

# Splitting compounds with electricity

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

Use the marking notes to award marks. Method marks are given for correct ratios and electron balance even when a final number is wrong, and equations must be balanced for charge as well as atoms. Add the marks to a total out of 20.

**Level:** Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** GCSE C4

## Question 1 Reading the cell (2 marks)

- a. Q is the cathode because it is joined to the short plate, the negative terminal. (1 mark)
- b. The positive copper ions move to Q and gain electrons to form copper metal. (1 mark)

Marking: 1 mark each; accept 'negative electrode' for the reason in (a).

## Question 2 Molten lithium chloride (3 marks)

- a. Cathode: lithium; anode: chlorine. (1 mark)
- b.  $\text{Li}^+ + \text{e}^- \rightarrow \text{Li}$  (1 mark)
- c.  $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$  (1 mark)

Marking: balanced equations needed; allow ecf from (a).

## Question 3 Copper(II) nitrate solution (3 marks)

- a. Copper forms; copper is less reactive than hydrogen, so  $\text{Cu}^{2+}$  ions are discharged more easily than  $\text{H}^+$ . (2 marks)
- b. Oxygen, from hydroxide ions, because no halide ion is present. (1 mark)

Marking: 1 mark for product, 1 for reactivity reason; 1 for oxygen.

## Question 4 Splitting acidified water (3 marks)

- a. Volume of  $\text{O}_2 = 20 \text{ cm}^3$ . (1 mark)
- b. Two electrons are needed for each  $\text{H}_2$  but four for each  $\text{O}_2$ , so the same flow of electrons makes twice as many moles of  $\text{H}_2$  as  $\text{O}_2$ . Gas volumes follow mole ratios, so oxygen is  $40 \div 2 = 20 \text{ cm}^3$ . (2 marks)

Marking: 1 mark for electron balance, 1 for the 2 : 1 ratio.

**Question 5 Making aluminium** (3 marks)

- a. It lowers the melting point of the mixture, saving energy. (1 mark)
- b.  $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$  (1 mark)
- c. Oxygen reacts with the hot carbon to make carbon dioxide, so the anodes burn away. (1 mark)

Marking: allow 'dissolves the oxide' in (a) with the energy idea.

**Question 6 Uses of brine products** (2 marks)

Any two: chlorine for disinfecting water or making PVC; hydrogen as a fuel; sodium hydroxide for soap or paper. **Two product-use pairs.**

Marking: 1 mark per correct product with use.

**Question 7 Sodium hydroxide mass** (2 marks)

$n(\text{NaOH}) = 2 \times 0.10 = 0.20 \text{ mol}$ ;  $M = 40 \text{ g/mol}$ ;  $m = 0.20 \times 40 = \mathbf{8.0 \text{ g}}$ .

Marking: 1 mark for the 2 : 1 ratio, 1 for the mass.

**Question 8 Electroplating** (2 marks)

The key is the cathode because positive nickel ions,  $\text{Ni}^{2+}$ , are attracted to the negative electrode and gain electrons to form a nickel coating. The nickel anode dissolves and replaces the ions used, keeping the solution unchanged. **Key = cathode; nickel anode replenishes ions.**

Marking: 1 mark for cathode reasoning, 1 for the anode replacing ions.