

1

Sorting Materials into Groups



"Classification of materials makes their study easy, and systematic."



Do You Remember ?

- ★ We use several objects in our day-to-day lives. Pencils, erasers, books, notebooks etc., are objects that you must be using a lot. All objects are made of some substances called **materials**.

1. Introduction

It is very important to use the right material for making each object. For example, a chalk made of materials like wood or plastic would be useless because it cannot be used to write on the blackboard.

Therefore, it is important for us to know the properties of different kinds of materials around us.

2. Objects around us

Objects around us have different shapes, colours and uses. They are made up of one or more materials such as paper, glass, plastic, cloth, wood, metal, mud, soil, cotton, etc.

Classification of materials

The act of dividing things into category, according to some common relations or affinities is called classification.



Organisation of kitchen ware.

Materials can be grouped on the basis of their properties. For example, objects in kitchen can be classified on the basis of shape, like round plates can be classified together in a group, glasses in other category. Similarly, bowls and spoons can be kept in separate groups. Classification can be done either on the basis of physical properties or chemical properties. For example, classification of material in three states viz, solid, liquid and gas is on the basis of physical properties whereas classification of materials in acids, bases and salts is on the basis of their chemical properties.



Aim

To classify objects and the materials they are made of, for various purposes.

Materials required

Chalk, pencil, notebook, rubber, duster, hammer, nail, soap, spoke of a wheel, bat, match box, salt, potato.

Method

1. Classification of materials in two groups in one group we take materials made of paper or wood. In another group we have materials which are not made of paper or wood.

Objects	Materials that are made of these
Paper or wood	Notebook, pencil, duster, hammer, bat, match box
Other	Chalk, rubber, nail, soap, spoke of a wheel, salt, potato.

2. Classification of materials in a group which are used to prepare food.

Materials used to prepare food	Matchbox, salt, potato
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3. Identifying some materials that each one is made of.

Objects	Materials they are made of
Pencil	Wood, graphite
Hammer	Wood, metal
Plate (thali)	Steel, glass, plastic, other
Pen	Plastic, metal
Box	Wood, paper, metal, plastic, other



Materials are made for various purpose.



Materials are classified into different groups.

Conclusion

Materials are classified in different groups.



Aim

List some common objects which are made of given materials.

Method

Different types of objects that are made from the same materials	
Materials	Objects made of these materials
Wood	Chair, table, plough, bullock cart and its wheels, boxes, pencils, containers.
Paper	Books, notebooks, newspaper, toys, calendars, files, sheets
Leather	Clothes, shoes, decorative items.
Plastics	Boxes, pen, containers, utensils, chair, table, watch, bottle.
Cotton	Clothes, bandages, mattresses, pillows.

Conclusion

Different types of objects are grouped according to the material they are made up of.



- Group the objects given in the box below based on the states of matter.

cup	water	air	book	stone
oil	milk	oxygen	steam	

- Which of the following is not a pure substance?
(A) Hydrogen (B) Oxygen (C) Water (D) Air

3. Some physical properties of materials

We generally use a tumbler to keep a liquid. Therefore, would it not be silly, if we were to make a tumbler out of cloth. What we need for a tumbler is glass, plastics, metal or other such material that will hold water. Similarly, it would not be wise to use paper-like materials for cooking vessels.

We see then, that we choose a material to make an object depending on its properties, and the purpose for which the object is to be used.



Using a cloth as a tumbler

Different types of materials have different properties such as appearance, solubility, transparency, conductivity and behaviour towards magnet etc.

Lets study these properties one by one.

(1) Appearance

Materials usually look different from each other. Mud looks different from wood. Wood looks different from plastics. Plastics look different from copper. Copper looks different from iron or aluminium.

However, there might be some similarities between copper, iron and aluminium that are not in the plastics, wood or mud.

Let us perform the following activity.



Aim

To show that certain materials have lustre.

Materials required

paper, cardboard, wood, plastic, copper wire, aluminium wire, iron wire, sand paper and heavy scissors/metal cutter.

