AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.6.1.1

Calculating rates of reactions

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**8**
Available paper years	**2018–2025**

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.

5.6.1.1 Calculating rates of reactions

Answer 01 · Mark scheme

June 2018 | 8464/C/2F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	lines from: • independent to size of marble chips • control to volume of acid	ignore arrowheads do **not** accept if more than one line from one box	 1 1	AO2 AO3 5.6.1.2
05.2	calcium chloride carbon dioxide water	all three needed for **2** marks allow **1** mark if two correct do **not** accept carbon oxide do **not** accept hydrogen oxide	2	AO2 5.1.1.1 5.3.1.3
05.3	stops loss of acid	allow stops loss of water / liquid allow to ensure that only the gas escapes do **not** accept stops acid evaporating do **not** accept stops gas / CO_2 / water vapour escaping	1	AO3 5.6.1
05.4	0.053	allow 0.05 allow 0.053333… do **not** accept 0.052 ignore units	1	AO2 5.6.1.1
05.5	g/s		1	AO1 5.6.1.1

5.6.1.1 Calculating rates of reactions

Answer 01 · Mark scheme

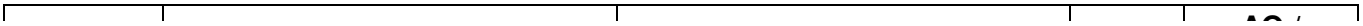
June 2018 | 8464/C/2F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	all points correctly plotted	allow **1** mark for 5 points correctly plotted allow ± ½ a small square	2	AO2 5.6.1.1
	line of best fit	should be a curve nearer to (10,0.8) than the anomaly (20, 0.6) and through all other points if plotting incorrect allow **1** mark for appropriate line of best fit through student's points	1	AO3 5.6.1.1
05.7	the eight small marble chips have a larger surface area, so more frequent collisions		1	AO3 5.6.1.2 5.6.1.3
Total			**11**	

5.6.1.1 Calculating rates of reactions

Answer 01 · Mark scheme

June 2018 | 8464/C/2F | Original Q5



5.6.1.1 Calculating rates of reactions

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

5.6.1.1 Calculating rates of reactions

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**

5.6.1.1 Calculating rates of reactions

Answer 02 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.6.1.1 Calculating rates of reactions

Answer 03 · Mark scheme

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

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**	

5.6.1.1 Calculating rates of reactions

Answer 03 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.6.1.1 Calculating rates of reactions

