AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.6.1.3

Collision theory and activation energy

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**9**
Available paper years	**2019–2025**

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.

5.6.1.3 Collision theory and activation energy

Answer 01 · Mark scheme June 2019 | 8464/C/1F | Original Q1

01.1	sports injury pack		1	AO1 5.5.1.1
01.2	B		1	AO1 5.5.1.2
01.3	C		1	AO1 5.5.1.2
01.4	lower than		1	AO1 5.5.1.2
01.5	thermometer		1	AO1 5.5.1.2
01.6	27.4 (°C) (27.4–14.3 =) 13.1 (°C)	allow values in the range 27.2–27.5 (°C) allow correct subtraction of incorrect temperature reading	1 1	AO2 5.5.1.1
Total			**7**	

5.6.1.3 Collision theory and activation energy

Answer 01 · Mark scheme

June 2019 | 8464/C/1F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec.

5.6.1.3 Collision theory and activation energy

Answer 02 · Mark scheme June 2019 | 8464/C/2F | Original Q3

03.1	2	allow multiples of whole equation	1	AO2 5.1.1.1 5.3.1.1 5.6.1.1 10.2.11

03.2	50 cm^3 measuring cylinder		1	AO3 5.6.1.1 10.2.11

03.3	headings: time **and** volume (of gas) units: s **and** cm^3 time values correct (and match units) volume values match time values	allow in either column allow any units of time and volume placed in relevant column ignore incorrect representation of time values if no other marks awarded allow **1** mark for time with correct units or volume with correct units	1 1 1 1	AO2 5.6.1.1 10.2.11

03.4	any **one** from: • concentration of the acid was lower (than expected) • some (gas) escaped • impure magnesium • temperature lower (than expected)	answers must relate to figure 4 ignore answers relating to amount or surface area or time	1	AO3 5.6.1.2 10.2.11

5.6.1.3 Collision theory and activation energy

Answer 02 · Mark scheme

03.5	any **two** from: • length of magnesium or surface area of magnesium • volume of acid • temperature (of acid)	 allow mass of magnesium allow same form of magnesium allow same size of magnesium ignore concentration of hydrochloric acid ignore room temperature	2	AO2 5.6.1.2 10.2.11

03.6	increased particles frequently	allow went up allow got bigger allow ions or molecules ignore concentration allow often	1 1 1	AO1 5.6.1.2 5.6.1.3 10.2.11

Total			**12**

5.6.1.3 Collision theory and activation energy

Answer 02 · Mark scheme

June 2019 | 8464/C/2F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.

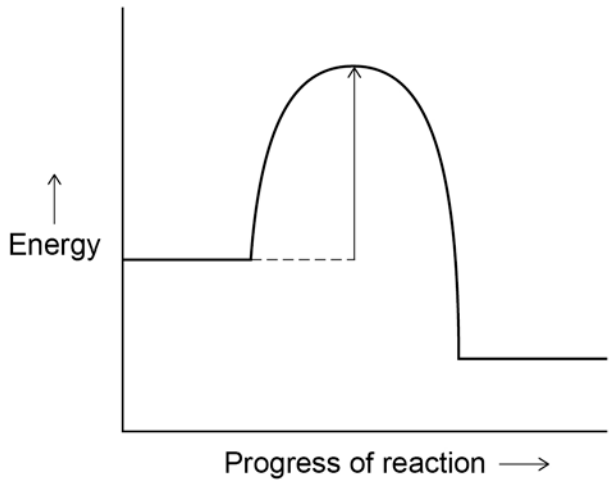
5.6.1.3 Collision theory and activation energy

Answer 03 · Mark scheme June 2019 | 8464/C/2F | Original Q5

05.1	3.50 %		1	AO2 5.10.1.1

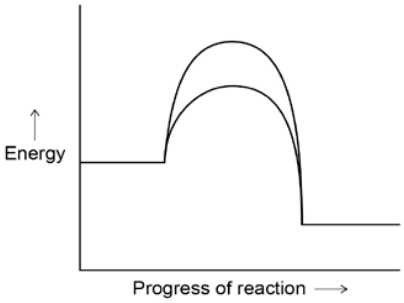
05.2	correct bar to 2.1 (%)	allow a tolerance of ± ½ a small square	1	AO2 5.10.1.1

05.3	(617 + 258) – 648 **or** 875 – 648 = 227 (kg)	an answer of 227 (kg) scores **2** marks	1 1	AO2 5.3.1.1

05.4	 ignore arrow heads		1	AO1 5.6.1.4

5.6.1.3 Collision theory and activation energy

Answer 03 · Mark scheme

05.5	(curve) starts and ends at same energy levels as existing curve maximum of curve below maximum of existing curve	ignore references to activation energy only award if MP1 correct an answer of  scores **2** marks	1 1	AO1 5.6.1.4

05.6	enzymes		1	AO1 5.6.1.4

Total			**8**

5.6.1.3 Collision theory and activation energy

Answer 03 · Mark scheme

June 2019 | 8464/C/2F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.6.1.3 Collision theory and activation energy