Method

1. Take small pieces of paper, cardboard, a thin piece of wood, a small strip of plastic, thin wires of copper, aluminium and iron, heavy scissors or a metal cutter and sand paper.
2. Cut each of the materials with heavy scissors or metal cutter. Carefully observe the cut surface of each material.
3. Rub each of the materials with sand paper. Carefully observe the sand-papered surface of the materials.

Observation

You will notice that in case of paper, cardboard, plastic and wood, the sand-papered surface is not shining.



Pearls, being lustrous look beautiful and thus, used for making jewellery.

Lustrous materials



Gold

Silver

Copper

Aluminium

Iron

Non-Lustrous materials



Mud



Wood



Rubber



Cardboard

However, in case of thin wires of copper, aluminium and iron, the sand-papered surface is shining. The special kind of shine present on natural materials or shine appears when they are freshly cut or sand papered is called **lustre**.

The materials which have natural shine on their surface or the shine appears when they are freshly cut or sandpapered are called **lustrous materials**.

Examples of lustrous materials

- (a) Among the solids, all metals have a lustre. Generally, this lustre is silvery white, except gold and copper which have a yellow and reddish lustre respectively. Graphite (a physical form of carbon) and iodine crystals have lustre. Similarly, gems and pearls are lustrous.



Cullinan, a diamond from Africa, is the largest diamond ever found.

- (b) Amongst the liquids, mercury (it is a liquid metal) is lustrous.

- (c) All gases are non-lustrous.



Quick Tips

- ★ Diamond shines due to reflection of light.

(2) Hardness

You must have experienced that if you press a piece of foam with your thumb it gets pressed, but a piece of stone or wood does not get pressed. You can say that a piece of wood or stone is **harder** than a piece of foam. However, how shall we find which amongst wood or stone is harder?

The best way of finding it out is to scratch the wood against the stone. If the wood gets scratched by stone, then the stone is harder than the wood. When the surfaces of two different materials are rubbed against each other, then the surface which scratches is said to be **hard** and the property is called **hardness** of the material.

Conversely, the surface which gets scratched is said to be **soft** as compared to the scratching surface.

For example,

- (a) Diamond is the hardest naturally occurring substance. Among the different kinds of diamonds, black diamond is the hardest.
- (b) Glass is also a hard substance, still diamonds can be used to scratch glass and hence are used for cutting glass.
- (c) Talc obtained from soapstone is the softest substance. Soapstone is a magnesium rich metamorphic rock from which talc is obtained.

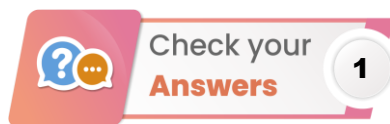
(3) Soluble or insoluble in water

It is a common experience that when we put a spoonful of common salt or sugar into a tumbler filled with water and stir the contents, the sugar or the common salt completely disappears.

We say that sugar or common salt dissolves in water. Such substances which dissolve in water are known as soluble substances.

Solubility: The property of substance due to which it dissolves in water is called solubility.

Insoluble substances: The substances which do not dissolve in water are called insoluble substances. For example, sand, chalk, etc.



1.

Solid	Liquid	Gas
cup	water	air
book	oil	Oxygen
stone	milk	steam

2. Air is a mixture of gases and water vapour. Hydrogen and oxygen are elements. Water is a compound. A, B and C can be made available in pure form.



Aim

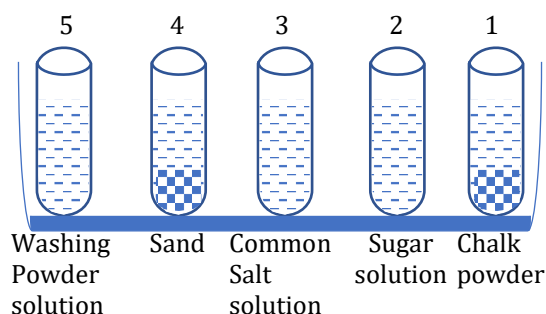
To prove that some solids are soluble in water.