Answer 04 · 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		

5.6.1.1 Calculating rates of reactions

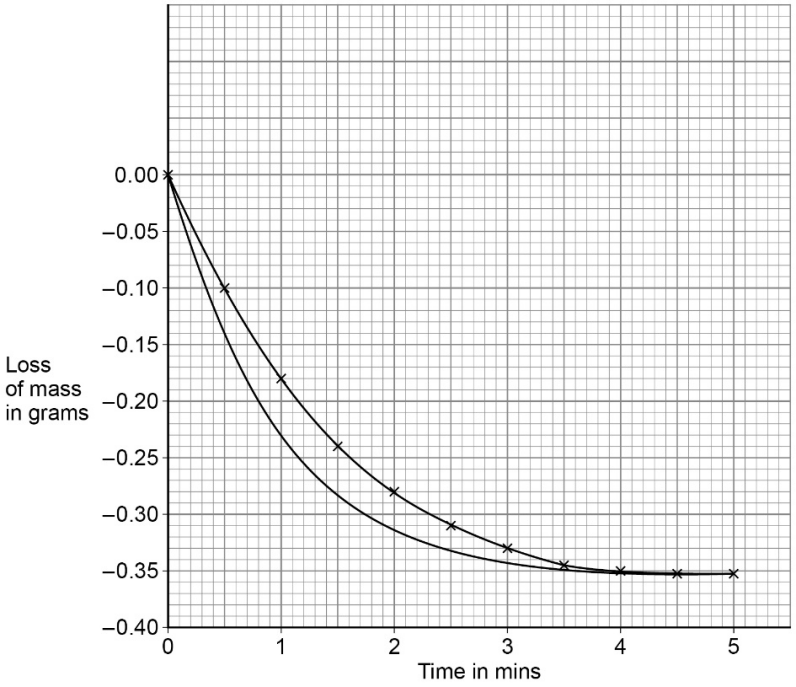
Answer 04 · Mark scheme

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	

5.6.1.1 Calculating rates of reactions

Answer 04 · Mark scheme

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**

5.6.1.1 Calculating rates of reactions

Answer 05 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec.
06.1	**independent** concentration (of hydrochloric acid)		1	AO1 5.6.1 RPA11
	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	
06.2	all points correctly plotted	allow a tolerance of ± ½ a small square allow 1 mark for 4 or 5 points correctly plotted	2	AO2 5.6.1 RPA11
	line of best fit	must include 0,0	1	
06.3	the rate decreases		1	AO3 5.6.1 RPA11
06.4	the magnesium reacted more quickly		1	AO3 5.6.1.2

5.6.1.1 Calculating rates of reactions

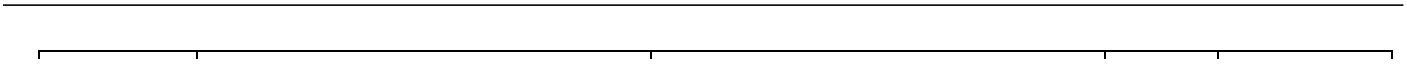
Answer 05 · Mark scheme

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**	

5.6.1.1 Calculating rates of reactions

Answer 05 · Mark scheme

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

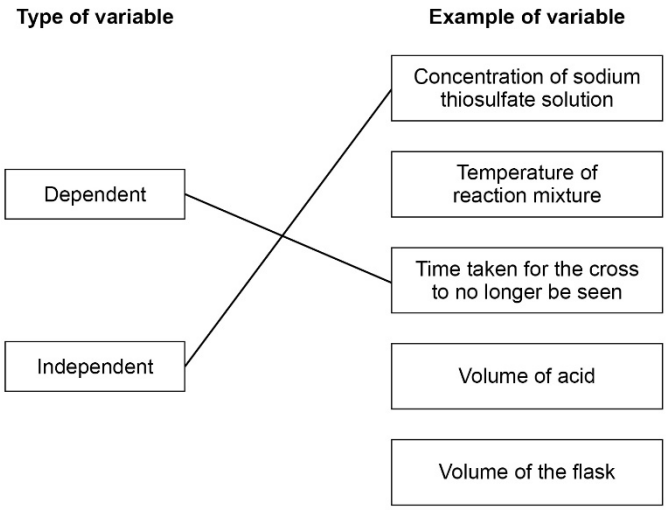


5.6.1.1 Calculating rates of reactions

Answer 06 · Mark scheme

June 2022 | 8464/C/2F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	 do **not** accept more than one line from a box on the left		1 1	AO2 5.6.1.1 RPA11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	19.5 (°C)		1	AO2 5.6.1.2 RPA11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	all points correctly plotted line of best fit	allow a tolerance of ± ½ a small square allow **1** mark for 3 / 4 / 5 points correctly plotted	2 1	AO2 5.6.1.1 RPA11

5.6.1.1 Calculating rates of reactions

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	7 (s)	allow ecf from question **04.3** allow a tolerance of ± ½ a small square	1	AO3 5.6.1.1 RPA11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	decreases		1	AO2 5.6.1.1 RPA11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	(mean =) $\frac{0.725}{20}$ = 0.03625	 ignore units	1 1	AO2 5.6.1.1 RPA11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	g/s		1	AO1 5.6.1.1 RPA11

5.6.1.1 Calculating rates of reactions

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.8	(mean =) $\frac{60.5 + 63.2 + 65.7}{3}$ = 63.13333 (s)	allow for **1** mark $\frac{60.5 + 63.2 + 65.7 + 82.3}{4} = 67.925$	1 1	AO3 AO2
	= 63.1 (s)	allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses the values in the question	1	AO2 5.6.1.1 RPA11

