A-LEVEL CHEMISTRY • EXERCISE SHEET

3.3 Metallic bonding

Name: _____ Class: _____ Date: _____ **Total: 8 marks**

KEY WORDS delocalised electrons 离域电子 • metallic bonding 金属键 • electron 电子 • ion 离子 • electrostatic attraction 静电引力

Objective

Build the skills to answer exam questions on **metallic bonding** — defining it and using it to explain the properties of metals.

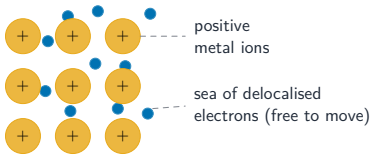
You must be able to:

- define metallic bonding as the attraction between positive metal ions and delocalised electrons
- use it to explain electrical conductivity and strength

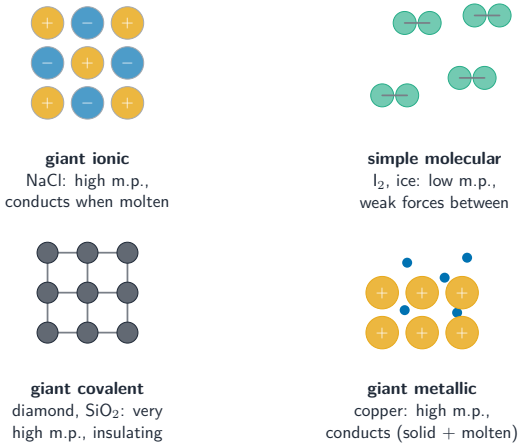
1 Worked examples

■ Metallic bonding

Metallic bonding 金属键 is the **electrostatic attraction** between positive metal ions and a "sea" of **delocalised electrons** 离域电子.



Positive metal ions sit in a sea of delocalised electrons that are free to move



The metallic lattice among the four structures

The free electrons explain why metals **conduct electricity** (the electrons move and carry charge) and are **strong** (the attraction acts throughout the lattice).

2 Practice

2.1 Define **metallic bonding**. [2]

2.2 Name the particles that carry charge when a metal conducts electricity. [1]

3 Exam-style questions

3.1 Metals conduct electricity because they contain: [1]

- **A** oppositely charged ions
- **B** delocalised electrons that are free to move
- **C** shared pairs of electrons
- **D** weak intermolecular forces

3.2 Explain, in terms of metallic bonding, why metals are good conductors of electricity. [2]

3.3 Magnesium has a higher melting point than sodium. Suggest why, in terms of metallic bonding. [2]

Solutions

2.1 the electrostatic attraction between positive metal ions and delocalised (sea of) electrons.

2.2 delocalised electrons.

3.1 B. Delocalised electrons are free to move and carry charge.

3.2 the delocalised electrons are free to move through the metal; they carry charge when a voltage is applied.

3.3 magnesium ions have a 2+ charge (vs 1+ for sodium) and contribute more delocalised electrons; the stronger attraction needs more energy to break, so a higher melting point.