Answer 04 · Mark scheme November 2020 | 8464/C/2F | Original Q4

04.1	water oxygen	ignore H_2O ignore O_2	1 1	AO1 5.1.1.1
04.2	concentration of hydrogen peroxide mass of catalyst		1 1	AO3 5.6.1.4
04.3	42 (cm^3)		1	AO2 5.6.1.4
04.4	all five points correctly plotted line of best fit drawn	allow a tolerance of ± ½ a small square allow **1** mark for 3 / 4 points correctly plotted	2 1	AO2 5.6.1.4

5.6.1.3 Collision theory and activation energy

Answer 04 · Mark scheme

04.5	(for the best catalyst) curve is steepest (at the beginning) **or** highest (initial) gradient **or** greatest volume of gas in stated time		1	AO3 5.6.1.1 5.6.1.2
04.6	same volume / concentration of hydrogen peroxide (used)	ignore amount allow catalyst does not affect volume	1	AO3 5.6.1.1 5.6.1.2
04.7	the particles have more energy there are more particle collisions per second		1 1	AO1 5.6.1.2 5.6.1.3
Total			**12**	

5.6.1.3 Collision theory and activation energy

Answer 04 · Mark scheme

November 2020 | 8464/C/2F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.6.1.3 Collision theory and activation energy

Answer 05 · Mark scheme

November 2020 | 8464/C/2F | Original Q7

Question	Answers	Mark	AO / Spec. Ref.
07.1	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO3 5.6.1.2
	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: • use a measuring cylinder / pipette / burette to measure 50 cm^3 of sodium thiosulfate • use a different measuring cylinder / pipette / burette to measure 10 cm^3 of hydrochloric acid • start the timer when the acid is added • record the temperature of the solution after the acid is added • stop the timer when the cross is no longer visible • record the temperature of the solution at the end of the reaction • calculate the mean temperature of the reaction • repeat the experiment at different temperatures • use the same concentration of sodium thiosulfate and same concentration of hydrochloric acid • use the same volume of sodium thiosulfate and the same volume of hydrochloric acid • describe how to heat the thiosulfate / acid solutions		

5.6.1.3 Collision theory and activation energy

Answer 05 · Mark scheme

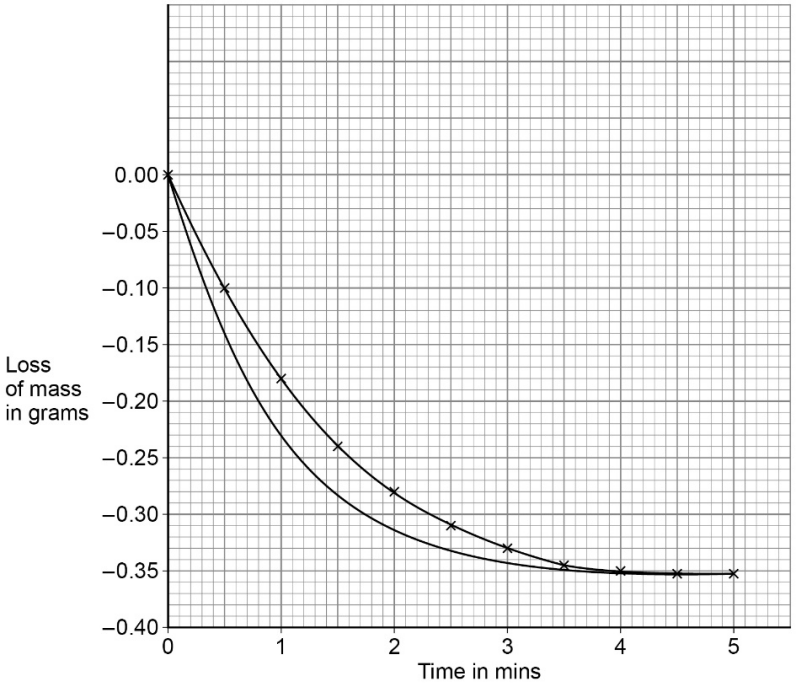
November 2020 | 8464/C/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	(change in mass of gas =) 0.15 **and** (time =) 2	ignore signs	1	AO2 5.6.1.1 5.6.1.4
	(rate of reaction =) $\frac{0.15}{2}$	allow correct use of incorrectly determined values for mass and / or time	1	
	0.075 (g/min)		1	

5.6.1.3 Collision theory and activation energy

Answer 05 · Mark scheme

November 2020 | 8464/C/2F | Original Q7

07.3	curve starts at same point, to the left and steeper line levels at −0.35 g the curve below can be awarded 2 marks  	1 1	AO2 5.6.1.1 5.6.1.2 5.6.1.4

Total			**11**

5.6.1.3 Collision theory and activation energy

Answer 06 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec.
06.1	**independent** concentration (of hydrochloric acid) **control** any **one** from: • temperature (of hydrochloric acid) • volume of (hydrochloric) acid • length of magnesium • surface area of magnesium	 allow same mass of magnesium allow same form of magnesium ignore amount	1 1	AO1 5.6.1 RPA11
06.2	all points correctly plotted line of best fit	allow a tolerance of ± ½ a small square allow 1 mark for 4 or 5 points correctly plotted must include 0,0	2 1	AO2 5.6.1 RPA11
06.3	the rate decreases		1	AO3 5.6.1 RPA11
06.4	the magnesium reacted more quickly		1	AO3 5.6.1.2