Total Question 4		14

5.6.1.1 Calculating rates of reactions

Answer 07 · 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

5.6.1.1 Calculating rates of reactions

Answer 07 · Mark scheme

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**

5.6.1.1 Calculating rates of reactions

Answer 08 · Mark scheme

June 2025 | 8464/C/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	balance	allow (weighing) scales	1	AO1 5.6.1.2 RPA11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	42 (cm^3)		1	AO2 5.6.1.2 RPA11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	concentration of hydrochloric acid		1	AO1 5.6.1.2 RPA11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	to reduce loss of gas	allow carbon dioxide for gas do **not** accept to stop loss of gas	1	AO3 5.6.1.2 RPA11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	calcium hydroxide solution		1	AO1 5.8.2.3

5.6.1.1 Calculating rates of reactions

Answer 08 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	time in s(econds) volume (of gas collected) in cm^3 time values in correct order volume values in correct order	if neither mark awarded allow **1** mark for headings of time **and** volume	1 1 1 1	AO2 5.6.1.1 5.6.1.2 RPA11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	$(\text{mean rate of reaction} =) \frac{18}{30}$ = 0.6 cm^3/s		1 1 1	AO2 5.6.1.1 RPA11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	the particles are closer together the particles collide more frequently		1 1	AO1 5.6.1.2 5.6.1.3

Total Question 2	**14**

5.6.1.1 Calculating rates of reactions

Answer 05 · 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.

5.6.1.1 Calculating rates of reactions

Answer 06 · Examiner comments

June 2022 | 8464/C/2F | Original Q4

Question 4

The skills tested in this question led to some good responses from students, particularly when reading scales, graph plotting and in guided calculations.

04.1 Identifying variables from a practical procedure is still one of the skills that students find challenging. Only 1 in 5 scored both marks, with a further quarter of these students correctly identifying one of the variables.

04.2 Nearly 95% of students were able to read the thermometer to give the temperature.

04.3 A quarter of students gained all the marks for plotting the graph, including a curved line of best fit. Fewer than 1 in 5 gained no marks. The common error was the line of best fit, with many drawing a straight line. Students need to realise that lines of best fit can be curved or straight and they need to make that judgement.

04.4 A quarter of students were able to successfully extrapolate the graph to find the value requested. Students should be encouraged to extrapolate the lines and read from that line, as opposed to estimating where the line crosses the point.

04.5 Two thirds of students correctly completed the sentence.

04.6 Guided calculations with no manipulation of the equation are well understood by students, and this one was no exception, with nearly 4 in 5 achieving both marks for the calculation. Transposition errors (both written and putting into calculators) accounted for a number of the incorrect responses.

04.7 The units were correctly identified by nearly 80% of students.

04.8 Around 1 in 4 students achieved all three marks for this calculation. The two most frequently seen errors were including the anomalous result and not rounding to 3 significant figures. This is another example where students need to read the whole question, perhaps highlighting the requirements, before embarking on the solution.

5.6.1.1 Calculating rates of reactions

Answer 07 · 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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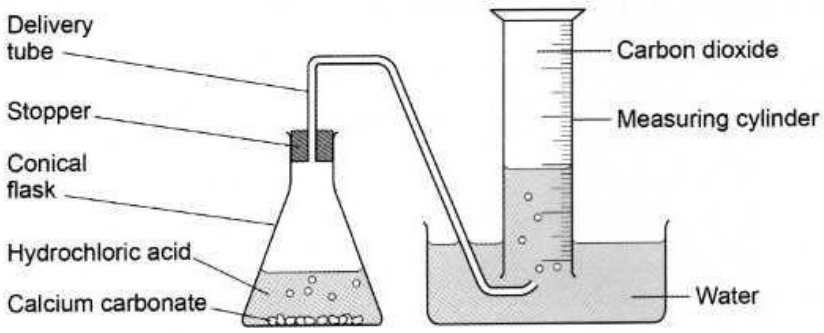
5.6.1.1 Calculating rates of reactions

