AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.4.2.1

Reactions of acids with metals

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**11**
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.

5.4.2.1 Reactions of acids with metals

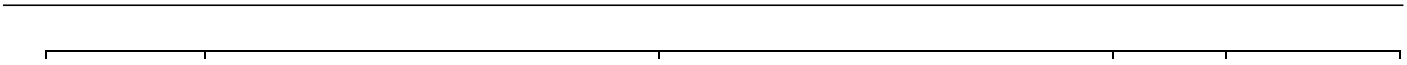
Answer 01 · Mark scheme June 2018 | 8464/C/1F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	H^+		1	AO1 5.4.2.4
03.2	nitric (acid) **or** HNO_3 zinc (oxide) **or** ZnO	this order only	1 1	AO2 5.4.2.3
03.3	dissolved in water		1	AO1 5.1.1.1
03.4	any value from 0 to less than 8		1	AO2 5.4.2.4
03.5	**Level 2:** The method would lead to the production of a valid outcome. Key steps are identified and 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 • add universal indicator **or** wide range indicator indicator turns blue / purple / violet (because pH = 14) **or** has highest pH **or** is an alkali so A is sodium hydroxide indicator turns red (because pH = 2) **or** has lowest pH **or** is an acid so B is phosphorus oxide indicator turns green (because pH = 7) **or** neutral so C is silicon dioxide • add solid to water A and B dissolve; C does not so C is silicon dioxide			5.1.2.3 5.4.2.4
Total			**9**	

5.4.2.1 Reactions of acids with metals

Answer 01 · Mark scheme

June 2018 | 8464/C/1F | Original Q3



5.4.2.1 Reactions of acids with metals

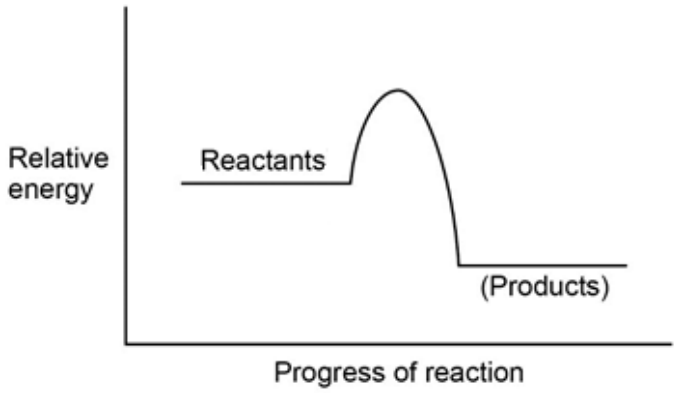
Answer 02 · Mark scheme June 2018 | 8464/C/1F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	(difference) sodium has one and chlorine has seven electrons in outer level / shell **or** number of electrons	number of electrons must be correct if quoted	1	AO2 5.1.1.7 5.1.2.1
	(similarity) both have three / same number of levels / shells **or** have electrons in third level / shell **or** both have incomplete (outer) levels / shells	allow both have 2 electrons in inner shell **or** both have 8 electrons in second shell **or** both are one electron away from full outer level / shell	1	
06.2		allow marks from suitable diagram(s)		AO1 5.2.1.2
	sodium (atom) loses	allow moves / transfers for loses do **not** accept sodium ion loses	1	
	one (outer shell electron)		1	
	chlorine (atom) gains	do **not** accept chloride	1	
	one (electron)		1	
		transfer of 1 electron from chlorine to sodium **max 2** marks		
		reference to sharing **or** covalent bonding **max 3** marks		

5.4.2.1 Reactions of acids with metals

Answer 02 · Mark scheme

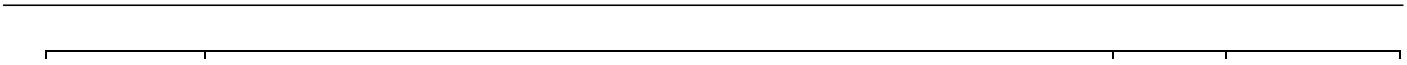
June 2018 | 8464/C/1F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3		ignore labels any curve / line going up and then down products line below reactants allow curve to start / finish anywhere along reactant / product lines	1 1	AO1 5.5.1.2
Total			**8**	

