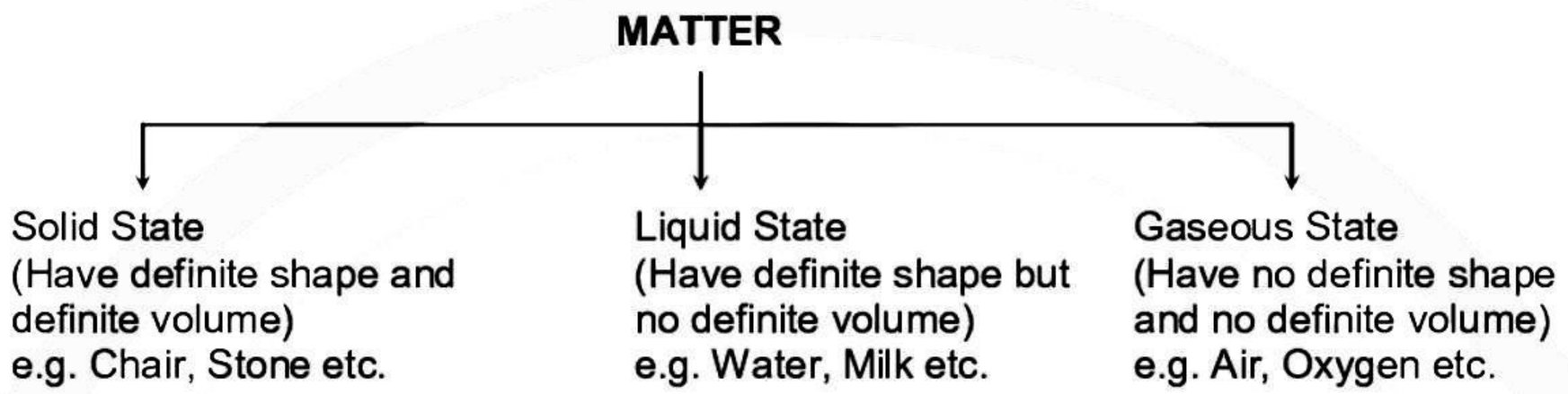
MATTER IN OUR SURROUNDINGS

Matter

Everything in this universe is made up of matter. Matter is defined as anything which occupies space, possesses mass and the presence of which can be felt by any one or more of our five senses, i.e., sight, touch, smell, hearing and taste.

States of Matter



Matter around us exists in three states, i.e., **solid, liquid and gas.** These three states differ from one another due to the difference in the size of spaces in between the constituent particles, their forces of attraction and kinetic energies.

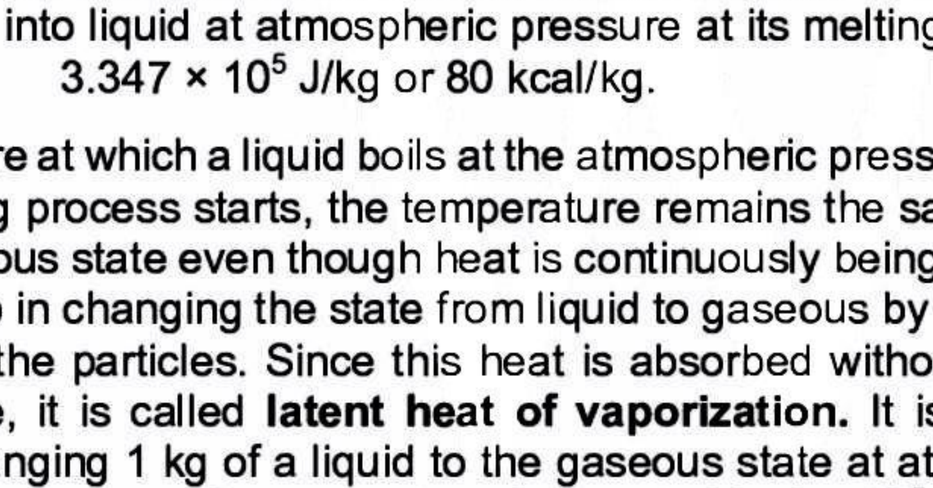
Differences in the characteristics of states of matter (solids, liquids & gases)

S. No.	Property	Solid	Liquid	Gas
1.	Packing	The particles are most closely packed.	The particles are less closely packed than solids.	Particles are at sufficient distances from each other.
2.	Shape	Solids have definite shape.	Liquids do not have definite shape. They assume the shape of container.	Gases do not have a definite shape. They assume the shape of container.
3.	Volume	Solids have definite volume.	Liquids have definite volume.	Gases do not have definite volume. They assume the volume of container.
4.	Density	Solids have high density.	Liquids have less density than solids but more than gases.	Gases have the least density.
5.	Diffusion	Solids have no tendency to diffuse.	Liquids have a tendency to diffuse slowly.	Gases diffuse rapidly.
6.	Rigidity	Rigid.	Fluid.	Fluid.
7.	Compressibility	Negligible.	Very low.	High.
8.	Inter-molecular forces of attraction	Maximum.	Less than solids.	Negligible.
9.	Kinetic energy of molecules	Least.	More than solids.	Very high.

- Besides solids, liquids and gases, there are two other states of matter, i.e., plasma and Bose-Einstein Condensate (BEC).

Inter Conversion of States of Matter

- **The states of matter are inter-convertible.** This inter-conversion can be carried out either by changing temperature or pressure or both. For example, ice (solid) on heating becomes liquid water, which upon further heating gets converted into steam (gas). Similarly, a gas such as LPG can be liquefied on applying pressure. Likewise CO_2 gas can be converted into **dry ice** (solid) by cooling under pressure.



- The temperature at which a substance melts to form a liquid at atmospheric pressure is called its **melting point.** Once the melting process starts, the temperature remains the same till the entire solid melts even though we continue to supply the heat. This heat is actually used up in changing the state from solid to liquid by overcoming the forces of attraction between the particles. Since the heat supplied is absorbed by the particles without showing any rise in temperature, this is called **latent heat of fusion.** It is the amount of heat energy required to change 1 kg of a solid into liquid at atmospheric pressure at its melting point. The latent heat of fusion of ice is 3.347×10^5 J/kg or 80 kcal/kg.

- The temperature at which a liquid boils at the atmospheric pressure is called its **boiling point.** Once the boiling process starts, the temperature remains the same till the entire liquid changes into the gaseous state even though heat is continuously being supplied. Actually this heat energy is used up in changing the state from liquid to gaseous by overcoming the forces of attraction between the particles. Since this heat is absorbed without showing any rise in temperature, therefore, it is called **latent heat of vaporization.** It is defined, as the heat energy required in changing 1 kg of a liquid to the gaseous state at atmospheric pressure at its boiling point. The latent heat of vaporisation of water is 22.59×10^5 J/kg or 540 kcal/kg.

- **Sublimation** is the change of solid state directly into gaseous state without passing through the intervening liquid state, and vice-versa. The process of sublimation is used to purify volatile substances such as naphthalene, ammonium chloride, camphor, etc. from non-volatile impurities.

- **Boiling** is a bulk phenomenon. Particles from the bulk (whole) of the liquid change into vapour state.

- **Evaporation** is a surface phenomenon and involves the conversion of a liquid into vapours at any temperature below its boiling point. During evaporation, some of the particles on the surface of the liquid, which have high kinetic energy overcome the forces of attraction by the neighbouring particles, leave the liquid surface and get converted into vapours.