

14th / 02 / 20

USING MATERIALS

Key words.

1. Materials
2. Polymers
3. Synthetic
4. Natural
5. Recycle
6. Monomers
7. Plastic
8. Biodegradable
9. Ceramic
10. Melamine
11. Fibre
12. Pollution

1. Polymer

Are large molecules composed of many repeated subunits called monomers e.g Polythene, Polyvinyl Chloride, Polystyrene among others.

2. Pollution

Is the introduction of contaminants into the natural environment that cause adverse change.

3. Recycle

Is to process scrap or waste and reprocessing the material into useful products.

4. Ceramics

Are made by mixing clay with water molding and then heating the material to form a hard but brittle structure OR Are materials or objects made out of soft clay and then hardened by heat

5. Plastics

Are synthetic materials which are molded when hot and shaped to desired articles for everyday use.

6 Fibres

Are natural or artificial polymers mainly used in the making of materials with high tensile strength such as ropes, fishing nets and fabrics.

= Natural

Is existing in or derived from nature; not made or caused by human kind.

x Material

Is something natural or synthetic that can be used for making different stuff.

g. Synthetic

This refers to man-made or artificially made material such as plastics, furniture, Nylon ropes among others.

h. Monomer

This is a relatively small molecule which can be bonded to each other to form a polymer.

Examples of monomers:

Monomer	Polymer
Ethene	Polyethene
Syrene	Polystyrene

plastics

Is a synthetic, solid hydrocarbon based polymer.

II. Biodegradable

This refers to something capable of being decomposed by biological activities especially by micro-organisms such as Bacteria, fungi, viruses among others.

- Melamine

Is a thermosetting plastic used for making products like plastic cups, plates, plastic surfaces of tables.

fiber

Is a simple elongated piece of material.

- Pollution

Is the release of dangerous substances into the environment upto levels that cause adverse effects or negative side effect to the environment.

Activity

1. Identify each of the materials in the figure.

A - Plastic garbage bin D - Clay brick / Burnt brick.

B - Wooden chair E - Nylon rope

C - Metallic gate

F - Polythene sheet.

2 State the process possessed by each of the materials in the figure.

It has a low melting point.

It is hard.

It is resistant to acids and bases.

It can be recycled.

It is a poor conductor of heat.

It is a poor conductor of electricity.

It is strong.

It is non-biodegradable.

It can melt / decompose when heated.

PROPERTIES OF A WOODEN CHAIR

It is a poor conductor of heat.

It is a poor conductor of electricity.

It is biodegradable.

It is rigid but brittle. liable to break easily under stress (pressure).

It does not rust.

It can burn / decompose when heated to form ash.

PROPERTIES OF STEEL GATE/METALLIC GATE.

It is hard.

It is malleable (can easily be hammered into thin sheets)

It is ductile (can easily be pulled / stretched into thin wires by mechanical force without breaking)

It has a high melting point.

It is a good conductor of heat & electricity.

It can rust.

It can be polished.

It is sonorous (can make loud noise (sound when hit))

PROPERTIES OF FIRED/BURNT BRICK.

It is hard.

It does not rust.

It is a poor conductor of heat & electricity.

It retains heat.

It is resistant to rain.

PROPERTIES OF NYLON ROPES.

It is strong.

It is non-biodegradable.

It does not rust.

It is resistant to stretch.

It is a good conductor of heat & electricity.

It can melt/decompose when heated.

PROPERTIES OF POLYTHENE SHEETS.

It has a low melting point.

It is waterproof.

It is non-biodegradable.

It is resistant to acids and bases.

(3) How important is the property indicated for the use of each of the materials?

Plastic garbage bin is used because it is hard and resistant to acids and bases.

Wooden chairs are used because they are poor conductors of heat & electricity and wood is easy to bore.

Steel gate is used because it is hard and cannot be attacked by fire. It cannot burn.

Burnt brick is used because it is strong for resistance to water.



Nylon rope is used because it is strong and extensible for tying things.

Polythene sheet is used because it is resistant to water and resistant to acids and bases.

