

How ions bond: transfer and lattices

Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Test answers (mark scheme)

Each model answer is followed by the marking points. Accept any correct equivalent wording, and award marks for correct charges even when the formula is written without subscripts.

Level: Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** HS-PS1-3, GCSE C2

Question 1 Magnesium oxide (3 marks)

- (a) Each magnesium atom transfers its two outer electrons to an oxygen atom.
- (b) Magnesium ion $2+$ and oxide ion $2-$.
- (c) **MgO**

Marking: 1 mark each.

Question 2 Crystal diagram (3 marks)

- (a) Each row repeats one X with two Y, so the ratio is **1 : 2**.
- (b) **XY_2**
- (c) Two Y^- ions give $2-$ in total, so X must be **$2+$** .

Marking: 1 mark each.

Question 3 Conduction (3 marks)

Sodium chloride contains ions. In the solid the ions are held in fixed positions in the lattice, so they cannot move. When molten the ions are free to move and carry charge.

Marking: 1 mark contains ions; 1 mark fixed in solid; 1 mark free to move when molten.

Question 4 Aluminium oxide (2 marks)

Lowest common multiple of 3 and 2 is 6. Two Al^{3+} give $+6$ and three O^{2-} give -6 .

Al_2O_3

Marking: 1 mark for balancing charge; 1 mark for the formula.

Question 5 Melting points compared (3 marks)

Both have giant ionic lattices with strong attractions between ions. The ions in magnesium

oxide have charges of 2+ and 2– but those in sodium chloride have 1+ and 1–. The attraction is stronger in magnesium oxide, so more energy is needed to separate the ions.

Marking: 1 mark giant lattice; 1 mark larger charges; 1 mark stronger attraction needs more energy.

Question 6 Counting ions (2 marks)

The ratio is 2 Na⁺ : 1 O^{2–}. Oxide ions = $6.0 \times 10^{20} \div 2 = 3.0 \times 10^{20}$.

3.0 × 10²⁰ oxide ions

Marking: 1 mark for the ratio; 1 mark for the answer.

Question 7 Brittle crystal (2 marks)

A force moves a layer of ions along by one position, so ions with the same charge are next to each other. They repel, and the crystal splits.

Marking: 1 mark for like charges meeting; 1 mark for repulsion splits the crystal.

Question 8 Ion arrangements (2 marks)

Ca²⁺ has 18 electrons: **2,8,8**. Br[–] has 35 + 1 = **36 electrons**.

Marking: 1 mark each.