5.4.2.1 Reactions of acids with metals

Answer 02 · Mark scheme

June 2018 | 8464/C/1F | Original Q6



5.4.2.1 Reactions of acids with metals

Answer 03 · Mark scheme June 2019 | 8464/C/1F | Original Q6

06.1	Ca Mg Zn Cu		1	AO3 5.4.1.2

06.2	any **two** from: • mass (of metal / element) • surface area (of metal / element) • concentration (of acid) • volume (of acid) • temperature (of acid)	 allow weight ignore size ignore length ignore pH ignore strength ignore room temperature	2	AO3 5.4.1.2

06.3	(type of) metal / element		1	AO2 5.4.1.2

5.4.2.1 Reactions of acids with metals

06.4	(beryllium is) less reactive any **one** from: • greater attraction between nucleus and outer electrons • more energy is needed to remove electrons • loss of electrons is more difficult • outer electrons closer to nucleus • less shielding	allow converse answers for magnesium MP2 only if MP1 is correct allow higher in group allow reactivity increases down the group ignore reactivity series	1 1	AO3 5.1.2.3 5.1.2.5 5.4.1.2

5.4.2.1 Reactions of acids with metals

Answer 03 · Mark scheme

06.5	$\frac{50}{1000}$ (dm^3) = 0.05 (dm^3) ($\frac{3.2}{0.05}$) = 64 (g per dm^3) **alternative approach:** $\frac{3.2}{50}$ (1) = 0.064 (1) (× 1000) = 64 (g per dm^3) (1) **alternative approach**: $\frac{1000}{50}$ (1) = 20 (1) (× 3.2) = 64 (g per dm^3) (1)	an answer of 64 (g per dm^3) scores **3** marks an incorrect answer for one step does **not** prevent allocation of marks for subsequent steps an answer of 0.16 / 0.064 / 0.64 / 6.4 / 6.4 × 10^{-5} (g per dm^3) gains **2** marks	1 1 1	AO2 5.3.2.5
Total			**9**	

5.4.2.1 Reactions of acids with metals

Answer 03 · Mark scheme

June 2019 | 8464/C/1F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.4.2.1 Reactions of acids with metals

Answer 04 · 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

5.4.2.1 Reactions of acids with metals

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**

5.4.2.1 Reactions of acids with metals

Answer 04 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.

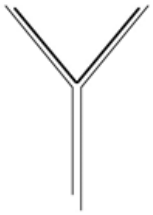
5.4.2.1 Reactions of acids with metals

Answer 05 · Mark scheme November 2020 | 8464/C/1F | Original Q1

01.1	1		1	AO1 5.4.2.4
01.2	hydrochloric acid		1	AO1 5.4.2.1 5.4.2.2
01.3	salt		1	AO1 5.4.2.1 5.4.2.2
01.4	sodium hydroxide		1	AO2 5.4.2.2
01.5	CuO		1	AO2 5.1.1.1
01.6	any **one** from: • increase the concentration of the acid • increase the surface area of the copper oxide • warm / heat the mixture	allow use powdered copper oxide ignore increase room temperature allow add catalyst ignore stir	1	AO1 5.4.2.2 5.4.2.3 RPA8
01.7	in excess		1	AO1 5.1.1.2 5.4.2.3 RPA8

5.4.2.1 Reactions of acids with metals

Answer 05 · Mark scheme

01.8			1	AO1 5.1.1.2 5.4.2.3 RPA8

01.9	crystallisation	allow evaporation	1	AO1 5.4.2.2 5.4.2.3 RPA8

Total			**9**

5.4.2.1 Reactions of acids with metals

Answer 05 · Mark scheme

November 2020 | 8464/C/1F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.4.2.1 Reactions of acids with metals

Answer 06 · Mark scheme

November 2021 | 8464/C/1F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	green to red		1	AO1 5.4.2.4
07.2	decreases		1	AO1 5.4.2.4
07.3	(aq)	allow aq ignore aqueous ignore HNO_3	1	AO1 5.2.2.2
07.4	any **two** from: • (white) solid disappears • fizzing **or** bubbles (of gas) **or** effervescence • (then) stops fizzing • (white) solid left at the end / bottom	 allow a gas is produced ignore colourless solution	2	AO3 5.4.2.2 5.4.2.3
07.5	$Zn(NO_3)_2$		1	AO2 5.1.1.1 5.4.2.2

