

3.3 Solids, Liquids, and Gases

Name: _____ Class: _____ Date: _____ **Total: 10 marks****KEY WORDS** heating curve 加热曲线 • intermolecular forces 分子间作用力 • solution 溶液

Objective

Build the skills to answer exam questions on **solids, liquids, and gases** — the particle picture of the three states.

You must be able to:

- describe particle arrangement, motion, and spacing in each state
- explain state changes in terms of energy and IMFs
- read a **heating curve** 加热曲线

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

■ The three states

- **Solid** — particles packed close in a fixed arrangement, vibrating in place.
- **Liquid** — particles close but free to move past each other.
- **Gas** — particles far apart, moving fast and randomly, filling the container.

■ State changes and energy

Adding energy loosens the particles: solid → liquid (melting) → gas (boiling). Energy goes into **overcoming IMFs**, not raising temperature, during a change of state.

■ The heating curve

On a temperature-vs-time graph of steady heating, the **flat plateaus** are the melting and boiling points: temperature stays constant while the state changes (energy breaks IMFs). The sloped parts warm a single state.

■ Which state at a temperature

Compare the temperature to the melting and boiling points. Below the melting point → solid; between → liquid; above the boiling point → gas.

2 Practice

Now apply the methods above.

2.1 In which state are particles far apart and fast-moving? [1]

2.2 On a heating curve, what is happening during a flat plateau? [1]

2.3 A substance melts at 0°C and boils at 100°C. State its state at 50°C. [1]

3 Exam-style questions

3.1 During boiling, the energy added is used to [1]

A	B
C	D

A raise the temperature

B overcome intermolecular forces

C break covalent bonds

D create new atoms

3.2 A heating curve for a pure substance shows two flat plateaus.

(a) What do the two plateaus represent? [2]

(b) Why does the temperature stay constant during each? [2]

3.3 Explain, in terms of particle spacing and forces, why gases are much easier to compress than liquids. [2]