

Splitting compounds with electricity

Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Lab answers

The model answers below use the sample table. Your own numbers will differ a little, but the straight line through the origin, the gradient near 0.6 g/A and the value close to 10^5 C per mole of electrons should appear in any careful set of results.

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Question 1 Plot the graph

1. The points lie on a straight line through the origin. 2. The mass of copper deposited is directly proportional to the current. **Mass $\propto$ current for a fixed time.**

Question 2 Find the gradient

Gradient = $0.57 \text{ g} \div 1.00 \text{ A} = 0.57 \text{ g/A}$. It is the mass of copper deposited per ampere in 30 minutes. **0.57 g/A.**

Question 3 Moles of electrons

1. $n(\text{Cu}) = 0.57 \div 64 = 0.0089 \text{ mol}$. 2. $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$. 3. $n(\text{e}^-) = 2 \times 0.0089 = 0.0178 \text{ mol}$. **0.018 mol of electrons.**

Question 4 Charge per mole of electrons

1. $Q = 1.00 \times 1800 = 1800 \text{ C}$. 2. $1800 \div 0.0178 = 1.01 \times 10^5 \text{ C/mol}$. 3. $(101\,000 - 96\,500) \div 96\,500 \times 100 = 4.7\%$. **About $1.0 \times 10^5 \text{ C/mol}$, within 5% of the accepted value.**

Question 5 Anode and cathode

1. $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$. 2. Some copper falls off the anode as small particles without dissolving, and some of the deposit on the cathode may flake off or be lost when rinsing. **Anode: $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$.**

Question 6 Uncertainty

1. $0.01 \div 0.11 \times 100 = 9.1\%$. 2. $0.01 \div 0.57 \times 100 = 1.8\%$. 3. The 0.57 g result is more reliable because the same absolute uncertainty is a smaller fraction of a bigger mass. **9.1% and 1.8%.**

Question 7 Conclusion and improvements

The mass of copper deposited is proportional to the current, and about two electrons are needed per copper atom. Improvements: run for longer so the masses are larger, and dry the plates in exactly the same way each time before weighing; also repeat each current and take a mean. **Mass is proportional to current.**