NOTE:

From the activity above, it is discovered that each of the materials has at least one property which determines its use.

Activity No. 2.

To show why certain materials are used in the making of objects

What you need (Material used)

A jar or plastic cup

Elastic band

Water in a bottle

A piece of cotton cloth

A piece of plastic

A piece of plywood

Water in a bottle

Rubber Cabilloon 1 piece of glass

Glass Chaving smooth edges

What to do?

1 Work in a group of three. Tie the piece of cotton cloth round the plastic cups.

2 Pour some water on the cotton cloth.

3 Wait for the cotton to soak a little.

4 Observe what happens to the water poured on the cotton.

5. Repeat the same procedure with the other materials (rubber, plastic, glass, wood)

Discussion question

1. Do all the materials allow water to pass through?
No.
2. What makes some materials allow water to pass and others not?
3. What can you conclude from this activity?

Answers:

1. No
2. Some materials have structures that do not allow water molecules to pass through especially the artificial polymers like plastics, rubber among others.
3. All the natural materials like silk, wool, cotton allow water to pass through while the manufactured materials do not allow water to pass through.

Properties of materials

* Do you know why electrical wires are made from copper and not wood?

Copper is a good conductor of electricity or can allow electricity to pass while wood is a bad conductor of electricity I cannot allow electricity to pass.

* Have you asked yourself why parts of an aeroplane are made of aluminium.

- Aluminium is light
-

The use we make of the different materials in our environment depends on particular properties

Some of the properties are physical and others are chemical

ELECTRICAL CONDUCTIVITY OF MATERIALS

One of the important properties shown by materials is electrical conductivity. Electrical conductivity is important because materials which conduct can be used as electrical wires and other equipments which pass electricity.

Activity 4.3

Identifying materials that conduct electricity.

What you need Materials needed..

Dry cell 1.5V

Electric wires and small bulb

Piece of iron nail

Piece of plastic

Piece of wood

Paper of wood

Paper and glass

Cotton cloth

Rubber

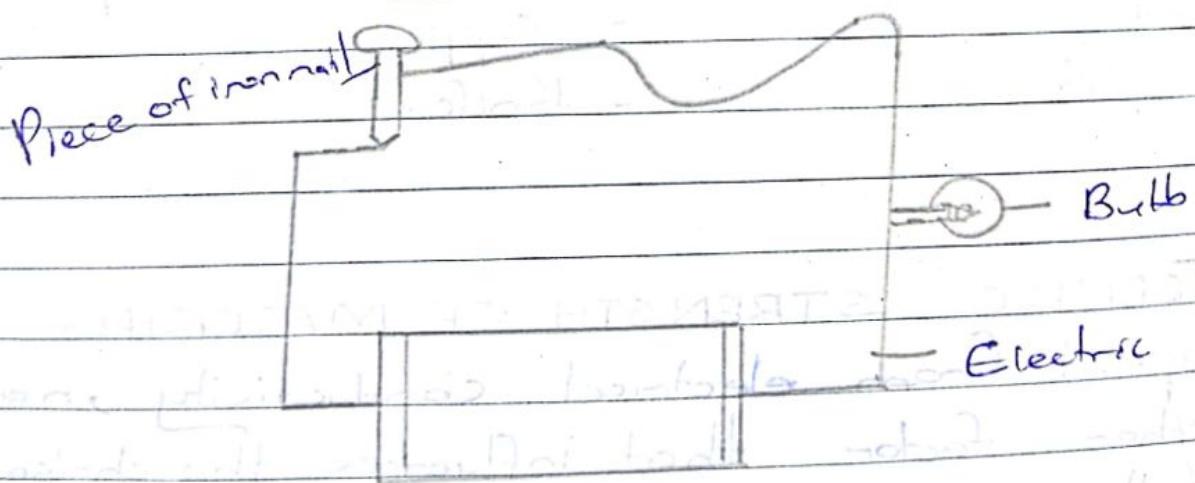
What to do.

1. Construct a simple electric circuit as shown in figure 4.2.

2. Place the iron nail in the circuit and check if the bulb is lighting.

3. Repeat the same procedure using the rest of the materials.

Is the bulb lighting everytime?



