Science

AS and A Level | AQA | 7404 & 7405

Topic Tests

For AQA Chemistry AS / A Level Year 1

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POD 6098

Contents

Teacher's Introduction

These topic tests have been designed to help comprehensively test your students' knowledge and understanding of the **AQA Chemistry AS / A Level Year 1** specification.

Each topic test closely follows the content of the specification and includes:

- **Factual questions**: Some more simple factual questions are included to ensure that all the content and basics are covered, and to allow weaker learners access to some marks
- **Short-answer questions**: These are not in exam style, and the purpose of these is to test different elements, knowledge and skills from the specification in a variety of styles
- **Exam-style questions**: Where appropriate, topics may contain one or more exam-style questions, to prepare students for what they might meet in the exam, and to test exam skills.

Mathematical and practical skills are also covered in these Topic Tests.

Tests have been designed to take between 30 and 40 minutes to complete and average between 25 and 35 marks, as shown in the table below. One longer specification topic has been split, as indicated in the table. The topic tests are suitable for a classroom assessment, revision aid or homework task and are, therefore, suitable for use immediately after a topic is completed in class or at the end of the teaching of the course.

Topic Number	Number of Marks
3.1.1	28
3.1.2	37
3.1.3 (Part 1)	21
3.1.3 (Part 2)	26
3.1.4	33
3.1.5	27
3.1.6	26
3.1.7	29
3.2.1	23
3.2.2	24
3.2.3	31
3.3.1	21
3.3.2	29
3.3.3	28
3.3.4	26
3.3.5	36
3.3.6	27

The number of marks awarded for each question is clearly shown, allowing the students to gauge the level of detail they will require for their answers. Full answers are included in the mark scheme, also making this a suitable tool for students to use independently.

Diagrams and graphs have been designed with photocopying in mind.

It is recommended that students have access to a periodic table and a calculator to complete the questions.

We hope you find these tests useful during your teaching.

H Bennett, September 2015

Update v1.1, 6 January 2017

Following a technical re-check of the resource, some minor errors and inconsistencies have been amended. In places, wording has been modified to provide clarity and avoid any possible misinterpretation of questions. Other key changes are summarised below:

- The correct number of significant figures have been added where necessary.
- Redistribution of questions across topic tests.
- Incorrect mark totals amended.

3.1.2 Amount of Substance

1. Define the term 'relative atomic mass' (A_r).

2. Define the term 'relative molecular mass' (M_r).

3. Give the value of the Avogadro constant and state what it defines. (2)

4. Calculate the number of moles of:
   a) NaCl in 5.85 g (1)
   b) K_2CO_3 in 4.146 g (1)

5. a) Calculate the number of moles of H_2SO_4 in 50 cm^3 of 0.20 mol dm^{-3} solution. (1)
   b) This sample of sulfuric acid was reacted completely with 47 cm^3 of KOH. Calculate the concentration of the potassium hydroxide used in this reaction. Give your answer to an appropriate number of significant figures.
   $$H_2SO_4 + 2KOH \rightarrow K_2SO_4 + 2H_2O$$ (2)

6. Calculate the volume of CO_2 gas in 0.08 mol at a pressure of 100 kPa and temperature of 298 K. Give your answer in dm^3 to the nearest whole number. The gas constant is 8.314 $JK^{-1}mol^{-1}$. (5)

7. A 38.53 g sample of a compound (M_r = 74) containing only carbon, hydrogen and oxygen has the following composition by mass:

   Carbon 25 g
   Hydrogen 5.2 g
   Oxygen 8.33 g

   Calculate the empirical formula of the compound and hence deduce the molecular formula. (3)

8. Give the formula for calculating percentage atom economy. Why is atom economy important? (2)

9. a) Balance the following equations:
   i. ____C_6H_{14} + ____O_2 → ____CO_2 + ____H_2O (1)
   ii. ____H_2SO_4 + ____NaOH → ____Na_2SO_4 + ____H_2O (1)
   b) For the reaction shown in equation ii) 25 cm^3 of 0.4 mol dm^{-3} H_2SO_4 was used. Calculate the mass of sodium hydroxide used in the reaction. (2)

10. a) A student is asked to make a 50 cm^3 solution of sodium hydroxide using 0.1 g of solid NaOH. Explain how the student would make this solution using a volumetric flask. (3)
    b) The maximum uncertainty for every reading from a burette is 0.05 cm^3. Calculate the percentage uncertainty for a measurement of 18.2 cm^3. Ignore any uncertainty due to the volume of a drop. (3)

11. In an experiment, 24.2 cm^3 of 0.200 mol dm^{-3} H_2SO_4 was required to fully dissolve a sample of $Cu(OH)_2$, producing 1.21 g of $CuSO_4{\cdot}xH_2O$ crystals once dried.
    Calculate the value of x. (7)

Total Marks 37

Preview of Questions Ends Here

3.3.6 Organic Analysis

1.

Level 3 – a clear and well-ordered response addressing most of the indicative content	
Level 2 – a mostly well-ordered response, with only some omissions of content	
Level 1 – one or two points included and answer is not ordered in a logical way	
No relevant content	**0**

Indicative content:

- Addition of Br_2 (bromine water)
- Sample which decolourises from orange to colourless has a C=C double bond — must be cyclohexene
- Addition of sodium carbonate
- Bubbles indicate which is the carboxylic acid – methanoic acid
- Add acidified potassium dichromate
- Colour change from orange to green confirms remaining samples are primary and secondary alcohols
- Distil off product of reaction with acidified potassium dichromate
- Add Tollen's reagent
- Product from ethanol, a primary alcohol, will give a silver mirror while product from propan-2-ol, a secondary alcohol, will not

2. a) From the molecular ion peak of the spectrum (1) (Accept: Furthest right peak)

   b) The carboxylic acid because the alcohol has the M_r 74.0729 (1).

3. Bonds absorb IR radiation, causing vibrations (1)
   Vibrations at particular frequencies (1)
   Produces a spectrum of different bond vibrations (1)

4. To distinguish between two similar molecules (i.e. structural isomers) (1) (as there would be differences in the fingerprint region of the spectrum)

5. 1,680 cm^{-1} – C = O (1); 2,700 cm^{-1} – O – H (1); compound is butanoic acid (1). Calculation (1).

6. Absorbs IR radiation (1). Bonds stretch/bend/vibrate (1). Some radiation reemitted back towards the Earth. (1) Traps heat in the atmosphere (1).

7. A broad peak between (approx.) 3,200 and 3,500 cm^{-1} showing the presence of an O–H bond (1). A peak at 1000–1300 cm^{-1} shows presence of a single C–O bond (1).

8. M_r of A: 88; B: 90; C: 88 (1)
   Mass spectrum has molecular ion peak at 88, so molecule is not B. (1)

   IR has a peak at ~1750. This is due to C=O bond, ruling out B. (1)
   A and B have O–H groups in and C does not. No broad O–H peak, implying not A or B. (1)
   (IGNORE reference to peak at just under 3000 due to C–H bond)

   MS rules out B and, IR rules out B and A. Correct molecule is C. (1)

Preview of Answers Ends Here