Materials required

Rack of test tube, water, common salt, sugar, washing soda, chalk powder, sand and test tubes.

Method

- (a) Take a rack of test tube, water, common salt, sugar, washing soda, chalk powder and sand.



Solubility of different materials in water.

- (b) Add a pinch of chalk powder in the first test tube, a pinch of sugar in the second test tube, a pinch of common salt in the third test tube, a pinch of sand in the fourth test tube and a pinch of washing soda in the fifth test tube.
- (c) Pour water into each test tube such that half of each test tube is filled with water. Shake each test tube vigorously and replace it in the rack.

Observation

You will notice that sugar, common salt and washing soda disappear in water, and hence are soluble substances. Sand and chalk powder do not dissolve in water, and hence are insoluble substances.

Solubility of liquid substances in water

Most of the liquids are insoluble in water. However, liquids such as alcohol, vinegar, lemon juice etc., dissolve in water.

The liquids which dissolve in water are called **miscible liquids**.

The liquids which do not dissolve in water are **immiscible liquids**.

Liquids such as kerosene oil, coconut oil, petrol, ether, benzene, etc., are not miscible with water. However, they are easily miscible with one another. For example, coconut oil is easily miscible in kerosene oil, petrol, ether and benzene.

**Be Alert !**

- ★ Carbonated beverages like cold drink soft drinks and fizzy drinks, contain carbon dioxide that has dissolved under pressure, so when pressure is released by opening the cold drink bottle, the liquid cannot hold as much CO_2 , so the excess bubbles out of the solution.



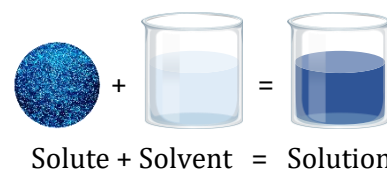
- Find the odd one out from the following.
 - Aluminium, iron, copper, silver, sand
 - Sugar, salt, sand, washing soda, milk powder
 - Nail, utensils, magnet, beaker, coin
 - Wood, stone, iron, cotton, diamond
- Will the following items float or sink if they are put on water, oil or kerosene?
Plastic ball, feather, balloon, hair, thermocol, boat.

**Aim**

To prove that some liquids are soluble in water.

Materials required

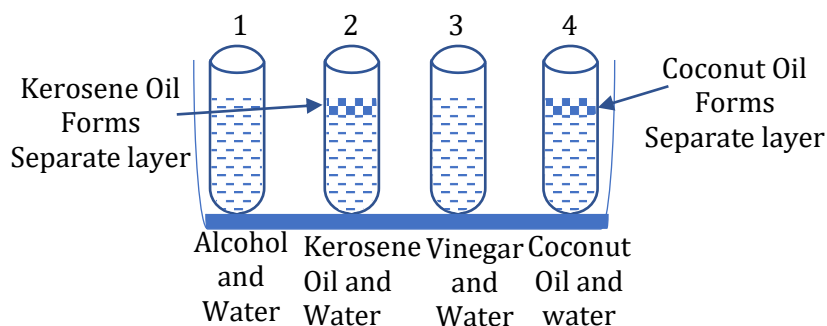
Rack of test tube, test tubes, water, alcohol, kerosene oil, vinegar and coconut oil.

**Method**

- Take a rack of test tubes, water, alcohol, kerosene oil, vinegar and coconut oil.
- Fill each of the test tubes half with water and place them in the test tube rack.
Add a few drops of alcohol in the first test tube, a few drops of kerosene oil in the second test tube, a few drops of vinegar in the third test tube and a few drops of coconut oil in the fourth test tube.
- Shake each test tube vigorously and replace it in the test tube rack. Wait for 10 minutes.

Observation

You will notice that kerosene oil and coconut oil will float on the surface of water and form separate layers. No separate layer is formed in case of vinegar and alcohol. Thus, the activity proves that vinegar and alcohol are soluble in water, and hence are miscible liquids, but kerosene oil and coconut oil are insoluble in water and hence are immiscible liquids.



