Solutions

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

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

2.1

- $MgCl_2$
- CaO

2.2

- methane: 4
- oxygen: 2 (a double bond)

2.3

- in the solid the ions are fixed in place
- when molten the ions are free to move and carry charge

2.4

- cathode: lead
- anode: bromine

2.5

- each carbon atom forms only three bonds, so one electron per atom is delocalised
- these electrons move along the layers and carry charge

3.1

- diamond is a giant covalent structure
- each carbon atom is joined to four others by strong covalent bonds
- a lot of energy is needed to break these many strong bonds

3.2

- $2Br^- \rightarrow Br_2 + 2e^-$
- oxidation, because the bromide ions lose electrons

3.3

(a) cathode: hydrogen; anode: chlorine; solution: sodium hydroxide

(b) the solution contains Na^+ ions and H^+ ions from water; hydrogen is less reactive than sodium, so H^+ ions gain electrons more easily; $2H^+ + 2e^- \rightarrow H_2$

(c) hydrogen: a lit splint gives a squeaky pop; chlorine: damp blue litmus paper turns red and then white (bleached)

(d) points to include:

- sodium chloride is a giant ionic lattice with strong attraction between oppositely charged ions in all directions (K)
- a lot of energy is needed to overcome these, so its melting point is high (An)
- chlorine is a simple molecular substance: strong covalent bonds inside each molecule, but weak forces between molecules (K)
- little energy is needed to separate the molecules, so its boiling point is low (An)
- solid sodium chloride does not conduct, because its ions cannot move (An)
- liquid chlorine does not conduct, because it has no ions and no free electrons (An)

Levels: **5–6** a full, logical answer with correct chemistry and correct terms; **3–4** several correct points, partly linked; **1–2** one or two relevant points.

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