

There are three states of matter, which are as follows:

- Solid
- Liquid
- Gas

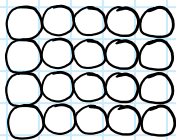
Solid

Properties

- Fixed shape
- Fixed volume
- Cannot be compressed

Characteristics

- Particles are orderly arranged and closely packed.
- Very strong attraction between the particles.
- Particles cannot move.
- Particles can vibrate and move about their fixed positions.
- Kinetic energy of the particles are very low.



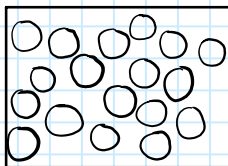
Liquid

Properties

- No fixed shape
- No fixed volume
- Cannot be compressed.

Characteristics

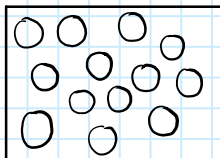
- Disorderly arranged
- Less closely packed than in solid.
- Strong attraction between the particles.
- Kinetic energy of the particles are low.
- Particles move throughout the liquid.



Gas

Properties

- No fixed volume
- Can be compressed
- Particles are disorderly arranged
- Attraction between particles are very weak
- Kinetic energy of particles are high
- Particles move about rapidly in any direction



Changing of state

Melting point

The constant temperature at which a purer solid changes into liquid is called melting point.
During presence of impurities in the solid melting point decreases.

Boiling point

The constant temperature at which a pure liquid changes into gas is called boiling point.
During presence of impurities in the solid melting point increases.

Evaporation

The changing of liquid into gas below the boiling point. (At any range of temperature).

The process is very slow.

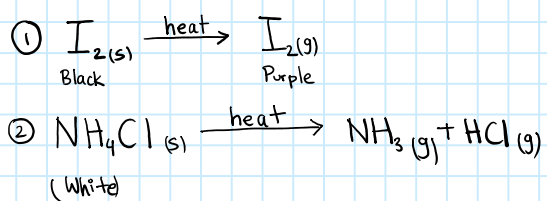
It occurs from the surface of the liquid.

Volatile liquids can easily evaporate.

Sublimation

The process by which solid substance are directly converted into gas is called sublimation.

During sublimation heat is needed.

