Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

- **electrostatic attraction**
- between **oppositely charged ions**

2.2

- calcium chloride: $1 \times (2+)$ balances $2 \times (1-)$: $\mathbf{CaCl_2}$
- aluminium oxide: $2 \times (3+) = 6+$ balances $3 \times (2-) = 6-$: $\mathbf{Al_2O_3}$

2.3

- the atom **loses one electron** (its outer electron)
- Na^+: $2, 8$

3.1

B

- a positive ion has **lost** electrons, so its protons outnumber its electrons

3.2

B

- the ions can move only when molten or dissolved; in the solid they are fixed

3.3

(a)

- **two** K^+ ions, each with its outer electron gone (drawn as an empty shell, or the full shell of 8 beneath)
- S^{2-} with 8 outer electrons: 6 of its own and 2 from potassium shown differently
- charges + on each potassium and 2− on sulfur, each ion in brackets

(b)

- each potassium atom loses only **one** electron, but a sulfur atom needs **two** to fill its outer shell
- so $2 \times (1+)$ balances $1 \times (2-)$ and the compound is neutral

3.4

(a)

- magnesium **loses two** electrons and oxygen **gains two** electrons (transfer from Mg to O)
- $\mathbf{Mg^{2+}}$
- $\mathbf{O^{2-}}$

(b)

- a **giant lattice** of ions in a regular arrangement
- positive and negative ions alternate, held by strong electrostatic attraction

(c)

- the ions have **larger charges** (2+ and 2− against 1+ and 1−)
- so the electrostatic attraction is **stronger** and more energy is needed to overcome it

(d)

- molten: the **ions can move** and carry charge
- solid: the ions are held in **fixed positions**