Answer 07 · 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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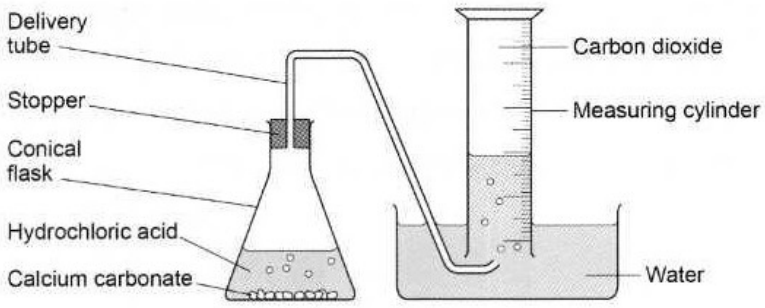
5.6.1.1 Calculating rates of reactions

Answer 07 · 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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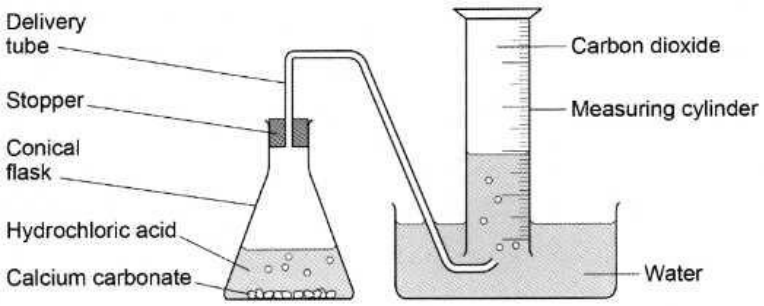
5.6.1.1 Calculating rates of reactions

Answer 07 · 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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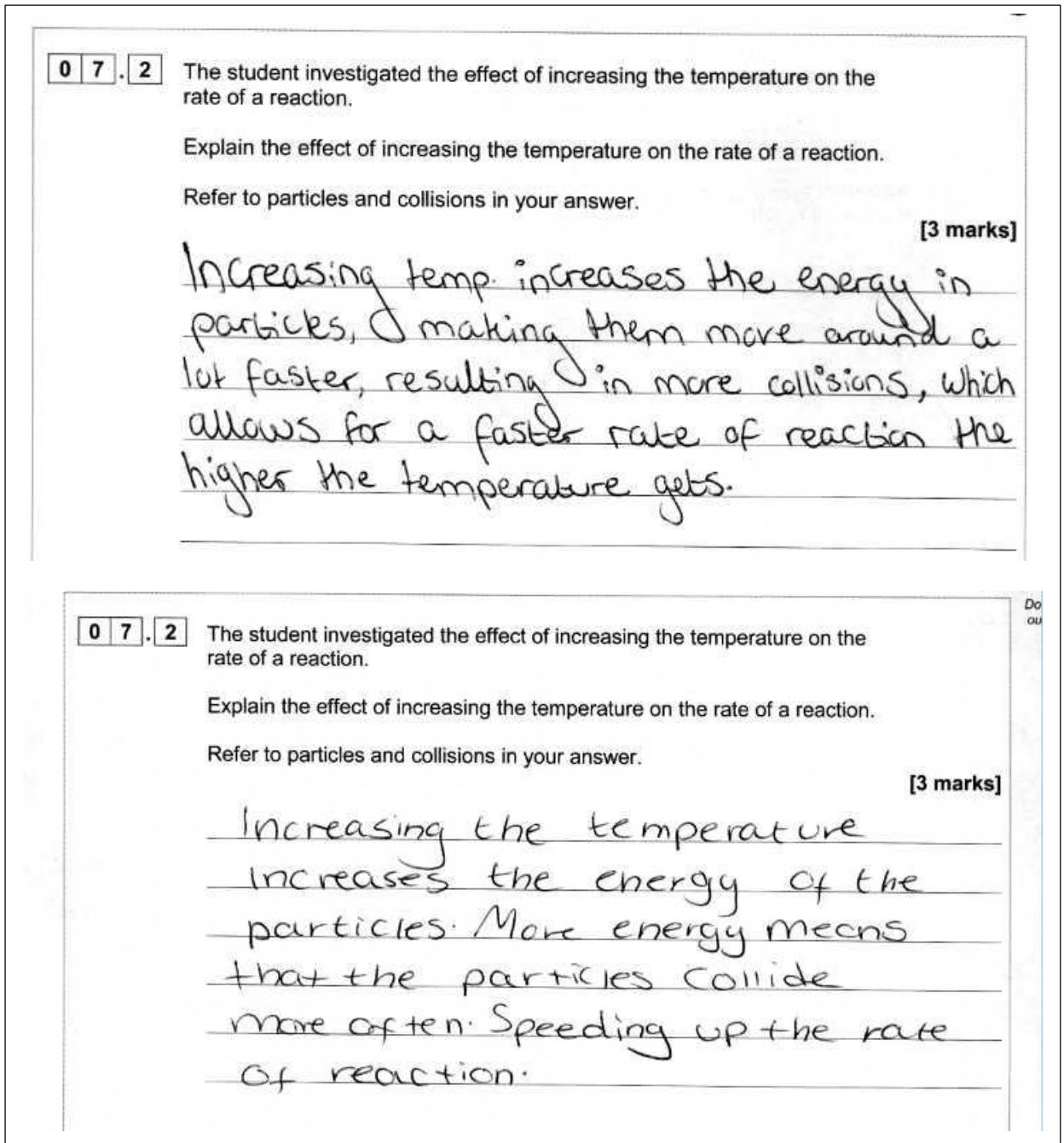
5.6.1.1 Calculating rates of reactions

