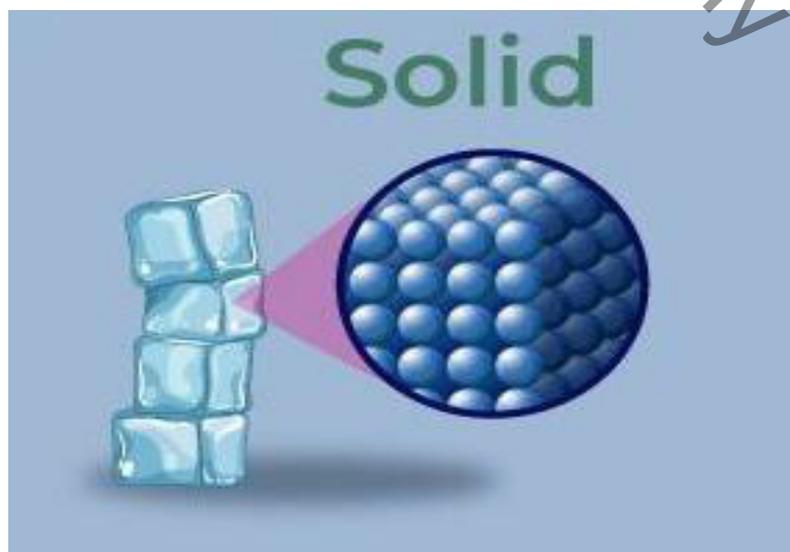


States of matter

- ▶ The kinetic particle theory of matter is a model that describes the arrangement, movement and energy of particles in a substance. The model is used to explain the physical properties of solids, liquids and gases.
- ▶ **There are 3 different form of material**
 - a) Solid
 - b) Gas
 - c) liquid

1- Solid:

- ▶ Solid matter is by far the most common state of matter found on earth (99.98% of the planet's mass).
- ▶ In solids, the particles or **atoms** of a substance are **packed tightly together** and **vibrate about fixed positions**.
- ▶ The vast majority of pure **elements** will exist as solids at room temperature.
- ▶ In terms of **particle theory**, solids can be described as spheres arranged so that they are **in contact** with one another, in an **orderly pattern**.
- ▶ These particles are held together by **strong forces of attraction**. As a result of these strong forces, solids will have a **fixed shape** and volume (e.g. a square block of wood will stay square no matter its container).
- ▶ At low enough temperatures, almost all substances will be solids. They are the **lowest energy** form of matter.



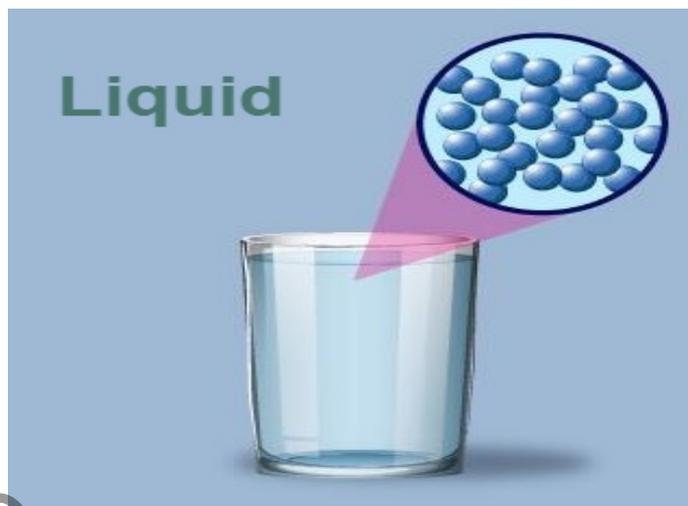
2- Gas:

- Gases are the **least orderly** of all the states of matter.
- In gases, the forces between particles are **very weak** and so they are able to **move around completely freely** and to spread out.
- Gases are **mostly empty space**, with large distances between particles.
- Gases don't have definite shape and volume, Gases will always expand to fill whatever container they are in.
- In terms of **particle theory**, gases can be described as an arrangement of particles with **no order**, where **none of the particles are in contact** with one another.
- Hotter the gas, faster they move.
- Gases are the **highest energy state** of matter and the second most common state for pure elements.



3- Liquid:

- Liquids are made up of **randomly arranged** particles of a substances that are, unlike the particles in a solid, **free to move around**.
- This allows liquids to **flow** and to **change their shape** according to their container. Their volume however remains fixed.
- In terms of **particle theory**, liquids can be described as particles that have **no orderly arrangement**, where each particles is **touching only a few** others.
- The particles in a liquid still remain **close together**. Though weaker than the forces in a solid, the forces between particles in a liquid still hold them into close groups.
- Liquids particles are moving constantly with random motion. The hotter the liquid, faster the liquid particle move.



Difference between different states of matter

Please go through the following attachment

Solid	Liquid	Gas
1. Have strong intermolecular force.	Weak intermolecular force.	Very weak intermolecular force.
2. Very less intermolecular space.	Large intermolecular space.	Very large intermolecular space.
3. Have definite shape and volume.	Do not have definite shape but have definite volume.	No definite shape and volume.
4. Have high density.	Density is low.	Very low density.
5. Solids cannot be compressed.	Liquids can be compressed.	Gases can be highly compressed.