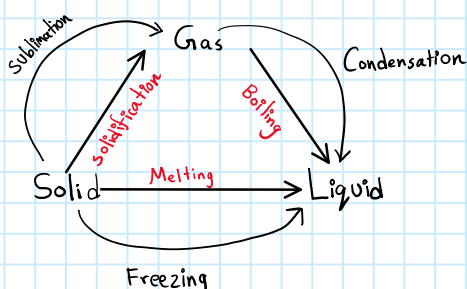


Solidification

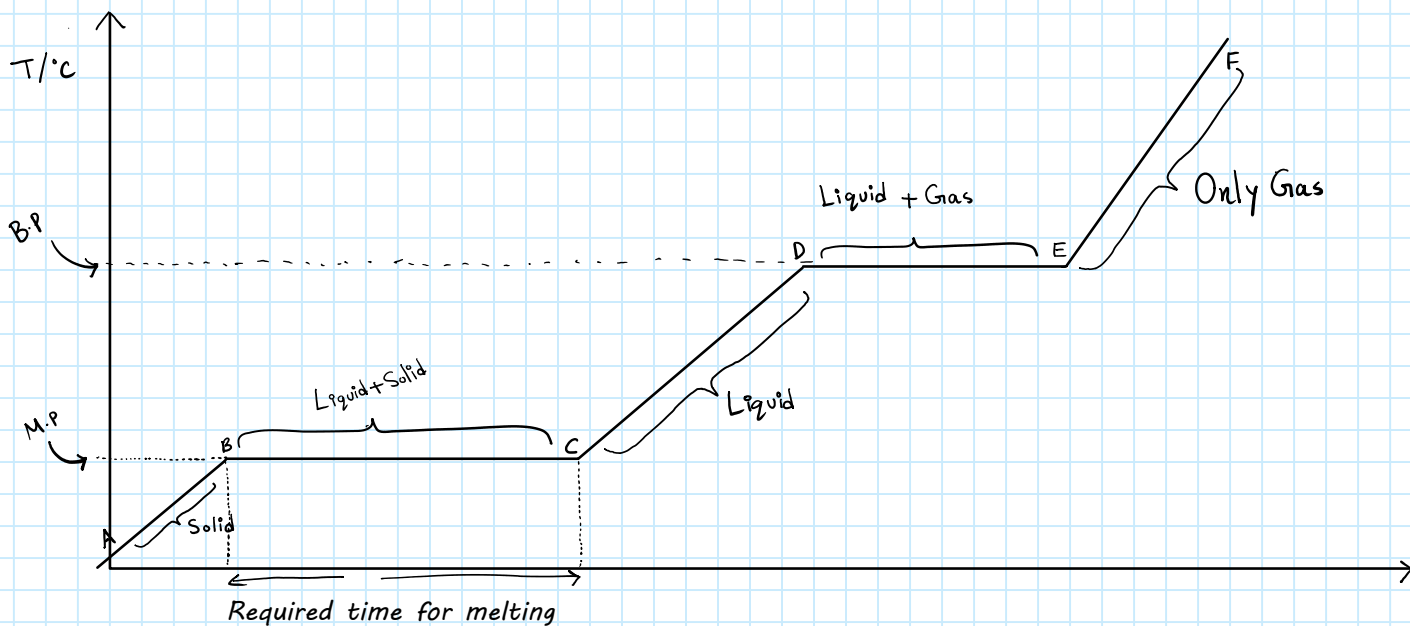
Gases are converted to solid directly.

Freezing

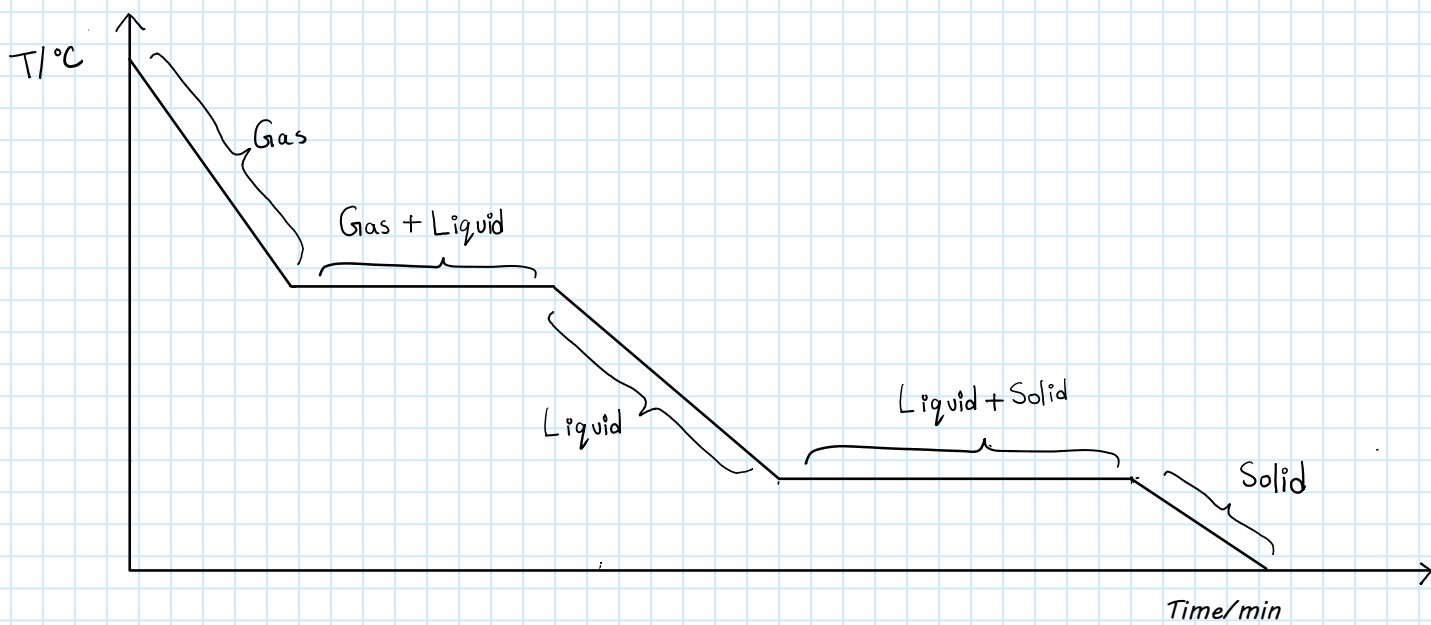
Liquids are converted to solid.



