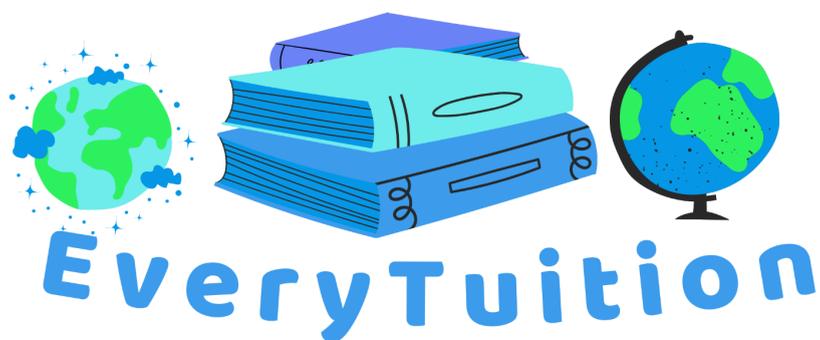


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GCSE AQA Chemistry: Topic 3

AQA Chemistry Topic 3: Quantitative Chemistry

Exam Questions/Mock Exam Questions



Questions For Foundation, Higher, and Triple Science [\(scroll down for questions for higher and triple science only\)](#):

(It would still be recommended to answer the foundation tier questions for triple science and higher tier to ensure you have good understanding).

Q1.

Jack is learning about atoms and masses.

(a) Define the term relative atomic mass (A_r).

[2]

(b) What is the relative atomic mass of oxygen (O)?

[1]

[Total: 3 marks]

Q2.

Tom weighs some sodium.

(a) The relative atomic mass of sodium is 23. What does this number represent?

[2]

(b) How many protons are in a sodium atom?

[1]

[Total: 3 marks]

Q3.

Harry looks at the periodic table.

(a) What is the formula of carbon dioxide?

[1]

(b) Calculate the relative formula mass (Mr) of carbon dioxide (CO₂).

(Relative atomic masses: C = 12, O = 16)

[2]

[Total: 3 marks]

Q4.

Ben is calculating masses.

(a) What is the Mr of water (H₂O)? (H = 1, O = 16)

[1]

(b) What is the Mr of sodium hydroxide (NaOH)? (Na = 23, O = 16, H = 1)

[1]

[Total: 2 marks]

Q5.

Daniel is learning about conservation of mass.

(a) State the law of conservation of mass.

[2]

(b) In a reaction, 12 g of carbon reacts with 32 g of oxygen to form carbon dioxide.
What is the mass of carbon dioxide formed?

[1]

[Total: 3 marks]

Q6.

George notices that sometimes mass seems to change during a reaction.

(a) Explain why the mass appears to increase when magnesium burns in air.

[2]

(b) Explain why the mass appears to decrease when a metal carbonate is heated.

[2]

[Total: 4 marks]

Q7.

Oliver is calculating moles.

(a) State the equation linking number of moles, mass, and Mr.

[1]

(b) Calculate the number of moles in 20 g of sodium hydroxide (NaOH). (Mr = 40)

[2]

[Total: 3 marks]

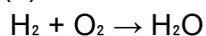
Q8.

Ethan looks at balanced equations.

(a) What does a big number in front of a chemical formula mean in an equation?

[1]

(b) Write the balanced symbol equation for:



[1]

[Total: 2 marks]

Q9.

Sam is comparing atoms and moles.

(a) What does one mole of any substance contain?

[1]

(b) How many atoms are in one mole of carbon atoms?

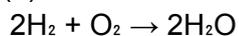
[1]

[Total: 2 marks]

Q10.

Charlie is working out reacting masses.

(a) Write the balanced equation for:



[1]

(b) Use the equation to calculate the mass of water made from 4 g of hydrogen.
(Relative atomic masses: H = 1, O = 16)

[2]

[Total: 3 marks]

Q11.

Noah is thinking about limiting reactants.

(a) What is meant by the limiting reactant?

