IGCSE CHEMISTRY • EXERCISE SHEET

2.7 Metallic bonding

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

KEY WORDS delocalised electrons 离域电子 • malleability 展性 • metallic bonding 金属键 • ion 离子 • metal 金属

Objective

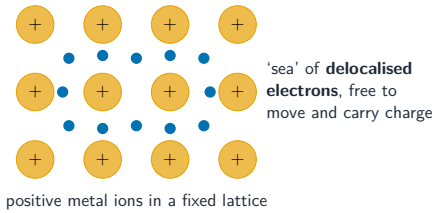
Build the skills to answer exam questions on **metallic bonding** 金属键 — the 'sea' of **delocalised electrons** 离域电子, and how it explains conductivity and **malleability** 展性.

You must be able to:

- describe metallic bonding (positive ions in a sea of delocalised electrons)
- explain why metals conduct electricity
- explain why metals are malleable and ductile

1 Worked examples

The metallic 'sea' of electrons



A metal is positive ions in a sea of delocalised electrons that are free to move

- **metallic bond:** electrostatic attraction between positive ions and the sea of electrons.
- **conducts:** the delocalised electrons are free to move and carry charge.
- **malleable/ductile:** layers of ions can slide without breaking the bond.

2 Practice

2.1 Define metallic bonding. [1]

2.2 State what carries the electric charge in a metal. [1]

3 Exam-style questions

3.1 A metal can be hammered into a sheet because: [1]

- **A** the bonds are weak
- **B** layers of ions can slide over each other
- **C** it contains molecules
- **D** the electrons are fixed

3.2 A piece of copper conducts electricity and can be drawn into a wire.

(a) Explain why copper conducts electricity. [2]

(b) Explain why copper is ductile (can be pulled into a wire). [2]

3.3 State why metals generally have high melting points. [2]

Solutions

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

2.2 the delocalised (free) electrons.

3.1 B. Layers of positive ions can slide over each other.

3.2 (a) it has delocalised electrons that are free to move; they carry charge through the metal.
(b) the layers of positive ions can slide over each other without breaking the metallic bonding, so the metal changes shape instead of breaking.

3.3 there is strong electrostatic attraction between the positive ions and the delocalised electrons; a lot of energy is needed to overcome it.