

States of matter

IGCSE Chemistry 0620 · Topic 1 revision notes

Everything from the 2 lessons of this topic on a few pages: the key idea of each lesson, the diagram to remember, the points to learn and the traps examiners set. Read it, cover it, test yourself.

1. Solids, liquids and gases

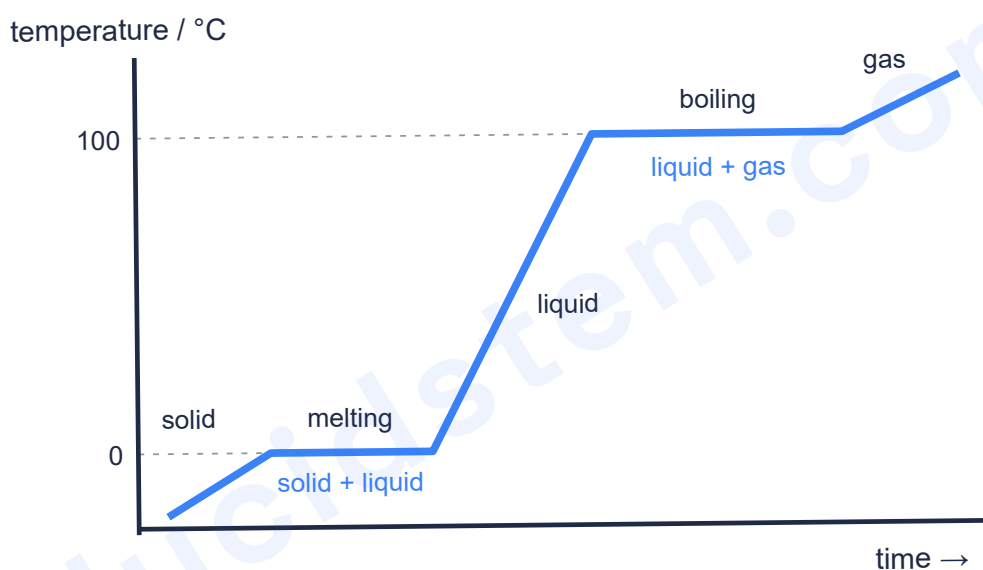
2. Diffusion

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1 Solids, liquids and gases

Syllabus 1.1

In a **solid** the particles are close together in a regular arrangement and vibrate about fixed positions, so a solid has a fixed shape and volume. In a **liquid** they are close together but irregular and move around each other, so a liquid has a fixed volume but takes the shape of its container. In a **gas** they are far apart, randomly arranged and move quickly in all directions, so a gas has no fixed shape or volume and is easily compressed. Heating gives particles more kinetic energy; changes of state happen when the forces between particles are overcome or formed.



flat sections: energy goes into overcoming the forces between particles

Fig. 1: heating curve for water, from ice to steam

Arrangement, motion, forces.

- ✓ **Solid:** close, regular, vibrate on the spot.
- ✓ **Liquid:** close, irregular, move around each other.
- ✓ **Gas:** far apart, random, fast in all directions.
- ✓ **Flat on a heating curve:** energy overcomes forces, temperature constant.

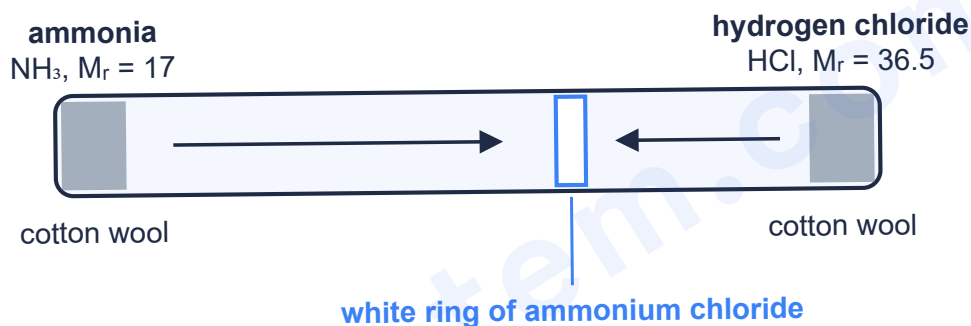
Watch out!

A flat section on a heating curve does **not** mean the heating has stopped. Energy is still going in, but it is being used to overcome the forces between particles, so the kinetic energy and the temperature stay the same until the change of state is complete.

2 Diffusion

Syllabus 1.2

Diffusion is the net movement of particles from a region of higher concentration to a region of lower concentration, caused by their random motion. No stirring is needed. Diffusion is fast in gases, much slower in liquids, and faster at higher temperatures because the particles move faster. **Extended:** at the same temperature, particles with a lower relative molecular mass move faster, so a gas with a lower M_r diffuses faster.



NH₃ travels further in the same time: lighter particles diffuse faster

Fig. 1: ammonia and hydrogen chloride diffusing towards each other

Random motion does the work.

- ✓ **Diffusion:** net movement from higher to lower concentration.
- ✓ **Gases** diffuse faster than liquids; solids hardly at all.
- ✓ **Hotter** means faster particles and faster diffusion.
- ✓ **Extended:** lower M_r means faster diffusion.

Watch out!

The white ring forms closer to the **hydrochloric acid** end, not in the middle and not near the ammonia. Explain it with relative molecular mass and speed of particles: saying the ammonia is "stronger" or "more concentrated" earns no marks.