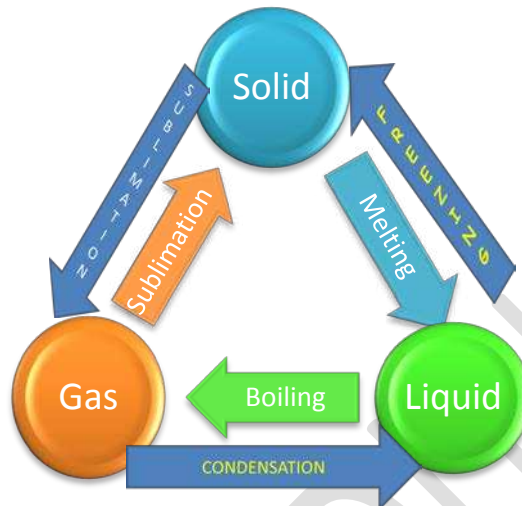


## Change of state



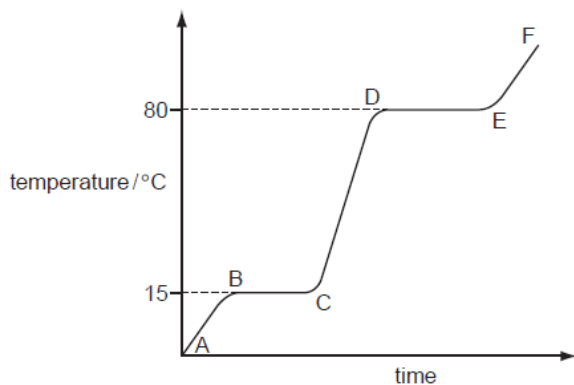
Some substances directly change state from solid to gas or from gas to a solid . This process is called as sublimation.

### Examples of substances that sublime are:

Solid      Gas

- Dry ice (solid carbon dioxide)
- Iodine
- Arsenic
- Naphthalene ( The stuff the camphor balls are made of)

## Explaining the change of state on the basis of kinetic theory



- Between A -B: The temperature of the solid increases. This is because increasing the heat energy increases the vibration of the particles in the solid.
- Between B-C: The force of attraction between the particles is weakened so the particles are able to slide past over each other. The temperature does not increase as all the

heat supplied goes into overcoming the forces between the particles instead of raising the temperature. The substance melts.

- Between C-D. As time progresses the average kinetic energy of the liquid particles increases. Hence the temperature increases.
- Between D-E: The force of attraction between the particles is further weakened, so much so that the particles move well away from each other. The temperature is constant because the energy supplied goes into overcoming the forces between the particles instead of raising the temperature. The substance boils.
- Between E and F: The average kinetic energy of the particles increases and hence the speed of the particles also increases. Hence the temperature increases. The gas particles are now further away from each other.
- Note: In the region BC, The equation of the equilibrium is:



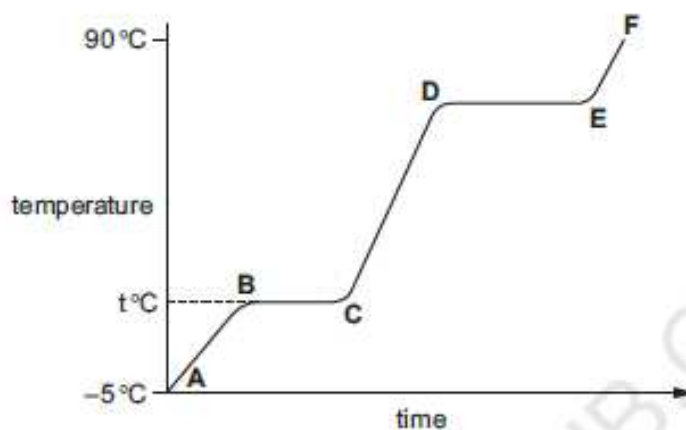
- The graph proves that a pure substance was used as the substance has a sharp melting point (at BC) and a sharp boiling point (at DE.)
  - The temperatures 15°C and 80°C are important as they represent the melting and the boiling points.
  - If an impure sample would have been used, the line BC would have been lower and the line DE would have been higher.
-

	<b>C TO D</b>	<b>E TO F</b>
<b>Separation between particles</b>	Close and touching	Far apart
<b>Movement of particles</b>	Random and slow	Fast and random
<b>Can the particles move apart to fill the volume</b>	Cannot move apart	Can move apart

[O/N/2014-p33-q2]

2 Compound X is a colourless liquid at room temperature.

- (a) A sample of pure X was slowly heated from  $-5.0^{\circ}\text{C}$ , which is below its melting point, to  $90^{\circ}\text{C}$ , which is above its boiling point. Its temperature is measured every minute and the results are represented on the graph.



- (i) Complete the equation for the equilibrium present in the region BC.



- (ii) What is the significance of temperature  $t^{\circ}\text{C}$ ?

..... [1]

- (iii) What is the physical state of compound X in the region EF?

..... [1]

- (iv) What would be the difference in the region BC if an impure sample of X had been used?

..... [1]