

Using equations to find masses and yields

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

The answers use the sample data. Your own values will differ a little, but the shape of the graph and the method for finding the concentration of the acid from the plateau must match.

Level: Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** HS-PS1-7, GCSE C3

Question 1 Plot the graph

The graph is a **straight line through the origin up to about 1.7 g, then a horizontal line** at about 0.87 g. Mass lost is proportional to baking soda while the acid is in excess; after that, the acid is limiting.

Question 2 Find the turning point

Extend both lines until they cross. The sloping line through trials 1–4 and the plateau meet at about **1.7 g** of NaHCO_3 .

Question 3 Explain the plateau

In trials 5 and 6 all the acid has reacted. Extra NaHCO_3 is in excess and cannot release more CO_2 , so the **mass lost stays at 0.87 g**.

Question 4 Moles of carbon dioxide

$n = 0.87 \div 44 = \mathbf{0.0198 \text{ mol}}$ (about 0.020 mol).

Question 5 Concentration of the vinegar

$n(\text{acid}) = 0.0198 \text{ mol}$; $V = 0.0250 \text{ dm}^3$; $c = 0.0198 \div 0.0250 = \mathbf{0.79 \text{ mol/dm}^3}$.

Question 6 Percentage yield of CO_2

$0.87 \div 0.88 \times 100 = \mathbf{98.9\%}$.

Question 7 Sources of error

Too small: some CO_2 dissolves in the liquid and stays in the flask. Too large: water vapour leaves with the gas and adds to the apparent mass lost. **Dissolved CO_2 and escaping vapour** are the two main errors.

Question 8 Improve the lab

Take more trials between 1.4 g and 2.0 g, and repeat each trial to find a mean. **More points near the turning point** and repeats improve the estimate.