

Using equations to find masses and yields

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

Model answers and mark schemes for the test. Award marks for correct method even when the final value is wrong, and apply error carried forward where the question allows.

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

Question 1 Balance and ratio (2 marks)

- a. $2\text{Fe} + 3\text{Cl}_2 \rightarrow 2\text{FeCl}_3$.
b. $n(\text{Cl}_2) = 0.40 \times 3/2 = \mathbf{0.60 \text{ mol}}$.

Marking: 1 mark for balanced equation; 1 mark for the 3 : 2 ratio used correctly.

Question 2 Salt from sodium carbonate (3 marks)

- a. $M = 106$; $n = 5.30 \div 106 = \mathbf{0.0500 \text{ mol}}$.
b. Ratio 1 : 2, so $n(\text{NaCl}) = \mathbf{0.100 \text{ mol}}$.
c. $m = 0.100 \times 58.5 = \mathbf{5.85 \text{ g}}$.

Marking: 1 mark each; allow error carried forward.

Question 3 Phosphorus and oxygen (3 marks)

- a. 0.20 mol of P needs $0.20 \times 5/4 = 0.25$ mol of O_2 . There is 0.30 mol of O_2 , which is more than 0.25 mol, so oxygen is in excess and **phosphorus is limiting**.
b. $n(\text{P}_2\text{O}_5) = 0.20 \times 2/4 = 0.10$ mol; $M = 142$; $m = \mathbf{14.2 \text{ g}}$.

Marking: 1 mark for moles of oxygen needed; 1 mark for conclusion; 1 mark for mass.

Question 4 Yield and losses (2 marks)

- a. $5.6 \div 8.0 \times 100 = \mathbf{70\%}$.
b. Some product is lost when it is transferred or filtered, or some reactant forms by-products.

Marking: 1 mark for the percentage; 1 mark for any valid reason.

Question 5 Concentration of a solution (2 marks)

- a. $n = 2.00 \div 40 = 0.0500 \text{ mol}$; $c = 0.0500 \div 0.500 = \mathbf{0.100 \text{ mol/dm}^3}$.
b. $n = 0.100 \times 0.0250 = \mathbf{0.00250 \text{ mol}}$.

Marking: 1 mark for each correct value, with the volume converted to dm^3 .

Question 6 Mass concentration (2 marks)

- a. $2.00 \div 0.500 = \mathbf{4.00 \text{ g/dm}^3}$.
b. Each dm^3 holds twice as many moles, so there are **twice as many solute particles** in the same volume.

Marking: 1 mark each.

Question 7 Reading a graph (2 marks)

- a. The line levels off at **0.6 g**.
b. All the acid has reacted, so the extra magnesium is in excess and **no more product can form**.

Marking: 1 mark each.

Question 8 Explain the limiting reactant (2 marks)

- a. The **fuel** is limiting.
b. The fuel has all been used up, while the oxygen in the air is in excess, so burning cannot continue.

Marking: 1 mark each.

Question 9 Silver nitrate solution (2 marks)

- a. $n = 0.050 \times 0.100 = \mathbf{0.0050 \text{ mol}}$.
b. $M = 170$; $m = 0.0050 \times 170 = \mathbf{0.85 \text{ g}}$.

Marking: 1 mark each; allow error carried forward.