5.6.1.3 Collision theory and activation energy

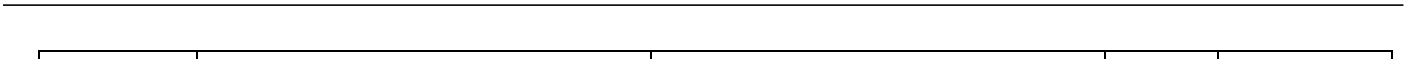
Answer 06 · Mark scheme

06.5	rate increases (because) particles have more energy (so) more frequent collisions	allow reaction happens faster allow (because) particles move faster allow (because) more particles have energy greater than the activation energy	1 1 1	AO1 5.6.1.2 5.6.1.3
Total			**10**	

5.6.1.3 Collision theory and activation energy

Answer 06 · Mark scheme

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



5.6.1.3 Collision theory and activation energy

Answer 07 · Mark scheme

June 2022 | 8464/C/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	hydrogen chloride	allow hydrochloric acid	1	AO1 5.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	(g)		1	AO1 5.2.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	⇌	allow reversible sign / arrow	1	AO1 5.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	exothermic		1	AO1 5.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	rate		1	AO1 5.6.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	C		1	AO1 5.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	any **one** from: • increases rate of reaction • reduces energy required • lower temperature can be used		1	AO1 5.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.8	formulation		1	AO1 5.8.1.2

Total Question 3		**8**

5.6.1.3 Collision theory and activation energy

Answer 08 · Mark scheme

June 2024 | 8464/C/2F | Original Q7

Question 7

Question	Answers	Mark	AO / Spec. Ref.
07.1	**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	AO3
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	AO2
	No relevant content	0	
	Indicative content • measure volume of (hydrochloric) acid • using a measuring cylinder • measure mass of calcium carbonate • using a balance • **add (hydrochloric) acid to calcium carbonate in conical flask** • **put stopper and delivery tube into conical flask** • **start a timer** • **record volume of gas collected at set time intervals or time how long it takes for a fixed volume of gas to be collected** • **repeat using different sized pieces of calcium carbonate** • use same mass of calcium carbonate • use same volume of (hydrochloric) acid • use same concentration of (hydrochloric) acid • use same temperature of (hydrochloric) acid • repeat each experiment		5.6.1.2

5.6.1.3 Collision theory and activation energy

Answer 08 · Mark scheme

June 2024 | 8464/C/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	(increasing the temperature) increases the rate of reaction		1	AO1 5.6.1.2 5.6.1.3
	(because) particles have more energy	allow (because) particles move faster	1	
	(so) the frequency of collisions increases	allow (so) a greater proportion of collisions have enough energy to react	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	(a substance that) increases the rate of reaction	allow (a catalyst) increases / changes the rate of reaction	1	AO1 5.6.1.4
	and is not used up during the reaction	ignore does not take part in the reaction	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	enzymes		1	AO1 5.6.1.4

Total Question 7	12

5.6.1.3 Collision theory and activation energy

Answer 09 · Mark scheme

June 2025 | 8464/C/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	any **two** from: • measure the volume of the alkali • repeat **and** calculate a mean • stir / swirl the mixture • use universal indicator solution	ignore references to safety allow use a measuring cylinder (to measure the alkali) allow use a burette (to measure the alkali) allow use a pH probe	2	AO3 5.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	7		1	AO1 5.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	neutralisation		1	AO1 5.4.2.2

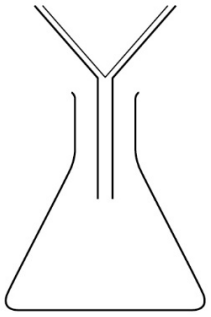
Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	H^+		1	AO1 5.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	nitric (acid)	allow HNO_3	1	AO2 5.4.2.2

5.6.1.3 Collision theory and activation energy

Answer 09 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	(**A**) overall energy change		1	AO1 5.5.1.2
	(**B**) progress of reaction		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	filter funnel with filter paper inside		1	AO1 5.4.2.3 RPA8
	a container to collect the filtrate		1	
		an answer of  scores **2** marks		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.8	zinc	allow Zn	1	AO2 5.4.2.1

Total Question 5	11

5.6.1.3 Collision theory and activation energy

Answer 06 · Examiner comments November 2021 | 8464/C/2F | Original Q6

Question 6 (standard demand)

Very few students were able to identify the variables. Most copied out the stages of the experiment from the rubric and did not go on to elaborate.

Graphs were usually accurately plotted and an appropriate line of best fit drawn. No credit was given for a bar chart as the first point had already been plotted for the students to follow.

The last part of the question required students to explain the effect of increasing the temperature on the reaction rate. Most students gained the first marking point for stating how temperature affected the rate of reaction but many did not go further to give a reason for this change. The idea of a higher temperature increasing the frequency of particle collisions was rarely seen.

