AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.8.2.3

Test for carbon dioxide

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**4**
Available paper years	**2020–2023**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

5.8.2.3 Test for carbon dioxide

Answer 01 · Mark scheme November 2020 | 8464/C/1H | Original Q3

03	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO3
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	5.3.1.3 5.4.2.2
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content: • weigh test tube • add metal carbonate • weigh test tube and metal carbonate • heat • allow to cool • weigh test tube and metal oxide • repeat (heat, cool and weigh) until no change in mass • determine mass of metal carbonate used • determine mass of carbon dioxide produced • repeat with different metal carbonate(s) an alternative method can be based on any mass of metal carbonates and at end divide by this mass to find mass carbon dioxide per gram metal carbonate level 3 change in mass is determined for at least one other carbonate		

Total			**6**

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Answer 01 · Mark scheme

November 2020 | 8464/C/1H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.8.2.3 Test for carbon dioxide

Answer 02 · Mark scheme November 2020 | 8464/C/2H | Original Q1

01.1	$C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$	allow multiples	1	AO2 5.1.1.1 5.7.1.3
01.2		MP2 is dependent upon correct response in MP1		AO1.2 5.8.2.3
	(bubble gas through) lime water	allow (bubble gas through) calcium hydroxide (solution)	1	
	turns milky / cloudy / white **or** white precipitate forms		1	
01.3	C_3H_6		1	AO2 5.1.1.1 5.7.1.4
01.4		MP2 is dependent upon correct response in MP1		AO1 5.8.2.1
	burning / lit splint	allow flame do **not** accept glowing splint	1	
	burns with a (squeaky) pop sound	allow pops	1	
01.5	bromine (water)	do **not** accept bromide	1	AO1 5.7.1.4
	(colour change) orange	allow 1 mark for colourless (to) orange	1	
	(to) colourless		1	
		ignore clear		
Total			**9**	

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Answer 02 · Mark scheme

November 2020 | 8464/C/2H | Original Q1

5.8.2.3 Test for carbon dioxide

Answer 03 · Mark scheme

November 2021 | 8464/C/2H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	use limewater **or** use calcium hydroxide solution (which) does not turn milky / cloudy	 allow (which) stays colourless	1 1	AO2 5.8.2.3
06.2	provides an alternative pathway (which has) a lower activation energy		1 1	AO1 5.6.1.4
06.3	(when) the apparatus prevents the escape of reactants and products (and the) forward and reverse reactions occur at same rate	allow (in a) closed system	1 1	AO1 5.6.2.3
06.4	equilibrium position stays the same increases the rate of the forward and the reverse reaction by the same amount	allow no effect	1 1	AO3 5.6.1.4 5.6.2.3
06.5	the yield of ammonia increases		1	AO2 5.6.2.4 5.6.2.7

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06.6	yield of ammonia decreases (because) system shifts in endothermic direction	 allow (because) system shifts to counteract the change allow (because) system shifts to transfer in energy (from the surroundings)	1 1	AO2 5.6.2.4 5.6.2.6
Total			**11**	

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Answer 04 · Mark scheme June 2023 | 8464/C/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	hydrogen / H^+		1	AO1 5.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2		MP2 is dependent upon MP1 being awarded		AO1 5.4.2.4
	(indicator) universal	ignore pH meter	1	
	(result) (green to) red / orange / yellow		1	
	OR			
	(indicator) (blue) litmus (1)			
	(result) (turns) red (1)			
	OR			
	(indicator) methyl orange (1)			
	(result) (turns) red (1)			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	the solubility decreases		1	AO3 5.3.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	pH of the solution increases		1	AO3 5.3.2.5 5.4.2.4

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Answer 04 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	(I)		1	AO2 5.2.2.2

Question	Answers	Mark	AO / Spec. Ref.
01.6	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO3 5.3.1.3 5.4.2.2
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative Content: • measure a (stated) mass of calcium carbonate • use a balance • add calcium carbonate into a conical flask • measure a (stated) volume of hydrochloric acid • use a measuring cylinder • add hydrochloric acid to the conical flask • immediately place the stopper (and delivery tube) in the conical flask • record the total volume of carbon dioxide gas **or** record volume of carbon dioxide collected in set time **or** time taken to collect fixed volume of gas • collected in the gas syringe • repeat • repeat method with different masses of calcium carbonate		

Total Question 1	12

Answer 03 · Examiner comments

Question 6 (standard / high and high demand)

Students have a good understanding of what catalysts are and what they do, but they failed to explain how they work and instead gave a list of features of catalysts. Some students recognised that the activation energy was lowered but that this was achieved by following an alternative pathway was rarely seen.

