

Solids, Liquids & Gases

What Is Matter?

Look around you in the classroom. Tick the things you see.

- Plant
- Chair
- Desk
- Blackboard
- Chalk
- Water
- Lizard
- Book

All the things mentioned above have two things in common:



All the things around us are matter

- They take up space.
- They have mass.

The space taken up by an object is called its **volume** and the amount of matter contained in an object is its mass. Anything that has mass and takes up space is

called **matter**. Thus people, animals, plants, water, chair, aeroplane, kite and all other things around us are matter.

Is air matter? Yes. It has mass, and it takes up space.

What Is Matter Made Up of?

All matter is made up of tiny particles called **molecules**. They are made of atoms. The molecule of every substance is different.

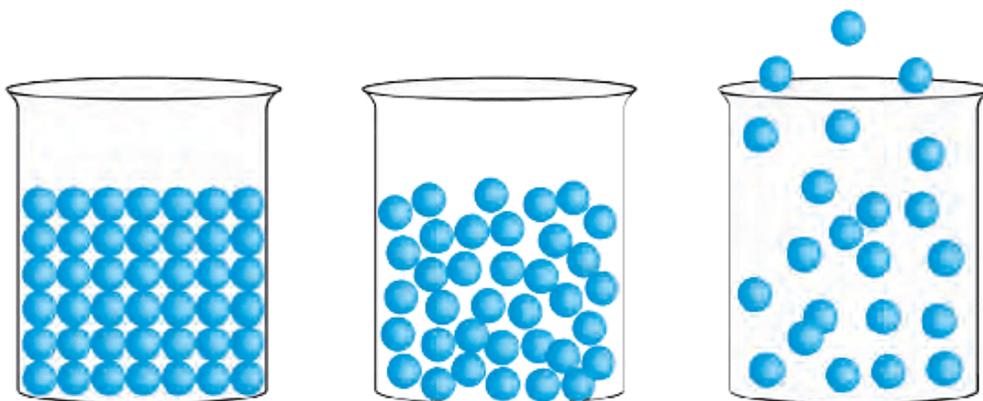
The States of Matter

Matter around us can either be solid, liquid or gas. A brick is a solid, water is a liquid and air is a gas. Solid, liquid and gas are the three states of matter.

The three states of matter have different properties. The arrangement of the molecules in them are also different. The space between the molecules, called **intermolecular space**, varies in the three states of matter.



Water is found in all three states



Solid

Liquid

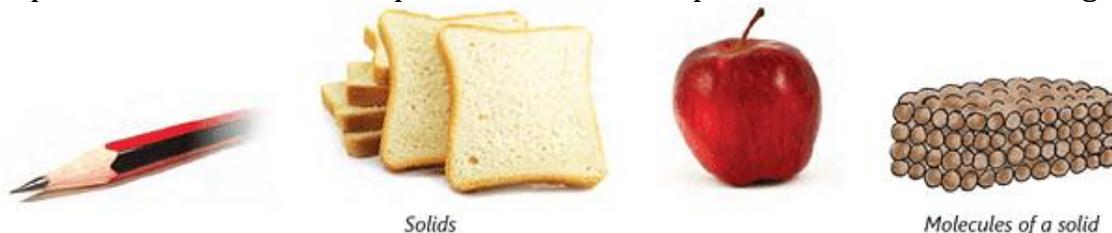
Gas

Intermolecular spaces in solids, liquids and gases

Let us study about the three states of matter.

Solids

A pencil, a slice of bread, a piece of wood and a pair of shoes are solid things.

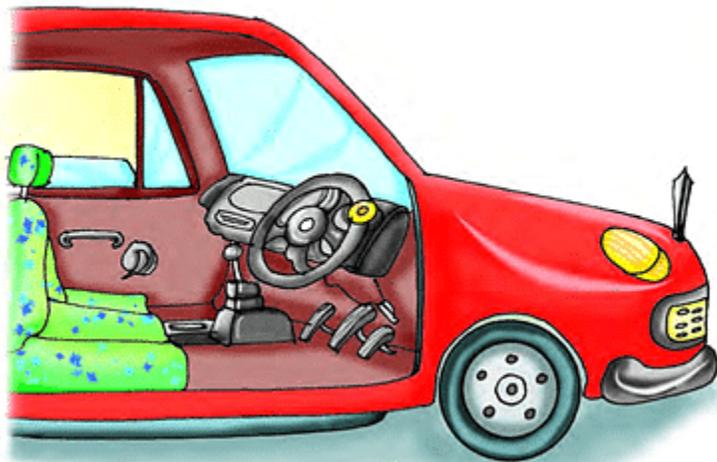


Properties of solids

Some common properties of solids are:

- Solids have a **fixed** shape.
- Solids **occupy** a definite space and hence have a fixed or definite volume.
- The molecules in solids are closely packed and the intermolecular space is very less. This is what gives solids a definite shape.

Thus, we can say that solids have definite shape and volume.