Answer 07 · Examiner comments June 2022 | 8464/C/2F | Original Q3

Question 3

The equilibrium identified in this question is detailed in the specification, however, many students found the questions challenging.

03.1 Around half of the students were able to identify hydrogen chloride or hydrochloric acid as the other product.

03.2 Students were told that ammonia is a gas in the stem of the question. However only half of the students gained the mark on this item.

03.3 Nearly two thirds of students were able to either draw the equilibrium symbol or describe the symbol with sufficient clarity.

03.4 Three quarters of students identified the reverse reaction as exothermic.

03.5 Approximately 60% of students were able to identify rate in this item. Nearly all the incorrect responses were concentration.

Answer 07 · Examiner comments June 2022 | 8464/C/2F | Original Q3

03.6 Less than a third of students identified C correctly. The most common incorrect responses were B and D with similar numbers identifying each.

03.7 Approximately one third of students gained a mark here. The most common correct response was for increasing the rate. Responses such as catalysts were not used up or catalysts could be reused did not answer the question.

03.8 In this open question only 1 in 20 students were able to identify a formulation. Bleach was the most seen incorrect response.

Answer 08 · Examiner comments June 2024 | 8464/C/2F | Original Q7

Question 7 (standard demand)

07.1 This AO2 and AO3 variation of one of the rates Required Practical Activities proved challenging to most students, with over a quarter of students not attempting it. Of the 30% of responses that did gain any marks most were limited to Level 1. To reach Level 2, three key steps, or two with control variables, were required. To achieve Level 3 marks, all key steps and control variables were needed.

The two most common steps identified were adding the hydrochloric acid to the calcium carbonate in the conical flask and then attaching the stopper and delivery tube. Many students made no further progress as they often referred to 'counting bubbles' or to 'reading the volume when the reaction had finished' with no link to timing so that calculating a rate would be impossible. Another common response was to 'repeat with a different mass of calcium carbonate' instead of using different sized pieces.

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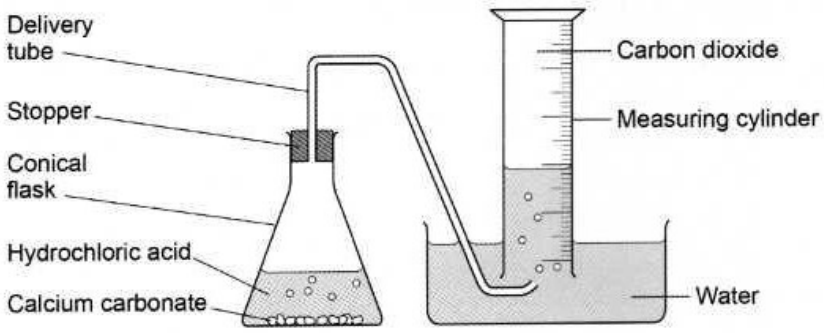
5.6.1.3 Collision theory and activation energy

Answer 08 · Examiner comments June 2024 | 8464/C/2F | Original Q7

0 7 . 1 A student investigated the effect of changing the particle size of calcium carbonate on the rate of reaction with hydrochloric acid.

Figure 6 shows the apparatus.

Figure 6



Describe a method the student could use to produce valid results.

[6 marks]

Add hydrochloric acid to a conical flask and add calcium carbonate. Then add a stopper and put in a delivery tube and put that in some water. Calculate the calcium carbonate that the gas has forced to move in the measuring cylinder.

This student has described the two most common key steps but has not gone on to add anything further so has not met the Level 2 descriptor: 1 mark was awarded.

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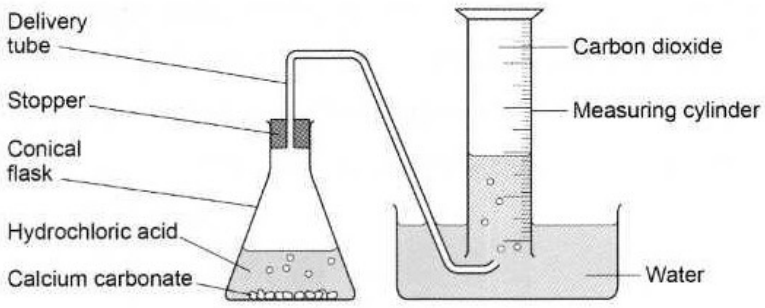
5.6.1.3 Collision theory and activation energy

Answer 08 · Examiner comments June 2024 | 8464/C/2F | Original Q7

0 7 . 1 A student investigated the effect of changing the particle size of calcium carbonate on the rate of reaction with hydrochloric acid.

Figure 6 shows the apparatus.

Figure 6



Describe a method the student could use to produce valid results.

[6 marks]

1.) Measure the mass of the calcium carbonate

2.) Add 50 cm^3 of hydrochloric acid into the conical flask and put the ~~delivery~~ stopper over to trap the gasses in.

3.) connect the delivery tube to the water so that the gasses can enter it.

