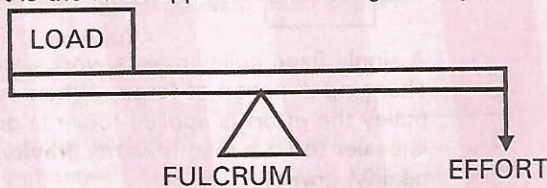
- Friction can be reduced by
  1. Making surfaces smooth or polishing surfaces.
  2. Applying lubricants (oil and grease) between moving parts of a machine.
  3. Streamlining bodies. This reduces friction in air and water.
  4. Using rollers when pushing or pulling heavy objects along the ground.
  5. Using ball bearings.

### Ways of increasing friction

- Friction can be increased by;
  1. Making surfaces rough.
  2. Applying adhesive between surfaces.

### (g) Levers

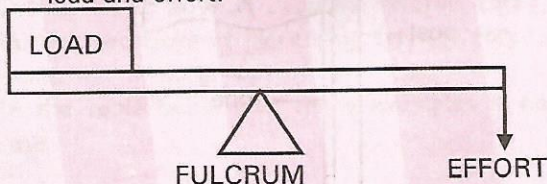
- A lever is a machine used to lift objects.
- A lever has three parts. These parts are fulcrum, load and effort.
- Fulcrum is the turning point of a lever. It is also called a pivot.
- Load is the object being lifted. The force to be overcome.
- Effort is the force applied when lifting the object.



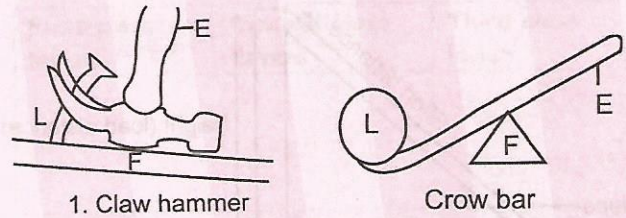
- Levers are divided into three groups.
- The three groups are
  1. First class levers
  2. Second class levers
  3. Third class levers
- The grouping of levers is determined by the position of fulcrum, load and effort.

#### 1. First Class Levers

- First class levers have fulcrum between the load and effort.

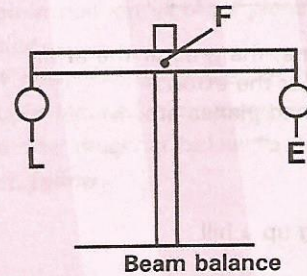


- Examples of levers in this group are: claw



1. Claw hammer

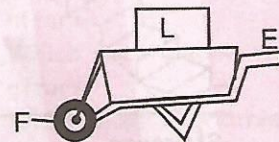
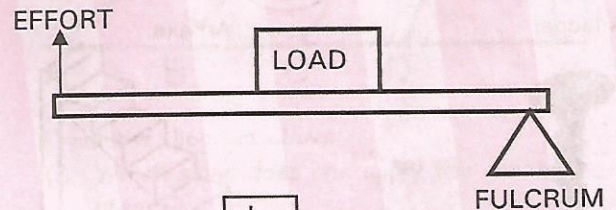
Crow bar



Beam balance

#### 2. Second class levers

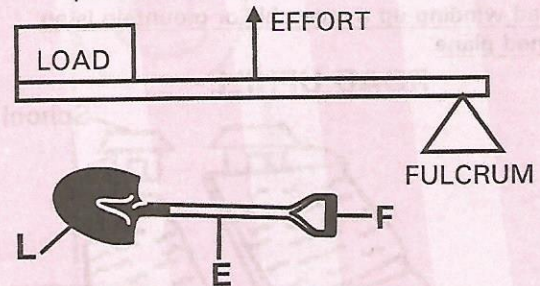
- Second class levers have load between fulcrum and effort.
- Examples are bottle opener, wheel barrow, door hinge, nut cracker and human foot.
- Second class levers have effort distance greater than the load distance.



Wheelbarrow

#### 3. Third class levers

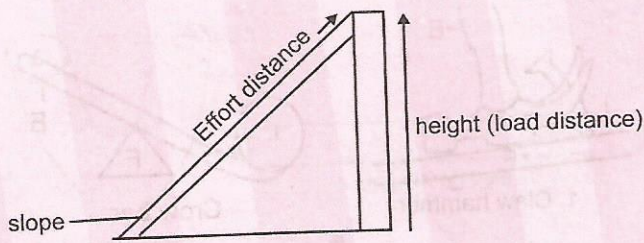
- Third class levers have effort between the load and fulcrum.
- In third class levers the effort distance is less than the load distance.
- Examples of third class levers are fishing rod, charcoal tongs, oar, broom, human arm and spade.(tweezers)



#### (h) Inclined Planes

1. An inclined plane is a slope.
- An inclined plane makes work easier by increasing the effort distance.
- Inclined planes are used to raise heavy objects to high levels.