Heating Curve



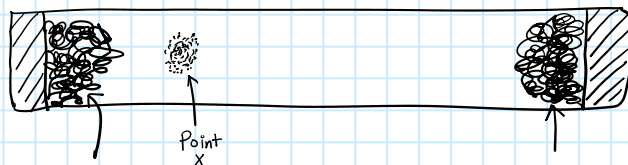
Cooling curve



Diffusion

- Diffusion is the movement of particles from a region of higher concentration to a region of lower concentration.
- Rate of diffusion depends on temperature and molecular mass of particles.
- With the increase of temperature the rate of diffusion increases. Particles have more kinetic energy and they move faster.
- With the increase of relative molecular mass, rate of diffusion decreases.

Example 1



Cotton wool soaked in Hydrobromic acid

Cotton wool soaked in aqueous ammonia

- Concentrated hydrobromic acid produces fumes of hydrogen bromide HBr(g) .
- Concentrated aqueous ammonia produces fumes of ammonia.
- After some time, solid ammonium bromide appears at point x.

Explanation using kinetic particle theory

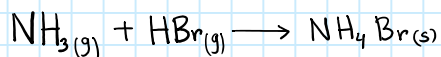
Ammonia molecules have enough energy to escape from its aqueous.

Hydrogen bromide molecules have enough energy to escape from its aqueous.

Diffusion of ammonia molecules and Hydrogen bromide molecules takes place.

Molecules move randomly and spread out.

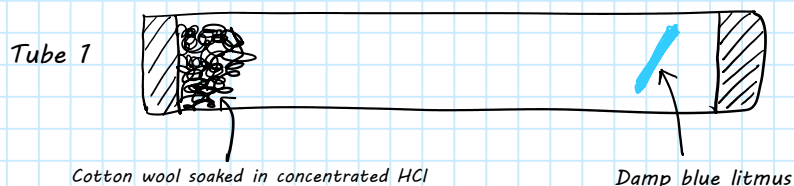
Solid ammonium bromide is formed due to the reaction between ammonia and hydrogen bromide.



HBr has higher Mr (Mr = 81) than ammonia (Mr = 17).

Ammonia molecules diffuse faster than hydrogen bromide molecules.

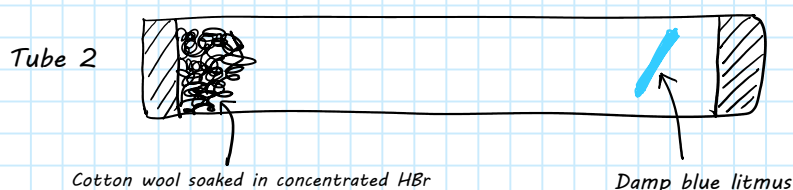
Example 2



Cotton wool soaked in concentrated HCl

Damp blue litmus

- Concentrated hydrochloric acid produces fumes of hydrogen chloride gas (HCl).
- After 4 minutes litmus turns red.



Cotton wool soaked in concentrated HBr

Damp blue litmus

- Concentrated hydrobromic acid produces fumes of hydrogen bromide gas (HBr).
- After 7 minutes litmus turns red.

Explanation using kinetic particle theory

- -Diffusion of hydrogen bromide gas and hydrogen chloride gas takes place.
- Molecules move randomly.
- Molecules move from a region of higher concentration to a region of lower concentration.
- Hydrogen bromide gas has a higher molecular mass than hydrogen chloride gas.
- Hydrogen chloride diffuses faster than hydrogen bromide.

Effect of temperature on volume of gas

- With the increase of temperature of a gas, volume increases.
- Particles move faster at higher temperature.
- Particles have high kinetic energy at higher temperature.
- Molecules move further away from each other.
- With the increase of pressure, volume of gas decreases because the pressure pushes the molecules closer.