4.) Measure the ~~amount of~~ ~~put into~~ amount of carbon dioxide.

5.) ~~Also measure the amount of~~ ~~Repeat the experi~~ Record the results of carbon dioxide and how much calcium carbonate was used.

6.) Repeat steps 1-5 ~~but~~ with different masses of calcium

Turn over ▶

This student has achieved the first two key steps; however, they have not described what they are going to measure or change in the repeats to achieve the other key steps.

The student has specified 50 cm^3 of hydrochloric acid and done repeats (of something) so that they have given a control variable. This would therefore just place this answer into Level 2 and 3 marks are awarded.

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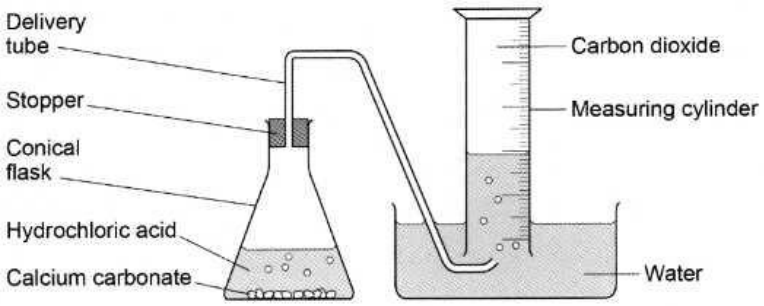
5.6.1.3 Collision theory and activation energy

Answer 08 · Examiner comments June 2024 | 8464/C/2F | Original Q7

0 2 . 1 A student investigated the effect of changing the particle size of calcium carbonate on the rate of reaction with hydrochloric acid.

Figure 3 shows the apparatus.

Figure 3



Describe a method the student could use to produce valid results. **[6 marks]**

- Use a balance to ~~find out the M~~ make sure your using the correct mass of calcium carbonate
- then place the calcium carbonate into the hydrochloric acid and place the stopper with the delivery tube on very quickly.
- record the amount of carbon dioxide in the measuring cylinder every 30 seconds ~~repeat this~~ until the calcium carbonate stops bubbling.
- repeat this method but with bigger particle size of calcium carbonate but they have to be the same mass as the smaller particles.

In this response the student has suggested that the 'correct mass' of calcium carbonate should be used in the first bullet point. This is insufficient for a control variable, but in the final bullet point the 'same mass' has been identified, so there is one control variable here. The first two key steps are identified in the second bullet point. Key steps 3 and 4 are given in the third bullet point. 'Amount' would not be acceptable in a points-based mark scheme, but this response should be marked holistically as it is an extended response. There is no explicit mention of starting a stopwatch; however, it is implied in the statement 'every 30 seconds.' The final bullet point gives the repeats with a different particle size and one control variable.

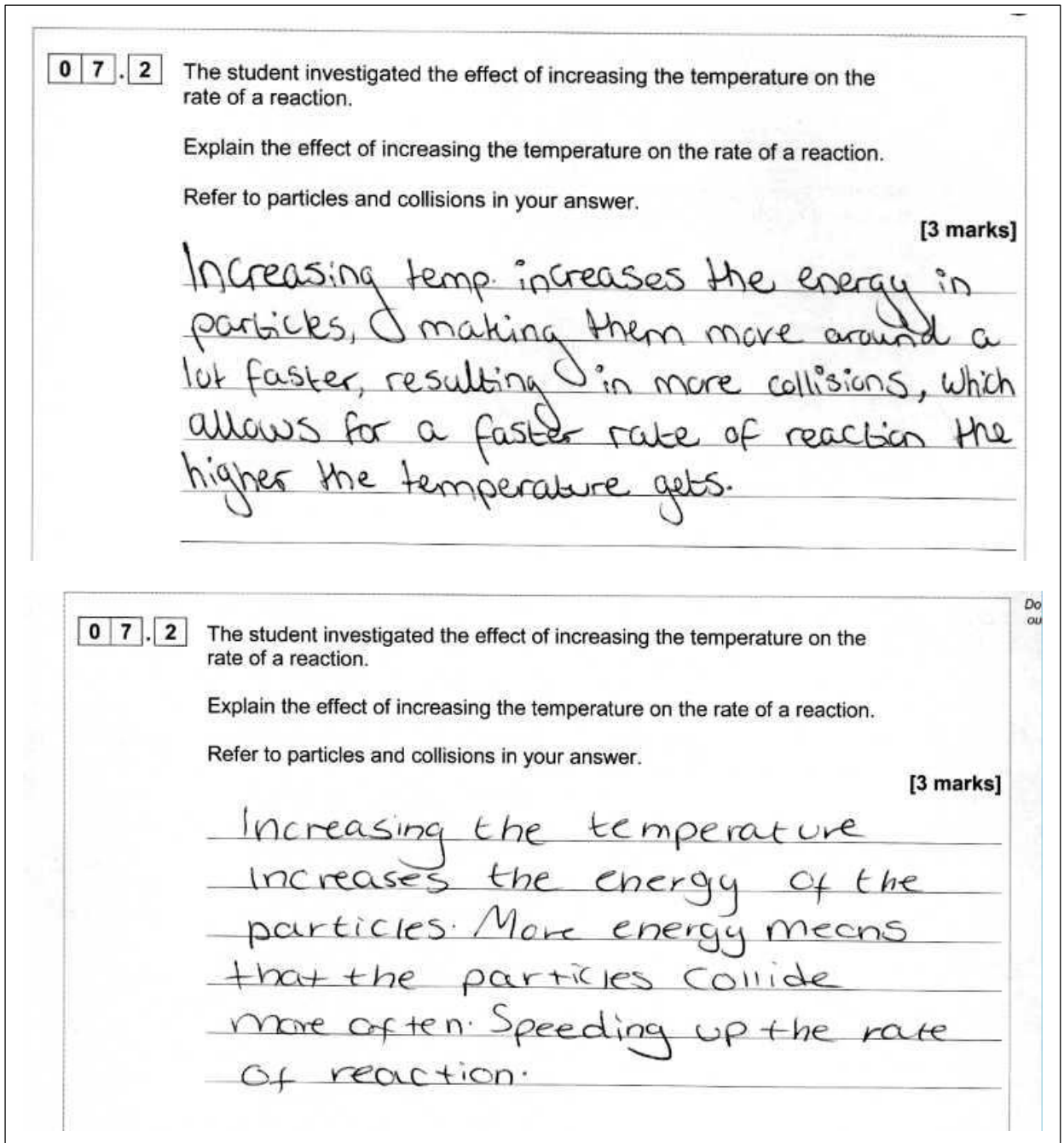
Therefore, there are all five key steps, and one control variable so this is a Level 3 response and is awarded 5 marks. An additional control variable is needed for 6 marks.