Different solid materials used in a car

Liquid

Things such as juice, milk, water and oil are liquids.

Properties of liquids

The properties of liquids are as follows:

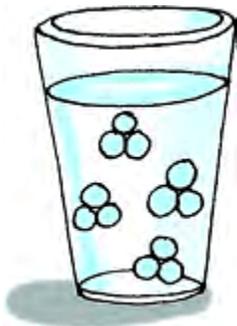
- Liquids do not have a definite shape; they take the shape of the container they are poured into.

- Liquids occupy a definite space and hence, have a fixed or definite volume.
- The molecules in liquids are loosely packed and the intermolecular space is more than in solids. This is what gives liquids the ability to flow.
- Liquids can flow from higher levels to lower levels.

Thus we can say, liquids can flow, they have definite volume but no definite shape.



Girl pouring liquid



Molecules of a liquid



Liquids flow from high to low places

Gases

The air we breathe, and the air we fill in balloons and footballs are gases.

Properties of gases

Some common properties of gases are:

- Gases do not have a definite shape or volume.
- Gases are often invisible.
- The molecules in gases are very far apart and the intermolecular space is very large, even more than in liquids. This is why gases occupy all the space they get.



Air is filled into balloons

Therefore, gases do not have definite shape or volume.

Air is all around us. It is made of gases. We cannot see or touch air but can feel it.

Air contains the gas **oxygen** that all plants and animals need for breathing. It also has **carbon dioxide** that the plants use to make food for the entire living world. With the help of this table you can differentiate between the states of matter.

Solids	Liquids	Gases
Have a fixed shape	Have no fixed shape.	Have no fixed shape
Have a fixed volume	Have a fixed volume	Have no fixed volume
Most solids cannot change shape easily	Can flow from high to low places	Can spread about in all directions
Molecules are closely packed	Molecules are less closely packed	Molecules are loosely arranged
Intermolecular space is less	Intermolecular space is more than in solids	Intermolecular space is large, more than in liquids

Change of States of Matter

Water is a liquid. But it can also be a solid, as ice. It can be a gas too, as water vapour. In all cases, the arrangement of molecules changes.

Freezing

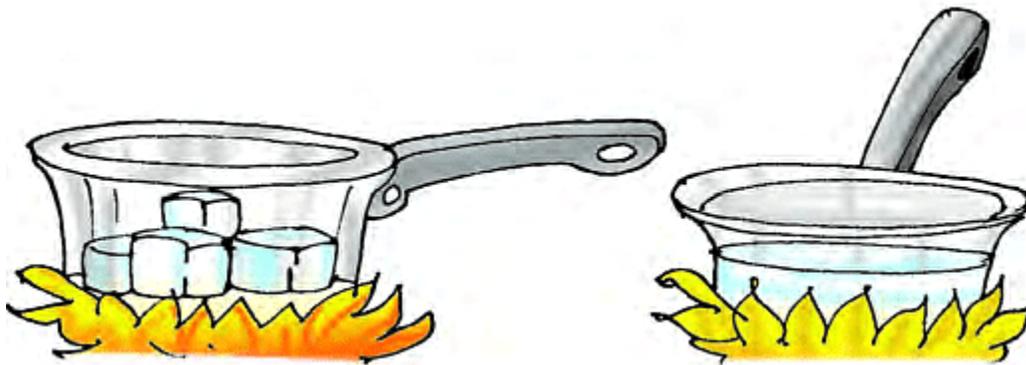
Freezing is the process by which a substance changes from a liquid state to a solid state upon cooling. When kept in freezer for 2-3 hours. The water changes into ice.



Freezing

Melting

Melting is the process by which a substance changes from the solid state to the liquid state upon heating. Keep some ice cubes in a pan and heat it gently. The ice melt to form water.



Melting

Evaporation

Evaporation is the process by which a substance changes from the liquid state into its vapour form upon heating. Heat water in a kettle. After some time the water starts boiling and you can see steam escaping from water.



When water is boiled in a kettle, steam or gas appears.

Condensation

Condensation is the process by which a substance changes from the gaseous state into the liquid state upon cooling. Water vapour can be changed back to water by cooling it. Put a cool steel plate above the water vapour coming out of the kettle of boiling water. The water vapour cools down when it comes in contact with the cool plate and changes back to water. Change of state can be easily observed in substances such as butter and wax.