[2]

(b) Why is the limiting reactant important in a reaction?

[2]

[Total: 4 marks]

Q12.

William is looking at concentration.

(a) State the equation linking concentration, mass of solute, and volume.

[1]

(b) Calculate the concentration of a solution containing 10 g of sodium chloride in 200 cm³ of solution.

[2]

[Total: 3 marks]

Q13.

Alex is studying yields.

(a) Define percentage yield.

[2]

(b) A reaction is expected to produce 20 g of product but only 15 g is made.
Calculate the percentage yield.

[2]

[Total: 4 marks]

Q14.

Jacob is asked about atom economy.

(a) State the equation for atom economy.

[1]

(b) Why is a high atom economy important in industry?

[2]

[Total: 3 marks]

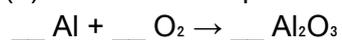
Q15.

James is revising for his test.

(a) Why is it important for chemical equations to be balanced?

[2]

(b) Balance this equation:



[1]

[Total: 3 marks]

Higher Tier**Q17.**

Jack is calculating relative formula masses.

(a) Calculate the Mr of calcium hydroxide, $\text{Ca}(\text{OH})_2$.

(Relative atomic masses: Ca = 40, O = 16, H = 1)

[2]

(b) Calculate the Mr of aluminium oxide, Al_2O_3 .

(Relative atomic masses: Al = 27, O = 16)

[2]

[Total: 4 marks]

Q18.

Tom is working out the number of moles.

(a) State the equation linking moles, mass, and Mr.

[1]

(b) Calculate the number of moles in 11 g of carbon dioxide (CO₂). (Mr = 44)

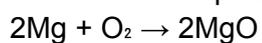
[2]

[Total: 3 marks]

Q19.

Harry burns magnesium in oxygen.

The balanced equation is:



(a) Calculate the mass of MgO produced when 12 g of Mg reacts with excess oxygen.
(Relative atomic masses: Mg = 24, O = 16)

[3]

(b) Explain why the mass of the product is greater than the mass of magnesium.

[2]

[Total: 5 marks]

Q20.

Ben investigates conservation of mass.

(a) Explain why mass appears to decrease when calcium carbonate is heated.



[2]

(b) Calculate the mass of CaO produced if 50 g of CaCO₃ is decomposed.

(Relative formula masses: CaCO₃ = 100, CaO = 56)

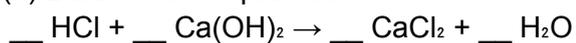
[3]

[Total: 5 marks]

Q21.

Daniel is asked about balanced equations.

(a) Balance this equation:



[1]

(b) Why must equations be balanced?

[2]

[Total: 3 marks]

Q22.

George is learning about limiting reactants.

(a) Define the term limiting reactant.

[2]

(b) Why is it important to know the limiting reactant in a chemical reaction?

[2]

[Total: 4 marks]

Q23.

Oliver carries out a titration experiment using hydrochloric acid and sodium hydroxide.

(a) Write the balanced symbol equation for the reaction.

[2]

(b) State one piece of apparatus used to measure the acid accurately.

[1]

[Total: 3 marks]

Q24.

Ethan is calculating concentration.

(a) Write the equation linking concentration, moles, and volume.

[1]

(b) Calculate the concentration of a solution containing 0.5 mol of NaCl in 250 cm³ of solution.

[2]

[Total: 3 marks]

Q25.

Sam prepares a solution of potassium hydroxide.

(a) He dissolves 28 g of KOH (Mr = 56) in water to make 500 cm³ of solution. Calculate the concentration in mol/dm³.

[3]

(b) Suggest one safety precaution Sam should take when handling potassium hydroxide.

[1]

[Total: 4 marks]

Q26.

Charlie calculates the yield of a reaction.

(a) Define percentage yield.

[2]

(b) A reaction was expected to produce 60 g of product but only 48 g was made.
Calculate the percentage yield.

[2]

[Total: 4 marks]

Q27.