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5.6.1.3 Collision theory and activation energy

Answer 08 · Examiner comments June 2024 | 8464/C/2F | Original Q7

07.2 Over half of the students gained at least 1 mark on this AO1 question, with 40% gaining 2 or more. The first two marking points were the more commonly awarded marks. Linking an increase in temperature to an increase in rate was the most common. However, very few students linked rate to the *frequency* of collisions, ie the more collisions per second, and are more likely to just talk about more collisions.



0 7 . 2 The student investigated the effect of increasing the temperature on the rate of a reaction.

Explain the effect of increasing the temperature on the rate of a reaction.

Refer to particles and collisions in your answer.

[3 marks]

Increasing temp. increases the energy in particles, making them move around a lot faster, resulting in more collisions, which allows for a faster rate of reaction the higher the temperature gets.

0 7 . 2 The student investigated the effect of increasing the temperature on the rate of a reaction.

Explain the effect of increasing the temperature on the rate of a reaction.

Refer to particles and collisions in your answer.

[3 marks]

Increasing the temperature increases the energy of the particles. More energy means that the particles collide more often. Speeding up the rate of reaction.

The first student has achieved the first two marking points, but 'more collisions' is insufficient for marking point 3.

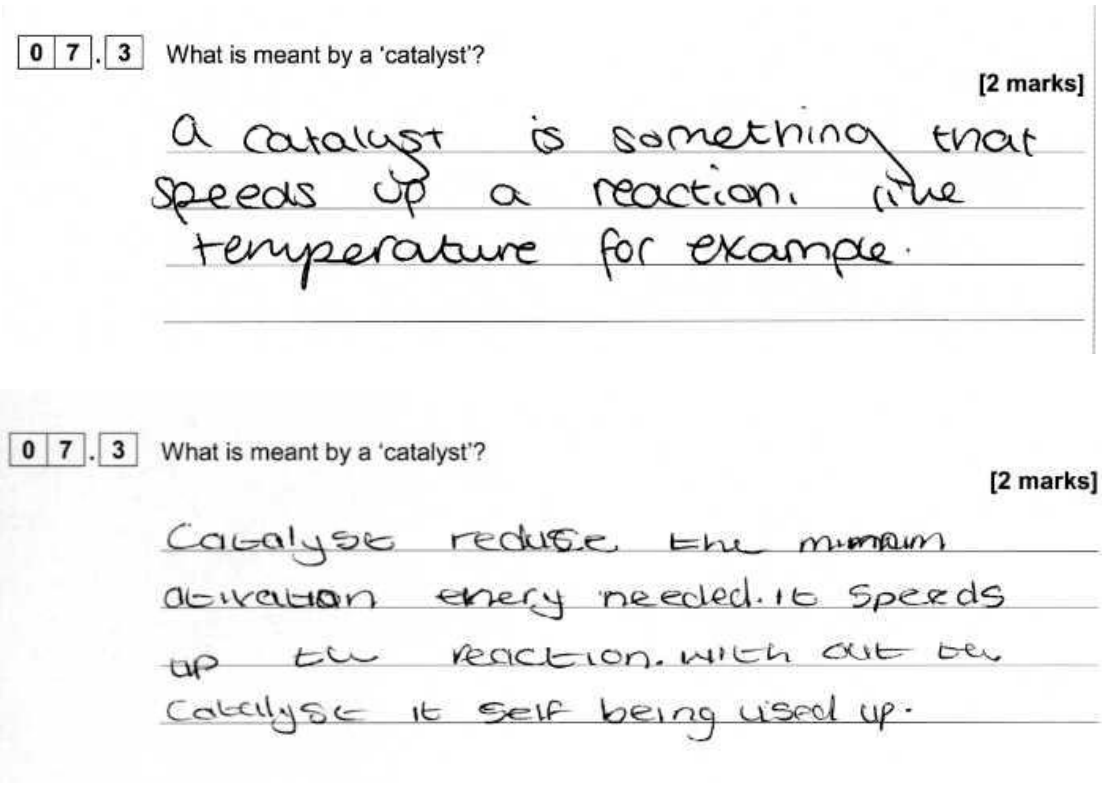
The second student has achieved all 3 marks. In addition to identifying that the energy of the particles increases, speeding up the reaction, 'particles collide more often' is equivalent to' more frequent collisions' as the collisions are linked to time.

