

## 2.7 Metallic bonding

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

**Total: 9 marks**

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

### Objective

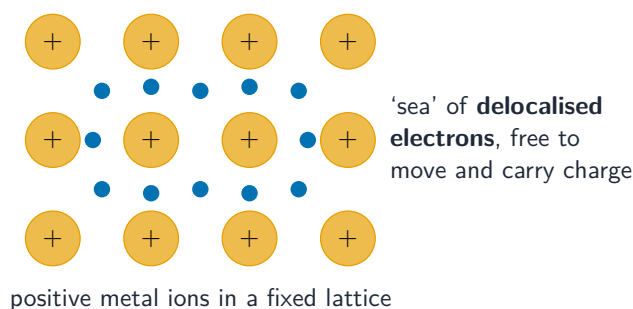
Build the skills to answer exam questions on **metallic bonding** 金属键 — the 'sea' of **delocalised electrons** 离域电子, and how it explains conductivity and **malleability** 展性.

**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

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**2.1** Define metallic bonding. [1]

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

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## 3 Exam-style questions

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**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

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

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

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

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

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## Solutions

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**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.