Noah is studying atom economy.

(a) State the equation for atom economy.

[1]

(b) A reaction produces two products:

Mr of desired product = 40

Mr of all products = 100

Calculate the atom economy.

[2]

(c) Explain why a high atom economy is good for industry.

[2]

[Total: 5 marks]

Q28.

William is asked about concentration calculations.

(a) 25 cm³ of hydrochloric acid of concentration 2.0 mol/dm³ is neutralised by sodium hydroxide.

Calculate the number of moles of HCl in 25 cm³.

[2]

(b) Convert 25 cm³ to dm³ in your working.

[1]

[Total: 3 marks]

Q29.

Alex carries out a titration using sodium hydroxide and sulfuric acid.

(a) Write the balanced symbol equation for this reaction.

[2]

(b) Explain why an indicator is used in this titration.

[2]

[Total: 4 marks]

Q30.

Jacob is calculating gas volumes.

(a) State the volume of one mole of gas at room temperature and pressure.

[1]

(b) Calculate the volume of 0.25 mol of oxygen gas at room temperature and pressure.

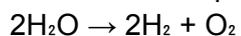
[2]

[Total: 3 marks]

Q31.

James is studying electrolysis of water.

The balanced equation is:



(a) Calculate the volume of oxygen gas formed when 120 cm³ of hydrogen gas is produced, at room temperature and pressure.

[3]

(b) Explain your answer.

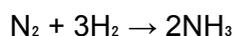
[2]

[Total: 5 marks]

Q32.

Luke is working on molar ratios.

Ammonia is made by the Haber process:



(a) How many moles of ammonia are produced from 1 mole of nitrogen?

[1]

(b) Calculate the mass of ammonia produced from 28 g of nitrogen.

(Relative atomic masses: N = 14, H = 1)

[3]

[Total: 4 marks]

Q33.

Sam looks at solutions.

(a) Calculate the number of moles in 500 cm³ of sodium hydroxide solution of concentration 0.2 mol/dm³.

[3]

(b) Convert 500 cm³ to dm³ in your calculation.

[1]

[Total: 4 marks]

Q34.

Ethan studies reactions with poor yields.

(a) Give two reasons why the yield of a reaction may be less than expected.

[2]

(b) Explain why improving yield is important in industry.

[2]

[Total: 4 marks]

Q35.

Daniel looks at industrial processes.

(a) Explain why both percentage yield and atom economy are important when choosing a process.

[4]

(b) Suggest one reason why a process with lower atom economy may still be used.

[2]

[Total: 6 marks]

Q36.

George investigates a chemical process that produces hydrogen gas.

Plan an experiment to measure the volume of gas produced in a reaction between magnesium and hydrochloric acid.

In your answer, include:

- the apparatus you would use
- how you would carry out the experiment
- the measurements you would take

[6]

[Total: 6 marks]

Triple Science Tier

Q36.

James is investigating the reaction between magnesium and hydrochloric acid.

(a) Explain why magnesium reacts with hydrochloric acid to produce hydrogen gas.

[3]

(b) Calculate the mass of magnesium needed to produce 1.12 L of hydrogen gas at room temperature and pressure.

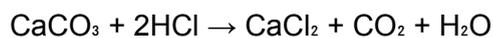
(Relative atomic mass: Mg = 24, 1 mol of gas = 24 L)

[3]

[Total: 6 marks]

Q37.

Tom is studying the reaction of calcium carbonate with hydrochloric acid.



(a) Calculate the mass of calcium carbonate needed to produce 11.2 g of CO₂.

(Relative formula masses: CaCO₃ = 100, CO₂ = 44)

[3]

(b) Explain why the mass of gas produced can be measured using a gas syringe.

[2]

[Total: 5 marks]

Q38.

Harry investigates solutions of sodium hydroxide.

(a) Write the equation linking number of moles, mass, and relative formula mass.

[1]

(b) Calculate the number of moles in 80 g of NaOH.

