

Classification of Materials

Suppose you have some coins. And you have to find out how much money you have, or the total value of the coins. If you group the coins into 1-rupee, 2-rupee and 5-rupee coins, it will make your job easier. When you group coins this way, you classify them on the basis of their value. **Grouping similar things together is called classification.** By classifying things, you also keep dissimilar things apart.

THE IMPORTANCE OF CLASSIFYING THINGS

You can understand the importance of classification with the help of simple examples.

The things in your house are the most common example. You classify or group them while arranging them. You keep the utensils in the kitchen, the books in the study and the beds in the bedrooms. You would be very irritated if you found your shoes on the dining table and the utensils in the drawing room!

The librarian of your school immediately finds the book you ask for because the books are properly classified. The books on each subject are grouped together. And then, within each group, they are arranged in alphabetical order of the author's surname, e.g., Atkins, Bahl, Chatterjee and Das, etc.

Classification also enables us to make a systematic study of anything. For example, both plants and animals are living beings but they are different. So living things must be divided into two groups—plants and animals. Similarly, all plants or all animals are not alike. Hence, they are classified further. Such classification helps us learn about the processes that go on inside the bodies of different living beings. This helps us understand how diseases develop in different kinds of animals and find cures for them. The diseases of human beings and the cures for them are different from those of other animals and so are the doctors. Will you visit a veterinary doctor when you fall ill?

Similarly, the classification of plants makes it possible to study them systematically. And by systematically studying them, we have learnt how to grow more food.

Classification helps in another way too. If you know about one member of a group, you get a general idea about all members of the group. This is how doctors can treat patients without having to study each patient individually.

Thus, classification is necessary in order to

- have a systematic knowledge of things,
- have a general idea about all the members of a group, and
- know how the members of a group differ from those of other groups.

HOW TO CLASSIFY MATERIALS

You see various things around you, such as books, television sets, tables, chairs, clothes, and so on. They are made of various materials, such as paper, metal, wood, cotton, wool, and so on. *The importance of a material depends upon its utility, which, in turn, depends upon its properties.* For example, you can pick up pins with a magnet because they are attracted to the magnet. You cannot pick them up with a piece of wood or some other material. The ability (property) of a magnet to attract things made of steel is put to use in pinholders.

This is why it is important to study the properties of materials and group similar materials together. Let us study some of these properties.

Lustre

You may have noticed that many things shine, i.e., they have a **lustre**. Materials that shine are called **lustrous**, and those which do not are called **nonlustrous**. All metallic substances, e.g., materials used for making jewellery, utensils, cutlery, water taps, door handles and flower vases, are lustrous. On exposure to air, most metals lose their lustre in the course of time. We then say that the metal is **tarnished**. The metal regains its lustre if its surface is rubbed with cloth or sandpaper, or polished.

On the other hand, there are many things (like wood, coal, plastic and paper) which have no lustre. You have learnt earlier that nonmetals are generally nonlustrous.

So, on the basis of lustre, you can classify materials as *lustrous* and *nonlustrous*. Try to classify some things in your home on this basis.

Smoothness of surface

Move your fingers over the surface of a mirror or a stainless steel tumbler and then on that of a stone or brick. The surface of the mirror or stainless steel tumbler is smooth, whereas that of the stone or brick is rough. You can collect things and classify them into two groups—things with smooth surfaces and those with rough surfaces.

Transparency

You will read in the chapter on light that different materials behave differently when light falls on them.

Transparent materials (e.g., glass and some plastics) allow most of the light falling on them to pass through.

Opaque materials (e.g., wood and cardboard) do not allow light to pass through.

Translucent materials (e.g., frosted glass and oiled paper) allow some of the light falling on them to pass through.

Hardness

You cannot change the shape of a **hard** material by pressing it, or cut it easily. In contrast, you can easily change the shape of a **soft** material by pressing it or stretching it. You can also cut it easily. Hard materials are used to make vehicles, machines and furniture, while soft materials are used to make cushions and clothing.

Ductility and malleability

A solid material is **ductile** if it can be bent or its shape can be changed without breaking it. A ductile material can be drawn into wires. A solid material is said to be **malleable** if it can be beaten or pressed into sheets or foils. A solid material that breaks on being bent, beaten or pressed is called **brittle**.

You have learnt earlier that metals are ductile and malleable and that nonmetals, if solid, are brittle.

Floating or sinking in water

You must have noticed that many substances float, whereas many others sink in water. Let us do the following activity to see which substances float and which sink.



Collect some common substances. Some examples are mentioned in the table below. Test whether they float or sink by putting them in a glass or jug of water. Record your findings as shown below.

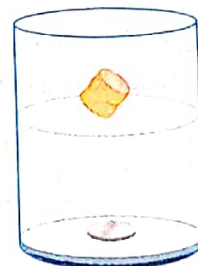


Fig. 3.1 A plastic block floats, whereas a coin sinks in water.

