

# 4

## Solids, Liquids, and Gases

All things take up space and have mass. <sup>Ans 1</sup> Any substance that has mass and occupies space is called **matter**. Solids, liquids, and gases are the three states of matter.

Identify the solid, liquid or gas in each example and then write them in the correct column to complete the table.

### You will learn about

- States of matter
- Change of states
- Solute, solvent, and solution
- Separation of substances






- Tea cup
- Tea inside the cup
- Steam



- Ball
- Air filled inside the ball



- Glass and the lid
- Straw
- Juice

Solids 	Liquids 	Gases 

## STATES OF MATTER

All matter (or substances) is made up of small particles. These particles are arranged in different ways in solids, liquids, and gases.

### Solids



*(Solids are substances in which the particles are packed very close to each other. Solids are usually hard and have a fixed shape. Pencil, book, chair, and marbles are examples of solids.)*

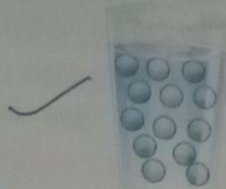
If we apply force, some solids can change their shape, e.g., dough can be rolled out into *chapatis*, and interesting shapes can be made out of clay.

Some solids, on applying force, can be bent or broken.



Examples of solids

### Liquids



*(Liquids are substances in which the particles are not very closely packed. Unlike solids, they have no fixed shape and can flow. They take the shape of the container they are poured into. Water, milk, and juices are examples of liquids.)*

If we pour some orange juice into a glass, it will take the shape of the glass. If we pour it into a bowl, it will take the shape of the bowl.

Liquids can flow from one place to another and so are also called *fluids*.



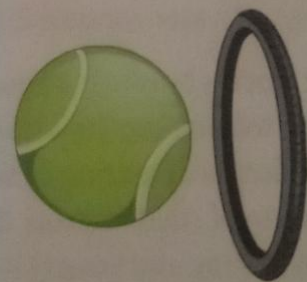
Liquids contained in different containers

### Gases



*(Gases are substances in which the particles are very loosely packed. They too have no fixed shape. Unlike liquids, they occupy all the available space in a container. Air and cooking gas are examples of gases.)* Air is actually a mixture of gases such as oxygen, nitrogen, and carbon dioxide.

Fluids include both *liquids* and *gases*.



Tyres and balls are filled with air

## Let's Remember



Write S for Solid, L for Liquid, and G for Gas. Also write one feature of each, in terms of its particles.

- |                  |       |          |       |
|------------------|-------|----------|-------|
| 1. Table:        | _____ | Feature: | _____ |
| 2. Orange juice: | _____ | Feature: | _____ |
| 3. Milk:         | _____ | Feature: | _____ |
| 4. Air:          | _____ | Feature: | _____ |

## CHANGE OF STATES

AN

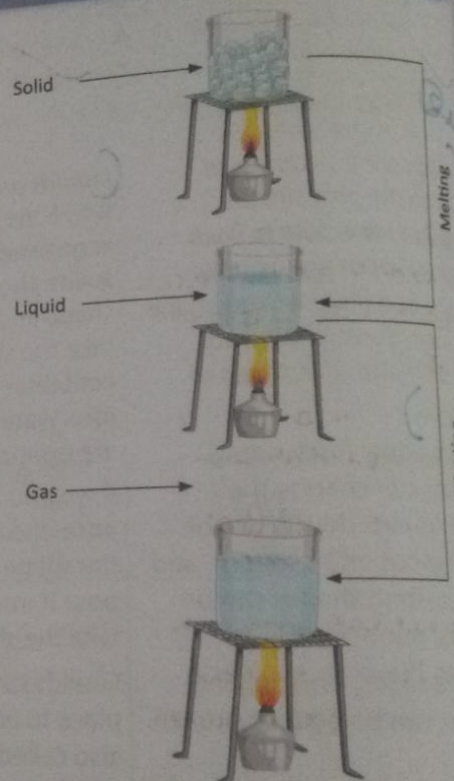
Matter can change its form from one state to another.

*The process by which a solid changes into a liquid is called melting.* When you take out an ice cube from the freezer and leave it at room temperature, you will see that the ice starts to melt into water.

*When this water is heated further, water starts to changing into vapour (steam).*

*The process by which a gas changes into a liquid on cooling is called condensation.* When you hold a cold steel plate over a pot of boiling water, you will see tiny drops of water condensing on the tray.

*The process by which a liquid changes into a solid on cooling is called solidification.* Freezing of water into ice is a form of solidification. If you fill water in an ice tray and keep it in the freezer, you will see that after some time the water turns into ice.



Changing states of matter in water

## Let's Discuss

1. Rani's scarf got wet in the rain. What could be the quickest way to dry her scarf?
2. Rain is formed when water changes its form from one state to another in nature. Discuss how rain is formed.

## Activity

**Aim:** To observe the process of condensation

**Things needed:** Mirror

**Method:**

1. Stand very close to the mirror and take a deep breath.
2. Exhale your breath onto the mirror and observe what happens.

