

States of Matter

IGCSE Chemistry • Topic 1

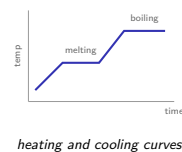
IGCSE Chemistry



States of Matter

What we will cover

- 1 The three states & their particles
- 2 Changes of state
- 3 Heating & cooling curves
- 4 Gas pressure
- 5 Diffusion



heating and cooling curves

1 Particles

States of Matter

└─ Particles

The three states of matter

- **solid** 固体 – regular; vibrate in place; fixed shape and volume
- **liquid** 液体 – close; can slide; fixed volume, takes the container
- **gas** 气体 – far apart, fast; fills the container; easy to compress

Kinetic particle theory 粒子动理论: heating raises the particles' kinetic energy.

States of Matter

└─ Particles

Changes of state

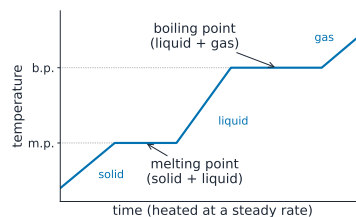
Melting and boiling take energy (to break attractions) at **constant** temperature. Freezing and condensing give that energy back.

Some solids **sublime** 升华 straight to gas (iodine, dry ice).

States of Matter

└─ Particles

Heating and cooling curves



Two **flat** parts on a heating curve:

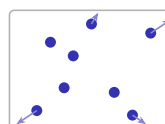
- at the **melting point** 熔点 (solid + liquid)
- at the **boiling point** 沸点 (liquid + gas)

The heat breaks **forces of attraction** 引力, so the temperature holds steady.

2 Gases

States of Matter
└ Gases

Gas pressure



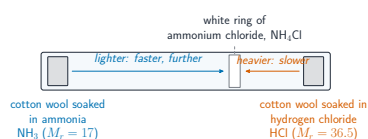
particles hitting the walls
cause the pressure

heat → faster, harder, more
often → more pressure

Squeeze a gas (smaller volume) and the particles hit the walls more often, so the **pressure** 压强 rises.

States of Matter
└ Gases

Diffusion



Diffusion 扩散: particles spread from high to low **concentration** 浓度.

A **lighter** gas diffuses faster. Light NH_3 ($M_r = 17$) beats heavy HCl ($M_r = 36.5$), so the white ring forms nearer the HCl end.

3 Recap

States of Matter
└ Recap

Worked example – comparing diffusion

Ammonia ($M_r = 17$) and **hydrogen chloride** ($M_r = 36.5$) diffuse from opposite ends of a tube. Where does the white ring form?

- Diffusion is the random movement of particles from high to low concentration.
- At the same temperature all gas particles have the same average **kinetic energy**.
- NH_3 is **lighter**, so it moves **faster** than HCl .
- It travels further before they meet ⇒ the ring forms **nearer the HCl end**.

Lighter particles diffuse faster **at the same temperature**. Say “lower M_r ⇒ faster” – do not just say “it is a gas”.

States of Matter
└ Recap

Topic 1 – key takeaways

1 States

solid packed, liquid close, gas far apart

2 Changes

melt, freeze, boil, condense, sublime

3 Curves

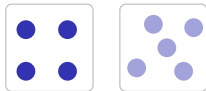
flat at the melting & boiling points

4 Diffusion

lighter particles diffuse faster

Check yourself

- 1 In which state do particles vibrate in fixed places?
- 2 What is the name for solid turning straight to gas?
- 3 Why is a heating curve flat at the melting point?
- 4 Which diffuses faster: a light or a heavy gas?



Answers 1. a solid 2. sublimation 3. heat breaks the forces, not raising the temperature 4. the lighter gas