# Exercise walk-through

## Metallic bonding ▪ 2.7

eXercise

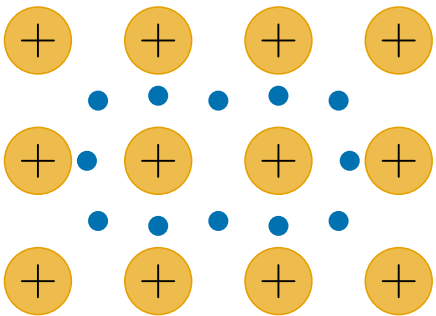
# You must be able to

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

# Method — The metallic ‘sea’ of electrons

- **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.

# Method — The metallic ‘sea’ of electrons



‘sea’ of **delocalised electrons**, free to move and carry charge

positive metal ions in a fixed lattice

*A lattice of positive metal ions with free electrons between them*

## Practice 2.1 ▪ 1 mark

Define metallic bonding.

# Solution 2.1

Method: The metallic ‘sea’ of electrons

**Worked steps**

the electrostatic attraction between positive metal ions and a sea of delocalised electrons B1.

## Practice 2.2 ▪ 1 mark

State what carries the electric charge in a metal.

# Solution 2.2

Method: The metallic ‘sea’ of electrons

**Worked steps**

the delocalised (free) electrons B1.

## Exam-style 3.1 ▪ 1 mark

A metal can be hammered into a sheet because:

**A** the bonds are weak

**B** layers of ions can slide over each other

**C** it contains molecules

**D** the electrons are fixed

# Solution 3.1

**A** the bonds are weak

**B** layers of ions can slide over each other ✓

**C** it contains molecules

**D** the electrons are fixed

**Worked steps**

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

## Exam-style 3.2 ▪ 2 marks

A piece of copper conducts electricity and can be drawn into a wire.
(a) Explain why copper conducts electricity.
(b) Explain why copper is ductile (can be pulled into a wire).

# Solution 3.2

Method: The metallic ‘sea’ of electrons

**Worked steps**

(a) it has delocalised electrons that are free to move **M1**; they carry charge through the metal **A1**.
(b) the layers of positive ions can slide over each other **M1** without breaking the metallic bonding, so the metal changes shape instead of breaking **A1**.

## Exam-style 3.3 ▪ 2 marks

State why metals generally have high melting points.

# Solution 3.3

**Worked steps**

there is strong electrostatic attraction between the positive ions and the delocalised electrons (M1); a lot of energy is needed to overcome it (A1).