

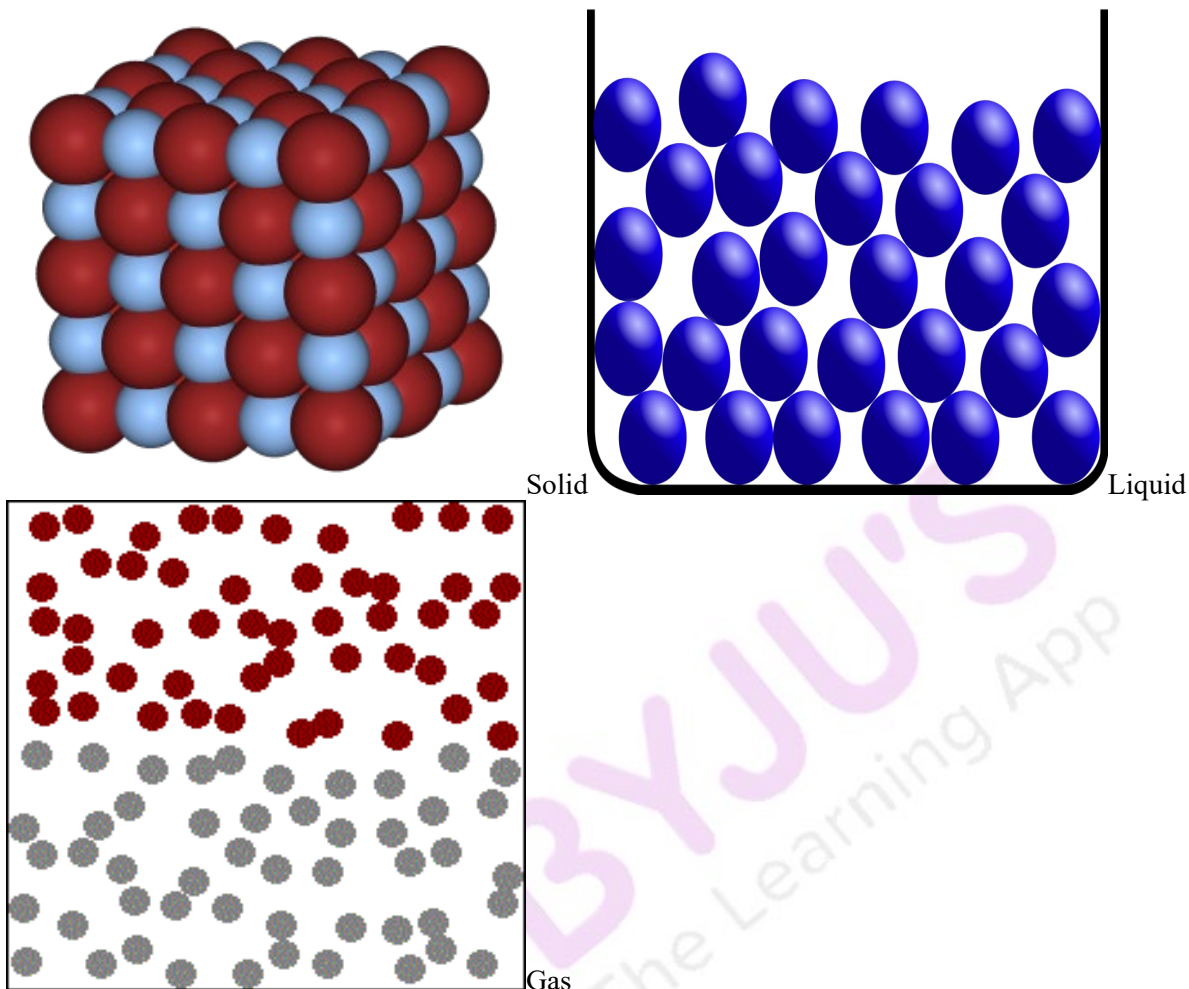
Anything that has mass and takes up space is referred to as matter. hydrogen and oxygen, sugar and sand, air and water, etc. Small, minuscule particles make up matter. Due to the space between them, matter particles are attracted to one another.

States of Matter

- Matter can be classified as solid, liquid and gas on the basis of interparticle forces and the arrangement of particles.
- These three forms of matter are interconvertible by increasing or decreasing pressure and temperature. For example, ice can be converted from solid to a liquid by increasing the temperature.

Property	Solid	Liquid	Gas
Shape and volume	Fixed shape and volume	No fixed shape but has volume	Neither definite shape nor volume
Energy	Lowest	Medium	Highest
Compressibility	Difficult	Nearly difficult	Easy
Arrangement of molecules	Regular and closely arranged	Random and little sparsely arranged	Random and more sparsely arranged
Fluidity	Cannot flow	Flows from higher to lower level	Flows in all directions
Movement	Negligible	Depends on interparticle attraction	Free, constant and random
Interparticle space	Very less	More	Large
Interparticle attraction	Maximum	Medium	Minimum
Density	Maximum	Medium	Minimum
Rate of diffusion	Negligible	It depends on interparticle attraction.	Maximum

Atomic view of the three states of matter



Physical Nature of Matter

- A physical property is that aspect of the matter that can be observed or measured without changing its nature or composition.
- It is independent of the amount of matter present.
- Physical properties include appearance, colour, odour, density, texture, melting point, boiling point, solubility, etc.

Characteristics of Particles of Matter

Matter

Matter is anything that has mass and occupies space.

- Everything that we can touch, see, hear, taste and also smell is matter.
- It is made up of really tiny particles which cannot be seen through the eye.