Why do States of Matter Change?

The change in state occurs due to the following factors:

- Changing the Temperature
- Changing the Pressure
- Changing the Intermolecular Space and Force of Attraction
- Changing the Kinetic Energy of Particle

Let's learn about them Changing the Temperature and Changing the Pressure and the other in detail.

► **Changing the Temperature**

The effect of change of temperature on heating a matter depends upon the nature of the matter and the conditions required in bringing the change. So, let's discuss all the 6 interchanges between these states now.

► **Solid to Liquid change**

This process is known as **Melting**. The process in which a solid substance changes into a liquid on heating is called melting. On increasing the temperature of the solid the kinetic energy of the particle increase which overcomes the force of attraction between the particles thereby solid melts and is converted into liqui

► **Liquid to Gas change**

This process is known as **Boiling** or **Vaporization**. The process in which a liquid changes into gas rapidly on heating is called boiling. The temperature at which a liquid boils and changes rapidly into gas at atmospheric pressure is called the boiling point of the liquid.

► **Gas to Liquid Change**

This process is known as **Condensation**. The process of changing gas into liquid by cooling is called condensation. Condensation is the reverse of boiling.

► **Liquid to Solid Change**

This process is known as **Freezing**. The process of transformation of liquid into a solid by cooling is called freezing. Freezing means solidification. It is the reverse of the melting process.

► **Solid to Gas Change**

This process is known as **Sublimation**. The change of solid directly into vapor on heating without passing through the intervening liquid state is called sublimation.

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The common substances which undergo sublimation are ammonium chloride, iodine, camphor, naphthalene, and anthracene. e.g. Solid carbon dioxide (or dry ice) sublimates to form carbon dioxide gas. Naphthalene balls disappear with time without leaving behind any residue.

► Gas to Solid Change

This process is known as **Deposition or DE sublimation**. It is a thermodynamic process in which gas changes into a solid directly without entering into the liquid phase.

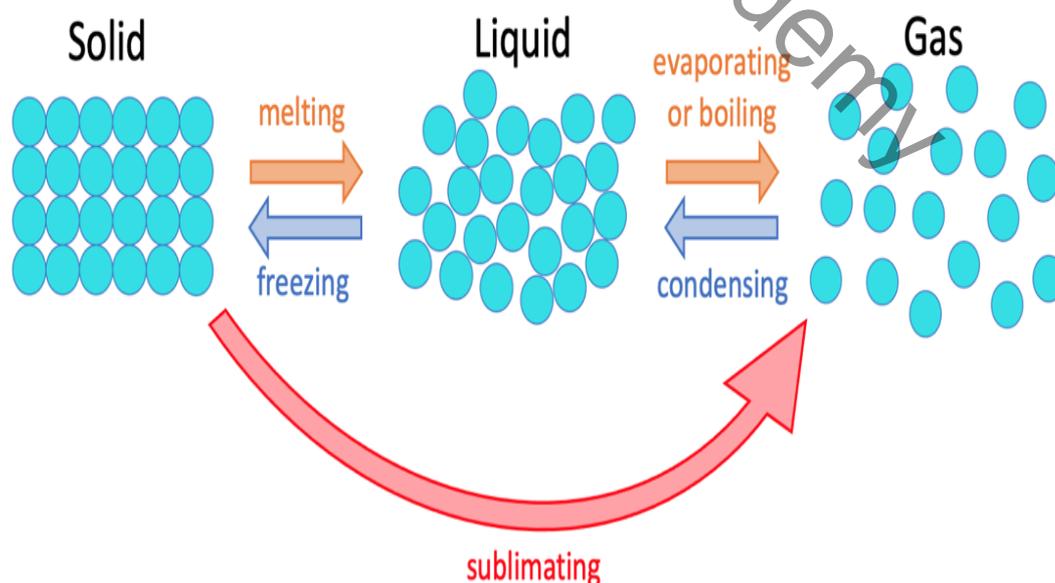
Changing the Pressure

The physical state of matter can also be changed by changing the pressure. By applying high pressure the particles of a gas can be brought close together means gases can be liquefied easily by applying pressure and reducing temperature. When pressure is applied particles come together thus the force of attraction increases and intermolecular space decreases.

Hence, gas liquefies. When pressure around the solid carbon dioxide is reduced its temperature increases and it directly changes into carbon dioxide gas.

Interconversion of Three States of Matter

The states of matter are interconvertible. The state of matter can be changed by changing the temperature or pressure. The transition of one state to another is referred to as the **interconversion of matter**. It is a process in which matter transitions from one state to another and then returns to its original state with no change in its chemical makeup. Heating may transform solids into liquids.



Symbol that we use in chemical equation

There are some symbol which is used for different states of matter in chemical equations

- I. (s) is used for Solid
- II. (L) is used for liquid
- III. (g) is used for gases
- IV. (aq) is used for aqueous



Need to predict the state of substances

- If Temperature is **below the melting point** of substance—> will be **solid**
- If it is **above the boiling point** —> will be **gas**
- If it is in **between 2 points**—> will be **liquid**