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5.6.1.3 Collision theory and activation energy

Answer 08 · Examiner comments June 2024 | 8464/C/2F | Original Q7

07.3 Over 40% of students were able to gain at least 1 mark for the AO1 definition of a catalyst. The first marking point was most seen; however, many misconceptions were also seen. One common misconception is that a catalyst is *any* change that speeds up the reaction. This contradicts what a catalyst is, so the first mark cannot be awarded.



0 7 . 3 What is meant by a 'catalyst'?

[2 marks]

A catalyst is something that speeds up a reaction. like temperature for example.

0 7 . 3 What is meant by a 'catalyst'?

[2 marks]

Catalyst reduce the minimum activation energy needed. It speeds up the reaction. without the catalyst it self being used up.

The first student starts off well; however, they suggest that temperature is a catalyst, so the mark is not awarded.

The second student clearly defines a catalyst for 2 marks, but includes information which is unnecessary, the idea that a catalyst reduces the activation energy. This would be required in an 'Explain' question, rather than the much simpler 'What is?', but does not affect the marks awarded.

07.4 Enzymes are in both the Chemistry and Biology sections of the specification; however, very few students were able to recall that biological catalysts are called enzymes.

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5.6.1.3 Collision theory and activation energy

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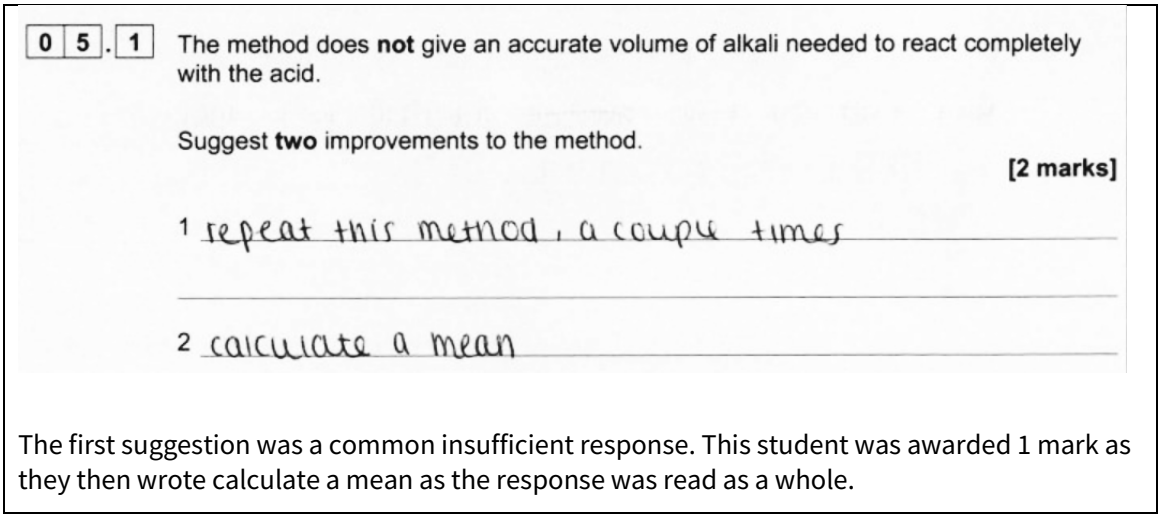
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Answer 09 · Examiner comments

June 2025 | 8464/C/1F | Original Q5

Question 5 (Low and Standard demand)

05.1 Improvements to methods are assessed as AO3 and are often not well attempted. Answers needed to improve the accuracy of measuring the volume of alkali, so creditworthy responses included measuring the volume of the alkali (e.g. with a measuring cylinder), ensuring that the reagents reacted by stirring the mixture or repeating and calculating a mean. This was not a high scoring question. There were many insufficient responses of 'repeat' without the necessary 'mean' included. Many responses used the inadequate terms 'amount' or 'how much' alkali, and others suggested altering the size or weight of the universal indicator paper rather than using a solution. Other uncreditworthy responses included attempting to control the 'time' or using 'more acid'. Others mentioned the need to use a measuring cylinder but referred to the acid and therefore gained no credit.



