5.2 Change of State

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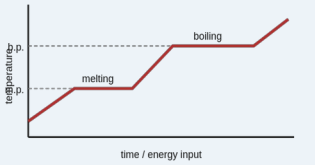
1. KEY VOCABULARY

TERM	MEANING
Specific heat capacity	Energy to raise 1 kg of a substance by 1 °C.
Specific latent heat	Energy to change the state of 1 kg, with no temperature change.
Internal energy	The total kinetic + potential energy of the particles.
Change of state	Melting, boiling, freezing or condensing.

2. THE HEATING CURVE

HEATING CURVE — energy in, temperature vs time



The flat parts: energy goes into breaking forces between particles, NOT into raising the temperature (latent heat).

KEY EQUATIONS

Specific heat capacity:
energy = mass × s.h.c. × change in temperature
— raises the TEMPERATURE of a material.

Specific latent heat:
energy = mass × specific latent heat
— changes the STATE (no temperature change).

Heating gives particles more kinetic energy, so they move faster (or break free) — the state can change.

solid → liquid → gas as energy is added.

3. THE KEY EQUATIONS

energy = mass × specific heat capacity × ΔT
— for changing the TEMPERATURE of a material.
energy = mass × specific latent heat
— for changing the STATE of a material.

4. PARTICLES & STATE CHANGES

Heating a substance gives its particles more kinetic energy, so they move (or vibrate) faster.
With enough energy, the forces holding the particles are overcome and the state changes: solid → liquid → gas.

5. WHY THE GRAPH IS FLAT DURING A CHANGE

During melting or boiling, the temperature stays constant even though energy is still being supplied.
That energy (the latent heat) is breaking the forces between particles — not raising the temperature.

6. THE WHY

Why temperature is constant during a change of state: the supplied energy goes into separating the particles, not into making them move faster — so the temperature does not rise.
Why water has a high specific heat capacity: it takes a lot of energy to warm — useful for cooling systems and central heating.

7. COMMON EXAM MISTAKES

✗ "Temperature rises steadily as you heat ice to steam."
✓ It is flat during melting and boiling (latent heat).
✗ Confusing specific heat capacity with specific latent heat.
✓ Heat capacity = temperature change; latent heat = state change.
✗ "Particles are destroyed when something melts."
✓ Particles stay — only the forces between them change.

8. SELF-CHECK · cover & quiz

Can you…

1. Define specific heat capacity and specific latent heat?
2. Write and use both energy equations?
3. Explain a heating curve in terms of particles?
4. Explain why the temperature is constant during melting?
5. Explain what happens to particles when a solid is heated?