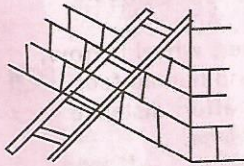




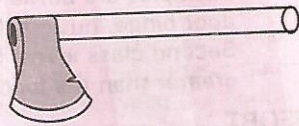
- In an inclined plane, the greater the effort distance, the lesser the effort.

- Examples of inclined planes are:

1. Ladder
2. Staircase
3. Ramp
4. Road winding up a hill
5. A screw nail
6. A wedge e.g. an axe
7. Carjack



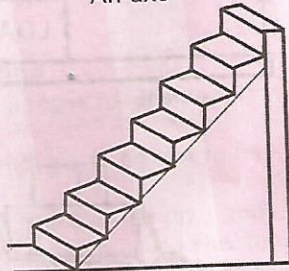
A ladder



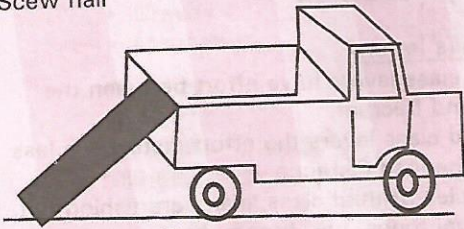
An axe



Scew nail



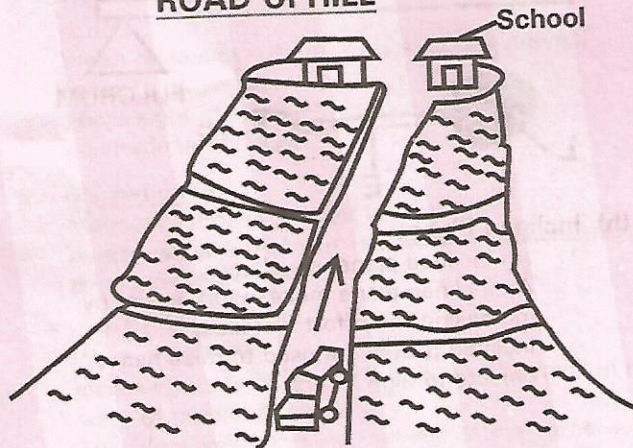
Staircase



Ramp

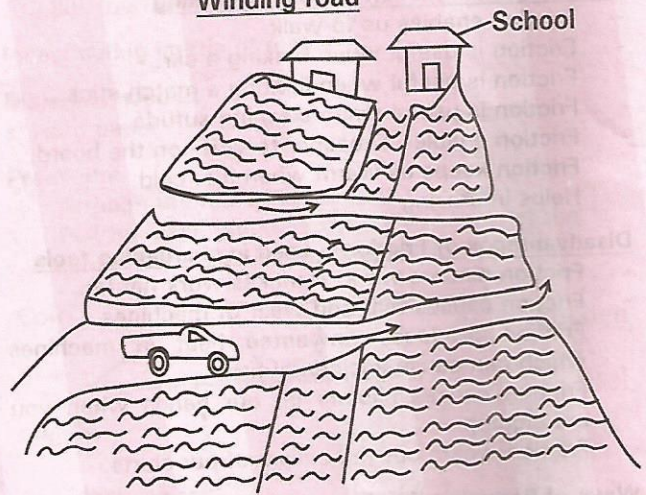
A road winding up a steep hill or mountain is an inclined plane.

### ROAD UPHILL



The road uphill forms a steep slope.

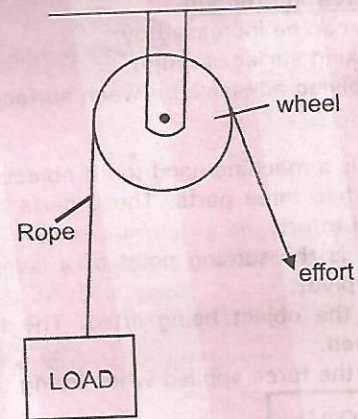
### Winding road



- A winding road is easier to climb than a road uphill.
- A winding road forms a gentle slope so it is easier to climb.
- When climbing along a winding one covers a long distance than a road uphill.

### (i) A single fixed pulley

- A pulley is used to raise heavy objects to a higher ground.
- A pulley has a wheel with a rope.