Likewise, students were able to successfully apply Le Chatelier's Principle to an equilibrium but were unable to explain those changes.

A common misconception is that the quantities of reactants and products are equal rather than the rates of the forward and the backward reactions. That catalysts speed up both of these rates equally was rarely seen. Students tended to describe the action of a catalyst but then failed to address the question of their effect upon the equilibrium position, for which they gained no credit.

Concluding Remarks

The demand of this paper was similar to that of papers set for this specification in previous series.

Students scored well on questions involving the use of data and knowledge of atmospheric pollution. They are advised to look at the number of marks allocated. If the question is asking to describe a trend in a graph, comments are not only required for the general trend but also the rate of change.

A range of methods were used to answer the mathematical questions. Students are always advised to show working - credit can be gained for correct working in the event that the final answer given is not correct. They should also take careful note of any additional instructions. In question 04.6, the final mark was often not gained as the answer was not given to 3 significant figures.

Practical work is at the heart of the specification. The importance of the use of variables in experiments is paramount. In question 02.1, when identifying control variables, students should refer back to the method provided where in this instance the volume of hydrochloric acid was given. Many answers referred to the "amount" of acid or metal which is insufficient to gain credit, likewise, adding a "piece" of magnesium which does not indicate that either the length or mass has been controlled. Reading through the method will also reveal what is being changed in subsequent repeats as the independent variable.

In questions, such as 02.3, where comparisons are to be made from given data, students should be encouraged to answer accordingly using a comparative and not rewrite the information that is provided without elaboration - this does not gain any credit as the student has not added any value to their answer. Some excellent answers were seen where the students expanded upon the data, for example, to explain why the molecules had different melting and boiling points or to explain how the length of the hydrocarbon chain was linked to a trend in physical properties, such as flammability.

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Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

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Answer 04 · Examiner comments June 2023 | 8464/C/1H | Original Q1

Question 1 (standard demand)

01.1 Students were asked to state which ion makes a solution acidic. 30% of students correctly identified the ion as H^+. Carbon was a very common incorrect response.

01.2 More than half the students named an indicator that could be used to test if a solution is acidic and most of these then gave the correct colour in the acid solution. The majority of students listed universal indicator.

01.3 More than three-quarters of students deduced that the solubility of carbon dioxide decreases as the temperature of water increases. The solubility increases proved to be the most common distractor.

Answer 04 · Examiner comments June 2023 | 8464/C/1H | Original Q1

01.4 Just over a third of students deduced that the pH of the solution increases as the temperature of water increases. More students selected the pH of the solution decreases.

01.5 More than three-quarters of students knew that the state symbol of water is (l). The most popular distractor was (aq).

01.6 This question proved accessible for the vast majority of students and discriminated well with over 80% of students achieving level two or above. Students needed to plan a method to investigate the volume of carbon dioxide produced when different masses of calcium carbonate react with hydrochloric acid. To access level 3, the method would lead to a valid outcome. To access level 2 the method would not necessarily lead to a valid outcome. Common reasons for students not accessing level 3 was the use of incorrectly named equipment or the use of a beaker to carry out the reaction as the gas syringe would not be able to be attached to a beaker so the gas could not be collected and measured. Details of when to read the gas syringe was the common omission. Students should be encouraged to state volumes and masses as most creditworthy responses regarding the control of volume and mass did so by stating a value and then repeated with other masses. Students working at level 1 usually gained credit for either mixing the reagents or attempting to collect and measure the gas produced.