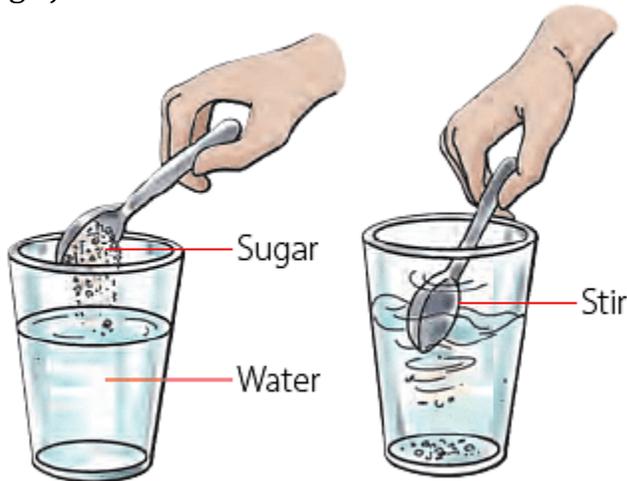
Condensation



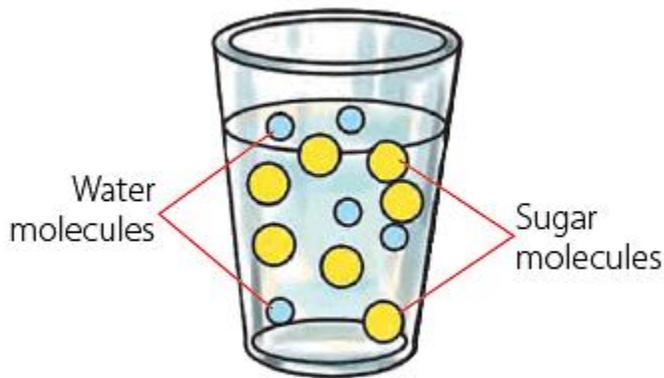
Melting of butter

Soluble Substances

Some solids dissolve in water. We call them **soluble** substances. Add a spoon of sugar to water. Stir the water with a spoon. What happens? The sugar disappears because it gets dissolved in water. We say that sugar is **soluble** in water. The sugar crystals dissolve and they occupy the spaces available in between the molecules of water. Some other substances that are soluble in water are salt, sugar, soap and orange juice.



Suger water solution



Molecules in a solution

Solute, Solvent and Solution

The substance that dissolves in a liquid to form a solution is called a **solute**. Salt and sugar are solutes.

The liquid in which a solute dissolves is called a **solvent**. Water is a solvent. Water is known as a **universal solvent** as it can dissolve many substances such as salt, sugar, coffee and many more.

A **solution** is the mixture formed when a solute dissolves in a solvent.

Solvent + Solute = Solution

Tips:

Petrol and kerosene are also solvents. Kerosene is used to dissolve oil paint whereas petrol is used to dissolve grease.

Insoluble Substances

Some solids do not dissolve in water. When we make tea at home, we mix water, milk, sugar and tea leaves together. The sugar dissolves in the tea but the tea leaves do not. We can say that the sugar is soluble whereas tea leaves are **insoluble** in water. We can separate insoluble solids from liquids by two methods.

1. Filtration

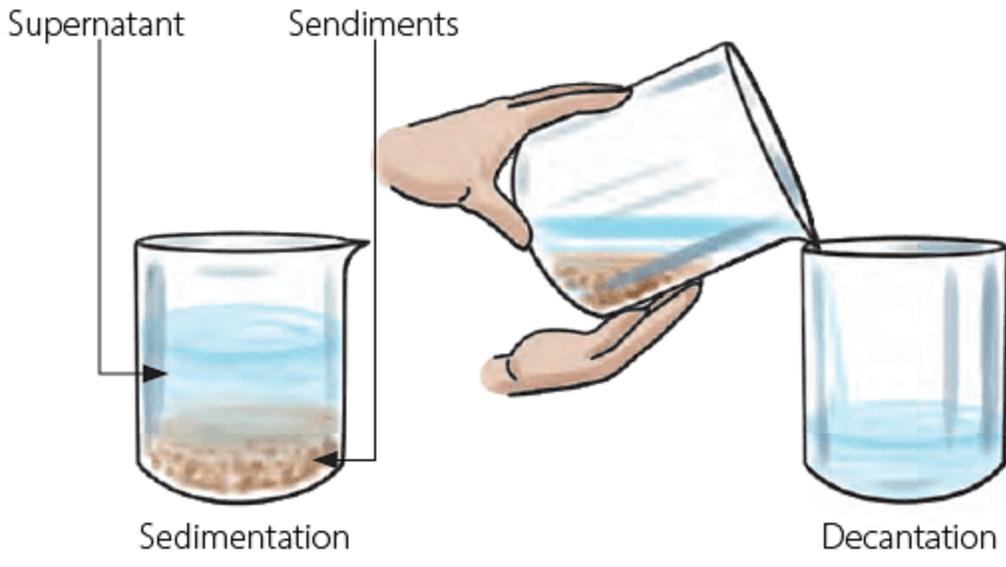
Tea leaves are taken out from the tea by filtration method. Tea is poured through a sieve and tea leaves are separated from the tea.



Filtration

2. Sedimentation and decantation

Mix some sand in a glass of water. Does it get dissolved? No, sand is also insoluble in water. Leave the water-sand mixture for some time. You will see that the sand is collected at the bottom of the glass. This process is called sedimentation. Now you can slowly pour the water from the glass, leaving sand undisturbed at the bottom of the glass. This process is called decantation.



Separating a mixture of sand and water using sedimentation and decantation