Substance	Floats	Sinks	Substance	Floats	Sinks
Plastic	✓		Jam		
Stone			Paper		
Rubber			Honey		
Wax			Iron (nail)		
Oil			Wood		

Solubility

When sugar is stirred in water, it disappears. In fact, the sugar crystals break up into molecules, which are invisible. The sugar molecules mix with the water molecules so intimately that they cannot be distinguished. We say that sugar is **soluble** in water, i.e., it **dissolves** in water and forms a **solution**. Thus, **a solution is a homogeneous mixture**. Substances like sand, chalk and sawdust, which do not dissolve in water, are said to be **insoluble** in water.

Some liquids, like glycerine and shampoo, also mix with water to form a solution. Such liquids are said to be **miscible** with water. Liquids like edible oil or kerosene, which do not

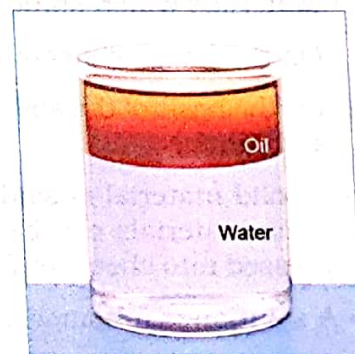


Fig. 3.2 Oil is immiscible with water.

mix with water, are said to be **immiscible** with water. Immiscible liquids, when mixed, form separate layers.

Some gases, like oxygen and carbon dioxide, are also soluble in water. Air, which is a mixture of gases, is soluble in water to some extent. Aquatic plants and animals use the carbon dioxide and the oxygen dissolved in water for their survival.

A liquid that dissolves other substances is called a **solvent** and the substance that dissolves is called a **solute**.

Water, though most widely used, is not the only solvent used for dissolving other substances. Methylated spirit, petrol, kerosene, ethyl alcohol, acetone and ether are among many other solvents. A material that does not dissolve in one solvent may dissolve in another.



Collect some solid and liquid materials at home and check if they are soluble in water. Add a small amount of the material to a glass of water and stir it. Record your observations in the following table, as shown for sugar.

Solid material	Soluble	Insoluble	Liquid material	Miscible	Immiscible
Sugar	✓		Shampoo		
Sand			Honey		
Chalk			Nail polish		
Salt			Lemon juice		
Wax			Grease		
Sawdust			Coconut oil		
Soap			Vinegar		

Points to Remember

- Grouping similar things together is called classification.
- Materials are classified on the basis of their properties.
- Materials which shine are said to be lustrous and those which do not are said to be nonlustrous.
- On the basis of smoothness of surface, materials are grouped as smooth and rough.
- On the basis of the ability to allow light to pass through, materials can be grouped as transparent, translucent and opaque.
- A solid material is said to be ductile if it can be bent or its shape can be changed without breaking it. Such materials can be drawn into wires. A solid material is said to be malleable if it can be beaten or pressed into sheets or foils. A solid material that breaks on being bent, beaten or pressed is called brittle.
- A solution is a homogeneous mixture.
- Materials that dissolve in water are said to be soluble in water, and those which do not are said to be insoluble in water.

Exercises

A. Answer the following in not more than 20 words.

1. What would you do to make a metallic object regain its lustre after it has lost its sheen?
2. Name two hard and two soft solids.
3. Name two objects, the surfaces of which are smooth and two, the surfaces of which are rough.
4. How do aquatic plants and animals survive in water?

B. Answer the following in not more than 40 words.

1. What do you mean by a solute and a solvent? Name two solids which are soluble and two which are insoluble in water.
2. How will you know whether a substance is miscible or immiscible with water? Give two examples of each type.
3. What do you mean by classification? Give one everyday example.
4. What are the benefits of classification?
5. Classify the following materials in three ways each (on the basis of their properties).
 (a) Wood (b) Glass (c) Paper (d) Iron

C. Choose the correct option in each of the following.

1. Which of the following materials is lustrous?
 (a) Wood (b) Gold (c) Paper (d) Sulphur
2. Identify the malleable substance among the following.
 (a) Wood (b) Stone (c) Glass (d) Aluminium
3. Which of the following is not opaque?
 (a) Wood (b) Frosted glass (c) Iron (d) Cardboard
4. Identify the odd one.
 (a) Milk (b) Oil (c) Ink (d) Sugar

D. Fill in the blanks, choosing words given in brackets.

1. Kerosene is with water. (miscible / immiscible)
2. A liquid that dissolves other substances is called a (solute / solvent)
3. A material can be drawn into a wire. (ductile / dense)
4. A material can be pressed into a sheet. (miscible / malleable)
5. A material breaks easily. (soft / brittle)
6. A metal is tarnished when it loses its (luster / hardness)

E. Match the following.

Edible oil
Common salt
Iron nail
Plastic block

Soluble in water
Sinks in water
Floats in water
Immiscible with



Fix different things such as a piece of glass, a piece of wood, coin, foil, wire, rubber, salt, sand, and so on, on a large chart paper. Below each, write the properties the substance has.