0 5 . 1 The method does **not** give an accurate volume of alkali needed to react completely with the acid.

Suggest **two** improvements to the method.

[2 marks]

1 repeat this method a couple times

2 calculate a mean

The first suggestion was a common insufficient response. This student was awarded 1 mark as they then wrote calculate a mean as the response was read as a whole.

05.2 Nearly two thirds of students knew that universal indicator paper turns green when pH = 7. The most popular incorrect distractor was pH = 5.

05.3 Nearly two thirds of students knew that neutralisation is the name of the reaction between an acid and an alkali. Combustion was the most common incorrect response.

05.4 Half of students knew that acids contain H^+ ions. The most popular incorrect distractor was Na^+ ions.

05.5 Nitric acid was the unknown acid that reacted with sodium hydroxide to produce sodium nitrate. This was not well known. Common responses that were not awarded the mark were nitrogen, nitrate (possibly because they had appeared earlier in the paper), hydrochloric acid, sulfuric acid and sodium.

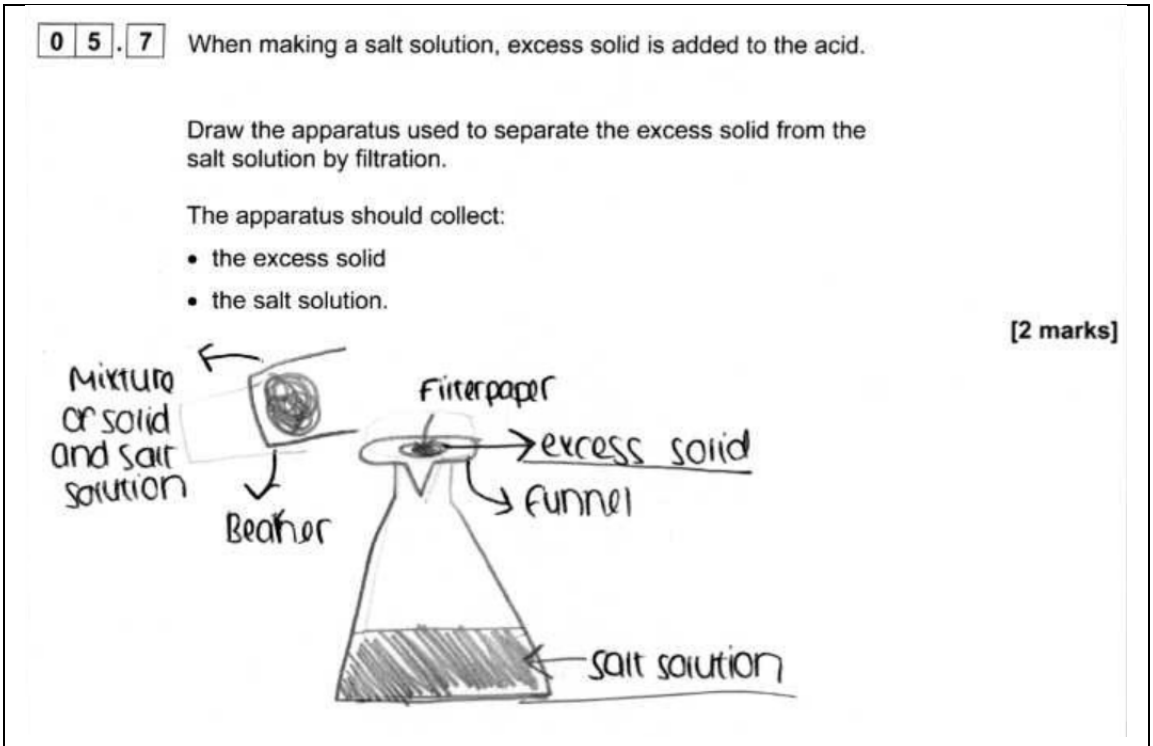
05.6 A third of students were able to select the labels from the box to complete the reaction profile. Reactants and products were common incorrect distractors. Credit was awarded if the student identified the correct answer in the box.

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5.6.1.3 Collision theory and activation energy

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05.7 Students had to draw apparatus used to separate excess solid from salt solution by filtration. Filter paper inside a filter funnel gained the first mark. Many diagrams had either the funnel or paper missing but those students who clarified their diagrammatic response with labels (for the paper and funnel) were awarded credit even if it was not clear that both pieces of equipment were drawn. The second mark was for any container to collect the filtrate although this could only be accessed if there was some evidence of filtration apparatus even if incorrect. Those students who included additional equipment which would affect the filtrate, for example, a Bunsen burner to heat the collection vessel with were not awarded the second mark. More than a quarter of students did not attempt this question.



Both marking points were awarded. It is not clear that there is filter paper inside a filter funnel but this student has clarified their diagram with two labels. A conical flask after filtration is creditworthy.

05.8 Half the students knew that the zinc reacts with hydrochloric acid to produce zinc chloride and hydrogen gas. Phonetic spellings were credited. Chlorine was the main incorrect response, zinc oxide/hydroxide often appeared, and there were a few other metals e.g. iron, infrequently.

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