To show that certain liquids dissolve in water.

Solubility of gases in water

Most of the gases are insoluble in water. For example, nitrogen, hydrogen and carbon monoxide are insoluble in water. However, some gases are soluble in water.

Oxygen gas is slightly soluble in water. It is the oxygen dissolved in water which enables the fishes and other aquatic animals to breathe with the help of their gills.

Carbon dioxide gas is slightly soluble in water. It is the dissolved carbon dioxide gas in water, which acts as a source of food for water plants. The water plants convert the carbon dioxide gas into their food with the help of chlorophyll and sunlight.

Thus, the materials can be classified on the basis of their solubility in water.



Fizzy drinks contain dissolved carbon dioxide, which goes off on opening the bottle, due to its less solubility.



Why do we call water the universal solvent?

Explanation

Apparently, it may seem that quite a large number of substances are insoluble in water. However, if the substances are kept in water for a very long time, which may be for a century or two, the water can dissolve anything and everything in itself. It is for this reason that water is called the universal solvent. It is for the same reason that water plays an important role in the bodies of living organisms, because it can dissolve a large number of substances.

4. Objects may float or sink in water

In Activities 2 and 3 you must have seen the substances like sand and chalk powder sink in water, whereas materials like coconut oil and kerosene oil float on the surface of water.

It is because, the substances heavier than water sink in it. Whereas, the substances lighter than water, float in it. Thus, we can group materials on the basis of sinking or floating in water. Let us perform the following to find out few substances which sink or float in water.



You have often observed that oil floats in gravy, as it is lighter than other constituents.



- ★ Density means how compact or concentrated something.
- ★ Heavier substances have high density and lighter substance have low density.
- ★ Heavier substances sink in water, whereas lighter substances float on water.

**Aim**

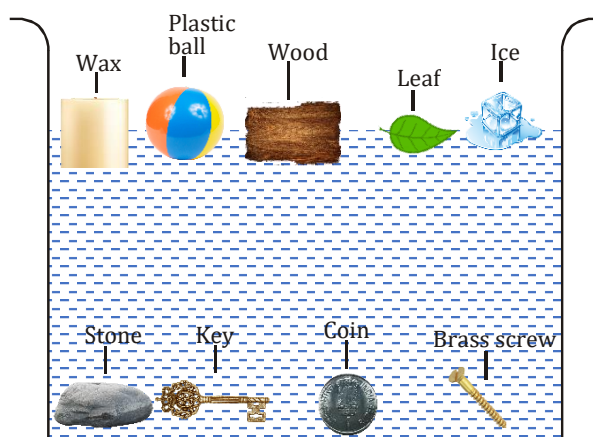
To find out substances which sink/float in water

Materials required

Stone, wax, metal key, plastic ball, wood, coin, leaf, brass screw, ice, glass bowl, water.

Method

- Take a small stone, a small piece of wax, a metal key, a plastic ball, a small piece of wood, a coin, a leaf, a brass screw, a small piece of ice and a glass bowl filled with water.
- Take a glass bowl filled with water. In the water, drop the above-mentioned substances one by one and observe what happens.



Some substance float and other sink in water.

Observation

- You will notice that the stone, the key, the coin and the brass screw sink in water. Thus, they can be grouped as substances heavier than water.
- You will notice that the wax, the plastic ball, the wood, the leaf and ice float on the surface of water. Thus, they can be grouped as substances lighter than water.

5. Transparency

Transparency is another property of materials which is used to distinguish them.

**Aim**

To illustrate transparent materials.

Materials required

Clear glass window pane, white sheet of paper, oil.

Method

- Look through the clear glass window pane of your bedroom. You will be able to see the things clearly outside your bedroom, in spite of the fact that there is solid glass in between you and outside. Such materials through which you can see are called **transparent materials**.
- Now place a white sheet of paper on the glass window pane and look through it. You will notice that you cannot see anything through paper. Such materials through which you cannot see are called **opaque materials**.
- Now remove the paper and in the middle of it. Pour a few drops of any kind of oil. When the oil spreads on the paper, place it on the glass window pane and look through it. You will notice that the objects outside are faintly visible. Such materials, through which you can see partially, are called **translucent materials**.