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Activity 4.3 - Discussion questions:

1. In which of the materials did the bulb light?
2. Which materials did not cause the bulb to light?
3. List any other 4 materials that would conduct electricity

Answers

1. Piece of iron nail.

2. - Plastic - Rubber
- Piece of wood - Piece of paper
- Glass - Cotton cloth

3. Metallic spoons - Metallic forks

Aqueous sodium chloride - Aqueous copper (II) sulphate

Carbon rod - Aluminium saucepans

Gold - Copper

Graphite - Knife.

TENSILE STRENGTH OF MATERIALS.

Apart from electrical conductivity, name one other factor that influences the choice of use of the particular material is tensile strength.

For example, an activity can be carried out to determine the suitability of building materials such as bricks, concrete, Iron bars, cement, sand, iron sheets, among others by comparing their tensile st.

Note:

Tensile strength is the ability of a material to resist breaking/tearing due to tension. This property is common to all types of materials such as, wires, ropes, metal beams among others.

Activity 4.4.

Comparing the tensile strength of different building materials

What you need?

Fired brick

Unfired brick

Concrete block

What to do:

1. Take the fired brick to the height of about 3 metres and allow it to fall on a cemented floor.

What do you observe?

2. Repeat the procedure using a concrete block and then unfired brick.

Discussion question:

1. What difference do you observe?

2. Which of the materials is suitable for building?

3. - storeyed house and why?

3. Suggest any changes that you need to improve the strength of any of the building materials.

Answers.



1. Fired brick remains unchanged but the other two (concrete blocks and unfired brick) are likely to break.

2. Fired brick because they are hard and resistant to breaking.

3. By firing the unfired brick.

By adding stone dust to the concrete brick.

Activity 4.5

To find out what happens when different materials are hammered

pot, shoe sole, piece of steel, hammer

What you need; fired brick, piece of dry wood

concrete block, piece of glass, piece of bottle, piece of cotton cloth

1. Take each material and hammer or hit it.

2. Heat a small piece of each material with a burner

3. Present your findings in a table

4. Repeat the experiment by heating the different materials

5. Tabulate your results

Discussion questions

1. State what happened and what you observed when you hammered the different materials.

2. In your groups, discuss why the different materials behaved in different ways.

3. State what you observed when you heated the different materials.

4. In your groups, explain the differences observed when the materials are heated.

Answers:

1) Material	Observation made when hammered.
Fired brick	Breaks
Dry wood	Shattered
Piece of glass	Shattered
Plastic bottle	Compressed / flattened / weakened
Piece of cloth	Weakened
Concrete block	Breaks
Pot	Breaks
Shoe sole	No effect
Piece of steel	Flattens.

2) The materials which are brittle e.g. glass and clay will break / get shattered easily by hammering. The materials made of metals e.g. piece of steel will flatten because they are malleable and ductile. Plastic materials e.g. plastic bottles have fibres and tend to become flattened but don't

Cotton materials e.g. cotton cloth have natural fibres which are not very strong so it can be bent/weakened easily.

3) Metals have high boiling points and are good conductors of heat so they become hot when heated.

Wood catches fire easily but it is a poor conductor of heat.

Similarly, pot and brick are poor conductors of heat but they have high heat retention (tend to retain heat when heated).

Plastics melt on heating cotton cloth is a fabric that is a bad conductor of heat but can easily burn when heated.

- 4) Heating changes the molecular structure of different materials.

~~Activity 4.6~~

~~OTHER IMPORTANT PROPERTIES OF MATERIALS:~~

1. In your groups, identify any other important properties on which the use of the materials is dependant.

2. Share findings with other members in class.

Answers

- Conductivity
- Density
- Melting point
- Boiling point
- Solubility,

STRUCTURES OF MATERIALS THAT SHATTER EASILY

1. Ceramics;

Ceramics are products/objects made from inorganic materials having non-metallic properties such as soft clay and hardened by heating.

Do you have a pot?

No

Have you ever seen a pot anywhere.

Yes, at Kelvin and Ahmed's home.