**Observation:** The mirror becomes foggy.

**Conclusion:** The deep breath is warm and contains water vapour. This water vapour condenses into very small droplets of water when it hits the cold surface of the mirror. Several of these water droplets cause the mirror to look foggy.

## SOLUTE, SOLVENT, AND SOLUTION

A solution is formed when two or more substances mix together such that they are evenly distributed. *(The substance that dissolves is called the solute. The substance in which the solute dissolves is called the solvent. A solute and solvent together form a solution.)* Am (4)

If we add salt to water, the water turns salty. In the same way, we can add sugar to warm milk and observe what happens.

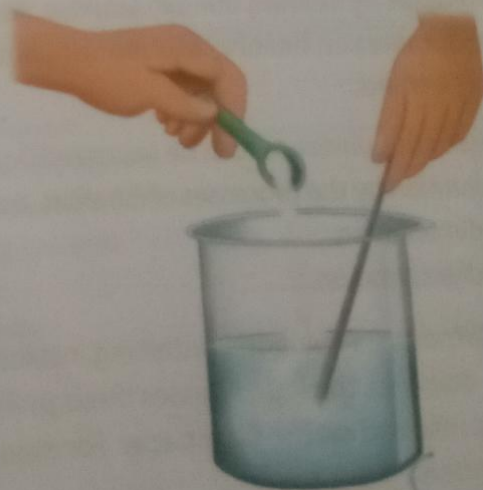
You will see that in both the cases, the salt and the sugar mix with the liquid and dissolve in it.

Here <sup>Examples</sup> (salt and sugar are the solutes, water and milk are the solvents, and the salty water and the sweet milk are solutions.)

**Solute + Solvent = Solution**

Sugar + Milk = Sweet milk

Salt + Water = Salty water



Salt dissolves in water

## Let's Remember



A. Name the process involved in each of the following:



B. Yash mixed some sugar in his hot milk. Name the solute and the solvent in this.

Solute: \_\_\_\_\_

Solvent: \_\_\_\_\_

## SEPARATION OF SUBSTANCES

There are two kinds of substances: soluble and insoluble.

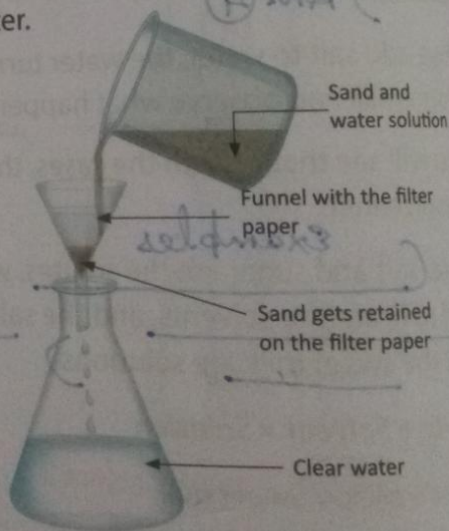
**Soluble substances** are those substances that dissolve completely in a solvent to form a solution. For example, salt and sugar are soluble in water.

**Insoluble substances** are those substances that do not dissolve completely in a solvent. For example, sand and chalk are insoluble in water.

There are many ways in which we can separate substances from a solution. Soluble substances can be separated by heating the solution. For example, salt can be separated from the salt solution by heating the salt solution. Water evaporates on heating and the salt particles are left behind.

Insoluble substances can be separated from a solution by the processes of filtration, and sedimentation and decantation.

In **filtration**, a solution containing insoluble substance is passed through a filter paper. On doing so, the liquid passes through the filter paper, while the insoluble substance gets retained on the filter paper. For example, sand and water can be separated by filtration.



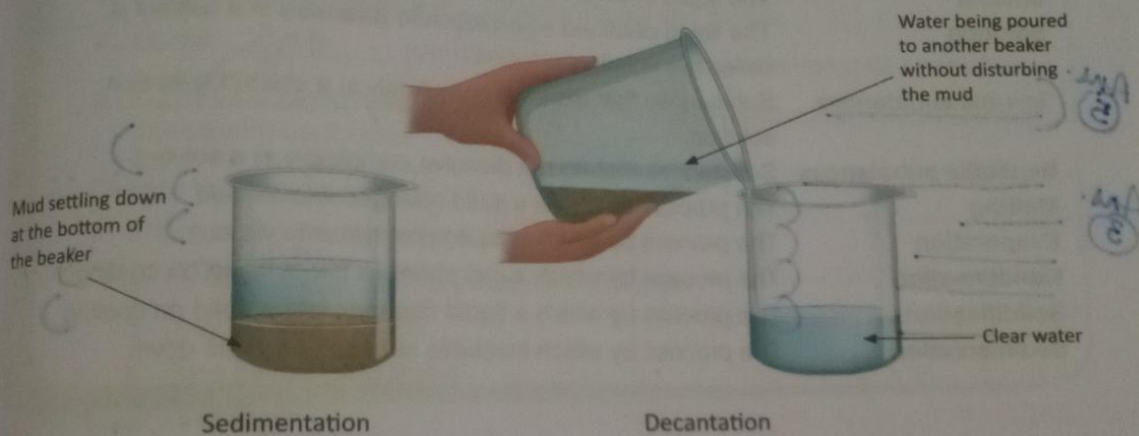
Separation of sand and water by filtration

An example of filtration used at homes is the separation of tea leaves from tea using a strainer.