The particles of which the matter is comprised influence its state and properties (physical and chemical).

1. Particles of matter have spaces between them

- This characteristic is one of the concepts behind the solubility of a substance in other substances. For example, on dissolving sugar in water, there is no rise in water level because the particles of sugar get into the interparticle spaces between the water particles.

2. Particles of matter are always in motion

- Particles of the matter show continuous random movements due to the kinetic energy they possess.
- A rise in temperature increases the kinetic energy of the particles, making them move more vigorously.

3. Particles of matter attract each other

In every substance, there is an interparticle force of attraction acting between the particles. To break a substance we need to overcome this force. The strength of the force differs from one substance to another.

Diffusion

When the particles of matter intermix on their own with each other, the phenomenon is called diffusion. For example, spreading of ink in water.

- During diffusion, the particles occupy the interparticle spaces.
- The rate of diffusion increases with increase in the temperature, due to increase in kinetic energy of the particles.

Can Matter Change Its State?

Effect of change of temperature on state of matter

On increasing temperature, the kinetic energy of the particles of the matter increases and they begin to vibrate with a higher energy. Therefore, the interparticle force of attraction between the particles reduces and particles get detached from their position and begin to move freely.

- As a result, the state of matter begins to change.
- Solids undergo a phase change to form liquids.
- Similarly, liquids also undergo a phase change to form gases.

Melting point

The melting point of a solid is defined as the temperature at which solid melts to become liquid at the atmospheric pressure.

- At melting point, these two phases, i.e., solid and liquid are in equilibrium, i.e., at this point both solid state and liquid state exist simultaneously.

Fusion

When two atoms collide to create a heavier atom, such as when two hydrogen atoms combine to create one helium atom, this process is known as fusion. This process generates enormous amounts of energy, many times more than fission, and powers the sun. Furthermore, it doesn't generate radioactive fission products.

The melting point at which ice a solid turns to water a liquid is 32°F (0°C).

Boiling point

The boiling point of a liquid is defined as the temperature at which the vapour pressure of the liquid is equal to the atmospheric pressure.

The boiling point for any material is the temperature point at which the material transforms into the gas phase in the liquid phase. This happens at 100 degrees centigrade for water. The Celsius scale was in fact created on the basis of the ice/water melting point and the liquid water/vapor boiling point.

Latent heat of fusion

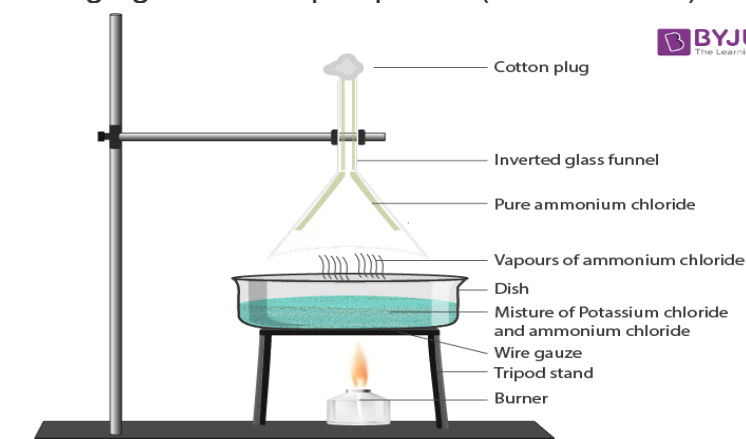
It is the amount of heat energy that is required to change 1 kg of a solid into liquid at atmospheric pressure at its melting point.

Latent heat of vaporisation

It is the amount of heat energy that is required to change 1 kg of a liquid into gas at atmospheric pressure at its boiling point.

Sublimation

The transition of a substance directly from its solid phase to gaseous phase without changing into the liquid phase (or vice versa) is called **sublimation**.



Transformation

Sublimation – Solid to Gas Phase

Effect of change in pressure on state of matter

By applying pressure, the interparticle spaces between particles of matter decreases. Thus, by applying pressure and reducing temperature we can convert a solid to liquid and a liquid to gas.

Flowchart for inter-conversion of the three states of matter

CHANGING STATES OF MATTER



Evaporation

The phenomenon by which molecules in liquid state undergo a spontaneous transition to the gaseous phase at any temperature below its boiling point is called evaporation.

- For example, the gradual drying of damp clothes is caused by the evaporation of water to water vapour.

Factors affecting evaporation

- **Temperature:** The rate of evaporation increases with an increase in temperature.
- **Surface area:** The rate of evaporation increases with an increase in surface area.
- **Humidity:** The rate of evaporation decreases with an increase in humidity.
- **Wind speed:** The rate of evaporation increases with an increase in wind speed.

Cooling due to evaporation

During evaporation, the particles of a liquid absorb energy from the surroundings to overcome the inter-particle forces of attraction and undergo the phase change. The absorption of heat from the surrounding makes the surrounding cool.

For example, sweating cools down our body.

Applications of Evaporative Cooling

- To keep water cool, it is kept in earthenware containers. Similar to the pores in cotton fabric, the pores in the earthen pot's surface area allow for more evaporation.
- To keep our body cool, we sweat a lot. Evaporation is what transpiration ultimately is. Our body's water evaporates, using energy in the process and lowering our body temperature as a result.
- We dress in cotton during the summer. Since cotton is a powerful water absorbent, it allows more perspiration to come into touch with the air, promoting more evaporation. We have a cooling effect when wearing cotton clothing because of this.