The picture below (you have seen) shows examples of different pots from different regions in Uganda.

Have you seen any of the pots displayed above?
No.

What is it used for?

Pots are examples of ceramics.

Other examples of ceramic materials.

- Tiles
- Bricks
- Cups
- Plates
- Pipes
- Glass
- Slabs
- Facing bricks
- Sinks
- Kettles

Main components of ceramics.

The main components of ceramics include:

- Clay which contains nitrogen and oxygen

- Silica/sand ($\text{Silicon}^{(\text{IV})}\text{oxide}$)
- Feldspar

Main components of ceramics.

The main components of ceramics include

- Clay which contain oxygen and nitrogen.
- Silica Island ($\text{Silicon}^{(\text{IV})}\text{oxide}$)
- Feldspar-(Aluminosilicate of potassium, sodium and calcium)

~~DESCRIPTION OF HOW CERAMICS ARE MADE~~

For the production of ceramics, clay is crushed, ground and sieved to obtain/get fine clay.

It is then mixed with water to make a paste known as slip. The slip is formed is molded into different shapes and dried.

The hardened shapes/objects are heated strongly in a kiln, little salt may be added to make it shiny.

The high temperature expels all the water, and causes chemical changes that make clay stronger and harder.

This makes the ceramic product/object non-porous, smooth and shiny.

Colours may be added to make the ceramic objects more attractive.

PROPERTIES OF CERAMICS:

- It can be moulded easily when wet: This is because the particles in the clay attract water thus allowing the particles in the clay to slip easily around each other.
- They are hard.
- They are water resistant.
- They are brittle. This is an undesirable property of ceramics.
- They are refractory materials. They are resistant to decomposition by heat pressure or chemical attack.
- They are thermal insulators.
- They are non-magnetic materials.
- They are resistant to oxidation.
- They have a high melting point

PROPERTIES OF CLAY THAT MAKE IT A SUITABLE MATERIAL FOR MAKING POTTERY OBJECTS / CERAMICS.

When clay dries up, it becomes hard. If dry clay is heated in a fire or oven/kiln, it becomes permanent hard.

When clay is fired, the particles in clay react with each other and are hard. giant structure is formed. The structure is similar to the structure to the structure of sand (silicon dioxide)

Uses of ceramics:

- Used for decoration such as fancy Bricks/tiles.
- Some ceramic products/objects are used in cooking.
- Used in construction of houses, e.g. tiles, bricks.
- Used for storage of water e.g. pots.
- Used at many places in gas turbine engines.
- Bioceramics are used as dental implants and synthetic bones.

Check point / Assignment.

a) Describe how ceramics are made.

b) State 5 uses of ceramics.

c) What are the physical properties of ceramics that make them suitable for their use.

Activity 4.7.

i) In 4 groups, collect different ceramic materials. For each material explain why it is suited for its use.

2 Research and discuss why fired clay materials are more used than unfired ones.

Answers

1. Cup; Retains heat

Pot; Retains heat.

Tile; Hard and water proof

Sink; Water proof

2. Fired clay materials are strong, hard and water proof. Hence suitable for many function than unfired clay materials.

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GLASS

Glass is made from ordinary sand. You can make glass by heating a mixture of ordinary sand (which is mostly made of silicon (IV) oxide) and sodium carbonate until it melts and turns into a liquid. The molecular structure of glass makes it rigid, hard and causes it to shatter easily. The liquid is then allowed to cool as a flat sheet of glass or it is moulded into any shape before it cools and turns solid.

Other substances, particularly metal oxides can be added to make different kinds of glass. Some of these glasses are coloured.

PROPERTIES OF GLASS

Glass has the structure of a liquid but the particles in it are too large to move around. So, glass is actually a liquid that behaves like a solid! Glass material is usually hard and brittle.

Unlike cement, glass is non-crystalline.

The particles in glass are not arranged in any particular pattern.

Activity 4.8

Properties of glass that make it suitable for different functions.

1. What are the uses of the different glass materials in figure 4.5?
2. What properties make the glass materials suitable for the uses stated?