

Using equations to find masses and yields

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

Name: _____ Date: _____ Class: _____ Mark: ____ / 20

This test has eight questions worth 20 marks in total. Show all working, give units, and use the relative atomic masses stated in each question. You may use a calculator.

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

Time: 45 minutes · 9 questions · Total: 20 marks · Calculator allowed

Question 1 Balance and ratio (2 marks)

Iron burns in chlorine: $\text{Fe} + \text{Cl}_2 \rightarrow \text{FeCl}_3$.

- Balance the equation. (1 mark)
- Calculate the moles of chlorine needed for 0.40 mol of iron. (1 mark)

Question 2 Salt from sodium carbonate (3 marks)

$\text{Na}_2\text{CO}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$. A technician uses 5.30 g of sodium carbonate and excess acid (Ar: Na = 23, C = 12, O = 16, Cl = 35.5).

- Calculate the moles of Na_2CO_3 . (1 mark)
- State the moles of NaCl formed. (1 mark)
- Calculate the mass of NaCl. (1 mark)

Question 3 Phosphorus and oxygen (3 marks)

$4\text{P} + 5\text{O}_2 \rightarrow 2\text{P}_2\text{O}_5$. A student burns 0.20 mol of phosphorus in 0.30 mol of oxygen (Ar: P = 31, O = 16).

- Identify the limiting reactant, showing your working. (2 marks)
- Calculate the mass of P_2O_5 formed. (1 mark)

Question 4 Yield and losses (2 marks)

A theoretical yield of 8.0 g gives 5.6 g of product.

- Calculate the percentage yield. (1 mark)
- Explain one reason why the actual yield is lower than the theoretical yield. (1 mark)

Question 5 Concentration of a solution (2 marks)

Sodium hydroxide, 2.00 g, is dissolved and made up to 500 cm³ (Ar: Na = 23, O = 16, H = 1).

- Calculate the concentration in mol/dm³. (1 mark)
- Calculate the moles of NaOH in a 25.0 cm³ sample. (1 mark)

Question 6 Mass concentration (2 marks)

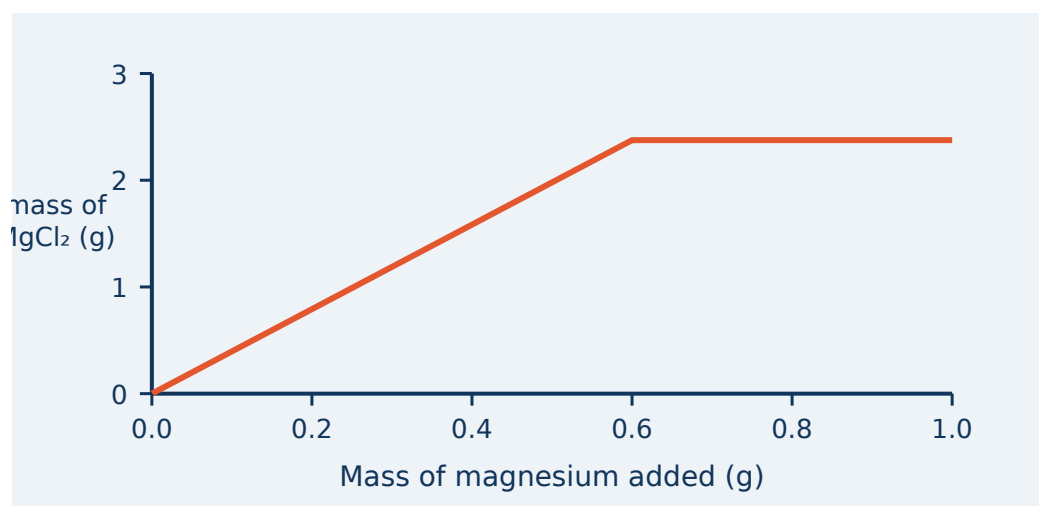
Using the solution in the previous question:

- Calculate its concentration in g/dm³. (1 mark)
- Explain why a 0.20 mol/dm³ solution is twice as concentrated as a 0.10 mol/dm³ solution. (1 mark)

Question 7 Reading a graph (2 marks)

Chidi adds magnesium to 50.0 cm³ of hydrochloric acid. The graph shows the mass of magnesium chloride formed.

- State the mass of magnesium at which the acid runs out. (1 mark)
- Explain why the line is horizontal after this point. (1 mark)



50.0 cm³ of acid with increasing masses of magnesium.

Question 8 Explain the limiting reactant (2 marks)

A camping stove stops burning although there is still plenty of air.

- State which reactant is limiting. (1 mark)
- Explain your answer. (1 mark)

Question 9 Silver nitrate solution (2 marks)

Chiamaka prepares 100 cm³ of 0.050 mol/dm³ silver nitrate (Ar: Ag = 108, N = 14, O = 16).

- a. Calculate the moles of AgNO₃ needed. (1 mark)
- b. Calculate the mass of AgNO₃ to weigh out. (1 mark)