(Relative formula mass: NaOH = 40)

[2]

(c) Suggest one safety precaution Harry should take when handling NaOH.

[1]

[Total: 4 marks]

Q39.

Ben is learning about concentration.

(a) Calculate the concentration in mol/dm³ of a solution containing 0.5 mol of NaCl in 250 cm³ of solution.

[3]

(b) Convert 250 cm³ into dm³ in your working.

[1]

[Total: 4 marks]

Q40.

Daniel is investigating gas volumes.

(a) 0.2 mol of hydrogen gas is produced. Calculate the volume at room temperature and pressure.

(1 mol of gas = 24 L)

[2]

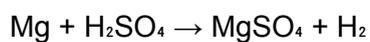
(b) Explain why gas volumes are measured using a gas syringe.

[2]

[Total: 4 marks]

Q41.

Oliver investigates a reaction where magnesium reacts with sulfuric acid.



(a) Calculate the mass of magnesium sulfate produced when 24 g of magnesium reacts completely.

(Relative atomic masses: Mg = 24, S = 32, O = 16)

[3]

(b) Explain why hydrogen is produced during this reaction.

[2]

[Total: 5 marks]

Q42.

Ethan is studying the yield of a reaction.

(a) Define percentage yield.

[2]

(b) A reaction is expected to produce 50 g of product but only 40 g is obtained.
Calculate the percentage yield.

[2]

(c) Suggest one reason why the percentage yield is less than 100%.

[2]

[Total: 6 marks]

Q43.

Charlie investigates atom economy.

(a) Define atom economy.

[2]

(b) A reaction produces 40 g of desired product and 100 g of total products.
Calculate the atom economy.

[2]

(c) Explain why a high atom economy is important in industry.

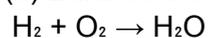
[2]

[Total: 6 marks]

Q44.

Noah is comparing the number of moles of hydrogen and oxygen in water.

(a) Balance the chemical equation:



[1]

(b) Calculate the number of moles of water formed from 2 moles of hydrogen gas.

[2]

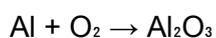
(c) Explain why the ratio of hydrogen to oxygen in water is always 2:1.

[2]

[Total: 5 marks]

Q45.

William is calculating reacting masses.



(a) Calculate the mass of Al_2O_3 formed when 54 g of aluminium reacts completely.
(Relative atomic masses: Al = 27, O = 16)

[3]

(b) Explain why it is important to balance this equation.

[2]

[Total: 5 marks]

Q46.

Alex is preparing a solution for a titration.

(a) Calculate the concentration in mol/dm³ of 0.25 mol of HCl in 500 cm³ of solution.

[3]

(b) Explain why the solution must be made up to the correct volume in a volumetric flask.

[2]

[Total: 5 marks]

Q47.

Jacob investigates reactions with limiting reactants.

(a) Define limiting reactant.

[2]

(b) Explain why knowing the limiting reactant is useful in calculating product mass.

[3]

[Total: 5 marks]

Q48.

James measures gas volumes during a reaction.

(a) Explain how a gas syringe can be used to measure the volume of hydrogen produced.

[2]

(b) Calculate the volume of gas produced from 0.1 mol of hydrogen at RTP.

(1 mol = 24 L)

[3]

[Total: 5 marks]

Q49.

Luke investigates the reaction of copper(II) oxide with sulfuric acid.

(a) Write the balanced symbol equation.

[2]

(b) Explain why the reaction produces copper(II) sulfate and water.

[2]

(c) Calculate the mass of copper(II) sulfate produced from 80 g of copper(II) oxide.
(Relative atomic masses: Cu = 63.5, S = 32, O = 16)

[3]

[Total: 7 marks]

Q50.

George is asked to plan an experiment to measure the volume of hydrogen gas produced from magnesium and hydrochloric acid.

In your answer, include:

- the apparatus you would use
- how you would carry out the experiment
- the measurements you would take

[6]

[Total: 6 marks]