Looking through opaque, translucent or transparent material

Transparent: A material through which you can see clearly is called transparent material. It happens so because light can pass through it.

For example,

- Solids such as glass, diamond, gems and certain kinds of plastics are transparent materials.
- Most of the liquids, such as water, kerosene oil, alcohol, sea water, etc., are transparent materials.
- All gases, such as oxygen, hydrogen, nitrogen, air, etc. are transparent materials.



Keeping eatables in transparent jars, makes it easy to see them.

Transparency: The property of a material through which you can see clearly is called transparency.

Opaque: A material through which you cannot see is called opaque material. Through it light cannot pass.

For example,

Solids, such as metals (all kinds), wood, paper, stones, etc, are opaque materials.

Opacity: The property of materials through which you cannot see is called opacity.

Translucent: A material through which you can see partially is called translucent material. Light can pass through it but we cannot see clearly through it.

For example,

Ground glass, frosted glass, tissue paper, butter paper, oiled paper, muddy water, fog, mist, dust laden air are translucent materials.

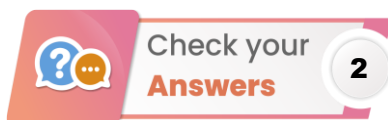
Thus, on the basis of seeing through a particular material, the substances can be grouped as transparent, opaque and translucent.



Why jewellers exhibit jewellery in glass show case?

Explanation

Jewellers exhibit the jewellery in glass showcases, so that it is easily visible and yet safe from thieves. Similarly, opticians show various kinds of spectacles and goggles in glass showcases.



1. (a) Sand (b) Sand (c) Beaker (d) Cotton
2. Given items will float on water, oil or kerosene.

Basic terminology

1. **Affinities** - A similar quality in two or more people or things.
2. **Hammer** - A tool with a heavy metal head that is used for hitting nails, etc.
3. **Spoke** - One of the thin pieces of metal that connect the centre of a wheel to the outside edge (the rim).
4. **Plough** - A large farm tool which is pulled by a tractor or by an animal.
5. **Bullock cart** - Two wheeled/ four wheeled vehicle pulled by oxen.
6. **Tumbler** - A drinking glass/ container without handle.
7. **Silly** - Not showing understanding, foolish.
8. **Lustre** - Brightness that a shiny surface has
9. **Vessel** - A container for liquids (bottle, cup, etc.)
10. **Exposed** - Not covered.
11. **Conversely** - In a way that is opposite to something.
12. **Vigorously** - Very forceful or energetic
13. **Miscible** - That can be mixed together.
14. **Immiscible** - That cannot be mixed together

15. **Brass** - An alloy (mixture of two metals i.e. copper and zinc.)
16. **Optician** - Person whose job is to test eyes, sell glasses, etc.
17. **Ground glass** - Glass that has a rough surface produced by grinding, used for diffusing light.
18. **Frosted glass** - Glass that has a rough surface so that you cannot see clearly through it.
19. **Mist** - A cloud made of very small drops of water in the air just above the ground, that makes it difficult to see.
20. **Laden** - Having or carrying a lot of somethings.
21. **Transparent** - Material through which you can see.
22. **Translucent** - Material through which you can see partially.
23. **Opaque** - Material through which you cannot see.
24. **Distinguish** - To make something different from others.
25. **Screw** - Thin pointed piece of metal used for fixing two things.
26. **Appearance** - The way that something looks.
27. **Conductivity** - Property of allowing heat or electricity to go through something.
28. **Solubility** - The ability to be dissolved, especially in water.
29. **Gems** - A precious stone
30. **Pearl** - hard round object which is shiny and usually creamy white in colour.
31. **Disappear** - To no longer be able to be seen.
32. **Partially** - Not completely.

Memory Map