Answer 07 · 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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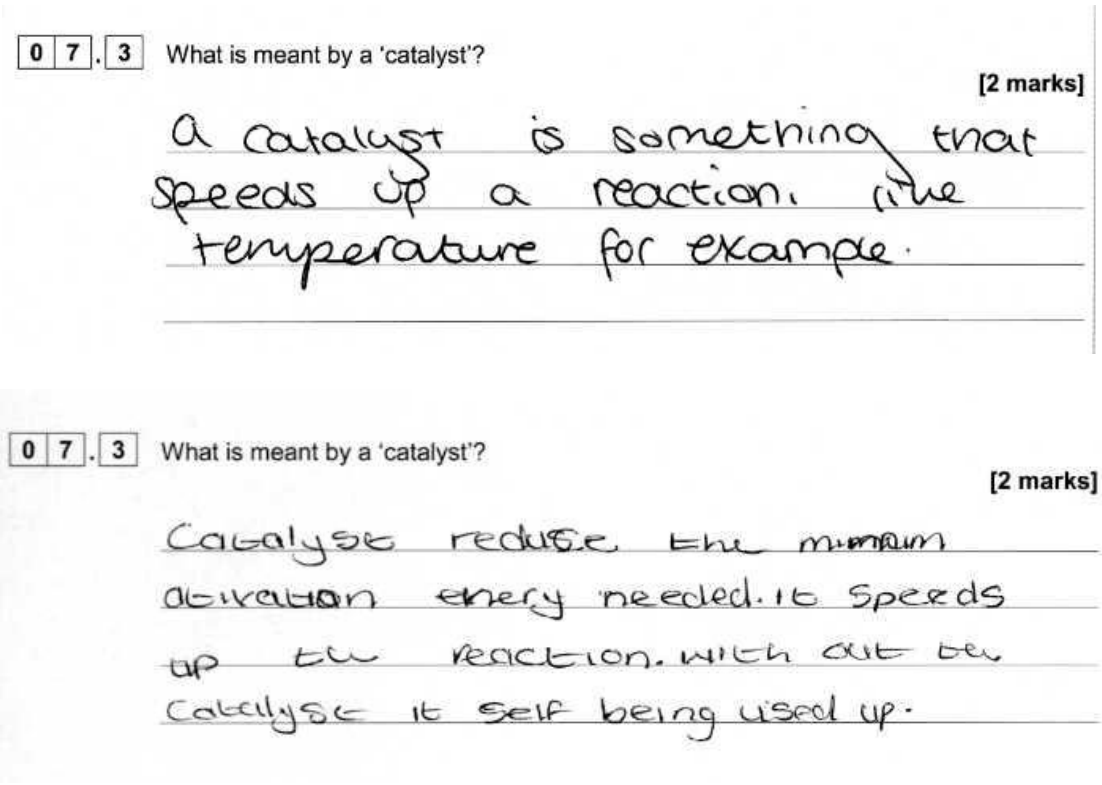
5.6.1.1 Calculating rates of reactions