During **sedimentation**, the liquid is left undisturbed for some time. The heavy insoluble solids settle down at the bottom. This process in which insoluble substances settle down is called **sedimentation**.

Then the upper clear liquid is poured into another container without disturbing the insoluble solids. This process is called **decantation**.

Mud and water can be separated by sedimentation and decantation.



*Separation of mud and water by sedimentation and decantation*

### Let's Remember



#### A. Give one word for the following:

1. Substances that completely dissolve in a solvent \_\_\_\_\_
2. Substances that do not completely dissolve in a solvent \_\_\_\_\_
3. The process in which insoluble substances settle down \_\_\_\_\_
4. The process in which a solution containing insoluble substance is passed through a filter paper \_\_\_\_\_

#### B. Write S for soluble and I for insoluble in water

1. Sand: \_\_\_\_\_
2. Salt: \_\_\_\_\_
3. Sugar: \_\_\_\_\_
4. Stone: \_\_\_\_\_

## Key Words

**Matter**

Any substance that has mass and occupies space is called matter.

**Solids**

Substances in which the particles are packed very close to each other

**Liquids**

Substances in which the particles are not very closely packed

**Gases**

Substances in which the particles are very loosely packed

**Solute**

The solid that dissolves in a liquid is called the solute.

**Solvent**

The liquid in which a solid dissolves is called the solvent.

**Solution**

The liquid obtained when a solute dissolves in a solvent is called the solution.

Ans  
5

Soluble substances

Substances that dissolve completely in a solvent to form a solution

Insoluble substances

Substances that do not dissolve completely in a solvent

Ans  
3

Melting

The process by which a solid changes into a liquid

Evaporation

The process by which a liquid changes into vapour

Condensation

The process by which a gas changes into a liquid on cooling

Solidification

The process by which a liquid changes into a solid on cooling

Sedimentation

The process by which insoluble substances settle down

## Summary

- Matter is made up of small particles.
- Matter exists in three states: solid, liquid, and gas.
- Matter can change from one state to another.
- A solution is formed when two or more substances mix together such that they are evenly distributed.
- Soluble substances can be separated from a solution by evaporation.
- Insoluble substances can be separated from a solution by filtration, and sedimentation and decantation.



# Exercises

OT

## Objective type questions

### A. Fill in the blanks with the correct words.

1. A substance that has mass and occupies space is called matter (solid/matter).
2. All substances are made up of particles (liquids/particles).
3. Fluids include liquids & gases (liquids/liquids and gases).
4. Matter can (can/cannot) change its form from one state to another.
5. A solution (solvent/solution) is formed when two or more substances are mixed with each other.

### B. Choose the correct option.

1. Which of these is true about solids?
  - a. Particles are packed very close to each other
  - b. They are usually hard
  - c. They have a fixed shape
  - d. All of these
2. Which of these can flow from one place to another?
  - a. Milk and water
  - b. Oxygen and juice
  - c. Air
  - d. All of these
3. Which of these falls in the group 'fluids'?
  - a. Solids
  - b. Liquids
  - c. Liquids and gases
  - d. Gases
4. Which of these processes changes water to ice?
  - a. Boiling
  - b. Evaporation
  - c. Condensation
  - d. Solidification
5. Which of these is the solute in a sugar solution?
  - a. Sugar
  - b. Milk
  - c. Water
  - d. None of these
6. Which of these processes are best suited to remove insoluble substances from water?
  - a. Distillation and evaporation
  - b. Sedimentation and decantation
  - c. Sedimentation, decantation, and filtration
  - d. All of these



7. Which of these would you use to separate salt from water?
- Sedimentation
  - Decantation
  - Filtration
  - Evaporation
8. Which process takes place when you take out an ice cube from the freezer and leave it at normal room temperature?
- Freezing
  - Melting
  - Condensation
  - Evaporation

ii. Very short answer type questions

A. Give two examples for the following.

- Substances in which particles are very closely packed
- Substances in which particles are very loosely packed
- Fluids
- Substances soluble in water
- Substances insoluble in water

<u>Pencil</u>	<u>Book</u>
<u>Oxygen</u>	<u>Nitrogen</u>
<u>Milk</u>	<u>Water</u>
<u>Sugar</u>	<u>Salt</u>
<u>Sand</u>	<u>Chalk</u>

B. Name what you would get in the following.

- When you take out an ice cube from a freezer and leave it in a normal room
- When you heat a liquid for sometime
- If you fill water in an ice tray and keep it in the freezer
- When sugar is added to water
- When salt is added to water

water  
Water Vapour  
Ice  
Sweet Water  
Salty Water

C. Answer the following questions.

- What is matter? Name the three states of matter.
- Differentiate between solids, liquids, and gases in terms of their particles.
- Define the following:
  - Melting
  - Condensation
  - Evaporation
  - Solidification
- With the help of an example, describe solute, solvent, and solution.
- Differentiate between soluble and insoluble substances.
- How does filtration help to remove insoluble substances?