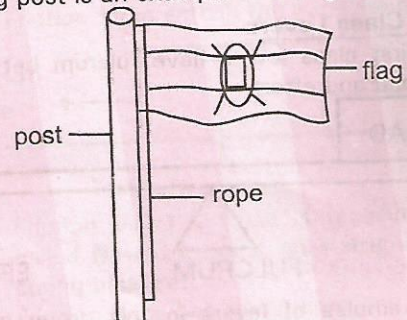


- A single fixed pulley makes work easier by changing direction of force. When using the pulley the effort is applied towards gravity. It is easier to lift a load towards gravity than against gravity.

### Characteristics of a single fixed pulley

1. Effort is applied towards gravity.
2. Effort applied is equal to the load.
3. Effort distance is equal to the load distance.
4. The pulley has no mechanical advantage.

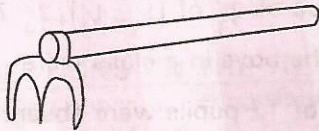
- A flag post is an example of a single fixed pulley.



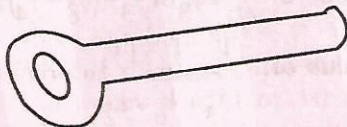


## STRUCTURED QUESTIONS ON THE TOPIC

- \_\_\_\_\_ are used to make work easier.
- Explain three ways in which machines make work easier.
- List down any three categories of machines.
- State the uses of the following simple tools.
  - Shears
  - Saw
  - Sickle
  - Spade
- Name the tools shown in the diagrams below.



(a) \_\_\_\_\_

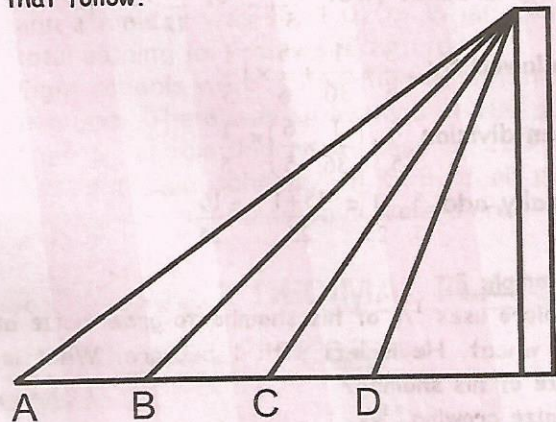


(b) \_\_\_\_\_

- State three reasons for maintaining simple tools.
- Outline four ways of maintaining simple tools.
- What is mass?
- Mass is measured in units called \_\_\_\_\_.
- The instrument used to measure mass is \_\_\_\_\_.
- The stones used to balance meat in butchery are called \_\_\_\_\_.
- List down all the materials needed when making a seesaw.
- Paul weighs 40kg while James weighs 60kg. The two boys are playing on a seesaw. What should they do to balance each other?
- What is motion?
- What causes motion?
- A push or pull on an object is called \_\_\_\_\_.
- Force is measured in units called \_\_\_\_\_.
- The instrument used to measure force is called \_\_\_\_\_.
- List down three types of forces.
- What is gravitational force?
- What is inertia?
- List down all the materials needed to investigate inertia of rest.
- What is friction?
- List down four advantages of friction force.
- List down four disadvantages of friction force.
- Outline three ways of reducing friction force.
- Outline two ways of increasing friction force.
- Name the three groups of levers.
- In the table below give three examples in each case.

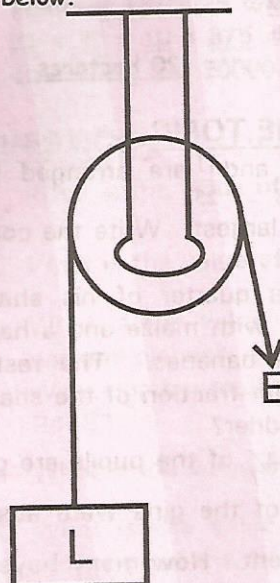
| First class levers | Second class levers | Third class levers |
|--------------------|---------------------|--------------------|
|                    |                     |                    |

- Explain how an inclined plane makes work easier.
- List down five examples of inclined planes.
- Double inclined planes are also called \_\_\_\_\_.
- Use the diagram below to answer the questions that follow.



From the diagram above;

- Which slope does one apply the greatest effort?
  - Which slope does one apply the least effort?
  - Which slope is greatest work done?
34. Name the simple machine shown in the diagram below.



- A \_\_\_\_\_ is an example of a single fixed pulley.
- To prevent the rope on a pulley from slipping off, the wheel has \_\_\_\_\_ to hold the rope.
- State three characteristics of a single fixed pulley.