Answer 07 · 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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5.6.1.1 Calculating rates of reactions

Contact us

Our friendly team will be happy to support you between 8am and 5pm, Monday to Friday.

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5.6.1.1 Calculating rates of reactions

Answer 08 · Examiner comments June 2025 | 8464/C/2F | Original Q2

Question 2 (Low and Standard demand)

02.1 Just under one third of responses were correct. Correct responses were roughly equally divided between 'balance' and 'scales'. A large number of students stated 'scale' (singular) which is not equivalent to 'scales' and this terminology error resulted in no mark being awarded. The most common incorrect equipment given was 'measuring cylinder'.

02.2 The vast majority of students were able to read the scale correctly as 42.

02.3 Half of all students chose the correct response of concentration of hydrochloric acid.

02.4 The majority of students failed to recognise that the reaction would start immediately and that some gas would inevitably escape from the conical flask. They therefore answered in terms of an absolute such as 'to stop gas escaping' or 'prevent the gas escaping' rather than expressing the fact that the insertion of the bung would 'minimise' or 'reduce' the volume of gas lost. Consequently, less than 10% of students gained this mark.

02.5 Only a third of students knew the chemical name for limewater is calcium hydroxide solution. The most common incorrect response was sodium chloride solution.

02.6 Many students found completing the table difficult. Units were often listed against each number in the table rather than in the headings, although this was given credit if the headings were correct and all the values added to the table had the unit alongside them. Several responses mixed up minutes and seconds and often omitted at least one time or volume. Overall, however

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5.6.1.1 Calculating rates of reactions

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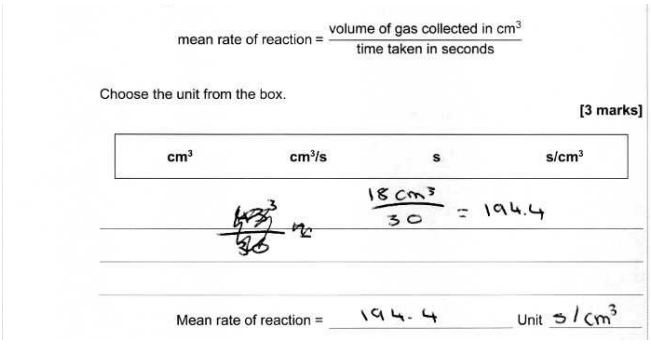
over three quarters of students still gained at least one mark and very few did not attempt the question.

02.7 This was well answered overall. Many students substituted the numbers into the given equation correctly although they sometimes struggled with the units.
A significant number unfortunately used 18^3 rather than 18 cm^3.



This student has substituted the numbers correctly into the given equation but has then carried out an incorrect calculation to arrive at their answer. They have used 18^3. Incorrect units have been chosen. Only the mark for substituting values into the equation can be credited.

02.8 Only about 20% of students could identify both reasons why increasing the concentration increases the rate of reaction. A large number of students included ' the particles move faster' in their response.