Answer 06 · Mark scheme

November 2021 | 8464/C/1F | Original Q7

Question	Answers	Mark	AO / Spec. Ref.
07.6	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 5.4.2.2 5.4.2.3 RPA8
	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	
	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: • react hydrochloric acid • (with) copper oxide • in a suitable container • warm (hydrochloric) acid • add copper oxide • until is in excess **or** until solid remains • stir • filter excess copper oxide • pour solution / filtrate into evaporating basin • use of water bath **or** use of electric heater • to heat gently **or** partially evaporate • leave to cool / crystallise For level 3 the correct chemicals must have been selected.		
Total		**12**	

5.4.2.1 Reactions of acids with metals

Answer 07 · 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

5.4.2.1 Reactions of acids with metals

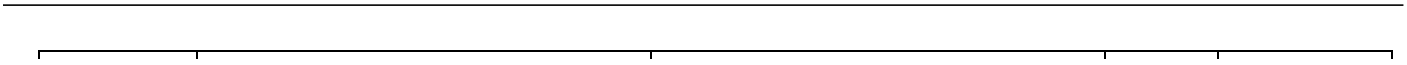
Answer 07 · Mark scheme

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**	

5.4.2.1 Reactions of acids with metals

Answer 07 · Mark scheme

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

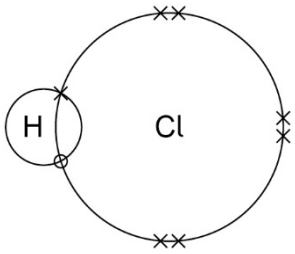


5.4.2.1 Reactions of acids with metals

Answer 08 · Mark scheme

June 2022 | 8464/C/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	one shared pair in overlap	allow any combination of circles, dots, crosses or $e^{(-)}$	1	AO1 5.1.2.6 5.2.1.4
	6 non-bonding electrons in outer shell of chlorine	do **not** accept extra electron(s) on outer shell of hydrogen ignore any inner shell electrons	1	
		an answer of  scores **2** marks		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	sodium chloride	allow NaCl	1	AO2 5.4.2.2

Answer 08 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	5.85 (g)		1	AO2 5.3.1.1 5.4.2.2 5.5.1.1 RPA10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	17.6 (°C)		1	AO2 5.4.2.2 5.5.1.1 RPA10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	exothermic (reaction)	allow neutralisation (reaction)	1	AO2 5.5.1.1 RPA10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	Na^+ OH^-		1 1	AO1 AO2 5.4.2.2 5.4.2.4 5.5.1.1

Total Question 2		**8**

5.4.2.1 Reactions of acids with metals

Answer 09 · Mark scheme

June 2022 | 8464/C/1F | Original Q7

Question 7

Question	Answers	Mark	AO / Spec. Ref.
07	**Level 3:** The method would lead to the production of a valid outcome. All 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	AO1
	No relevant content.	0	
	Indicative Content • measure volume of (hydrochloric) acid • into a suitable container eg polystyrene cup • measure the initial temperature (of hydrochloric acid) • with a thermometer • add stated mass of one metal • stir • measure the highest temperature reached of the solution **or** measure temperature reached after a set time period • determine the temperature difference • repeat • repeat for each metal • with same mass • in same physical state (powder, lump, etc) • with the same volume and / or concentration of (hydrochloric) acid • use results to arrange metals in order of reactivity • most reactive metal has the largest temperature change to access level 3 there must be an indication of how the temperature change is determined with the same mass of the 3 different metals reacted with the same volume of (hydrochloric) acid		5.1.4.2 RPA2

Total Question 7		**6**

5.4.2.1 Reactions of acids with metals

Answer 10 · Mark scheme

June 2024 | 8464/C/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	hydrogen		1	AO1 5.4.1.2 5.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	$MgCl_2(l)$		1	AO2 5.1.1.1 5.2.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	(negative electrode) magnesium	allow Mg	1	AO2 5.4.3.1 5.4.3.2
	(positive electrode) chlorine	allow Cl_2	1	
		allow **1** mark if both elements are reversed		

5.4.2.1 Reactions of acids with metals

Answer 10 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	(most reactive metal) magnesium (iron) copper (least reactive metal) any **two** from: • magnesium reacts with both copper chloride solution and iron chloride solution • iron only reacts with copper chloride solution • copper does not react with either magnesium chloride solution or iron chloride solution	 allow Mg allow Fe allow Cu allow magnesium has two / most reactions allow iron has one reaction allow copper does not react	 1 2	AO3 5.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	1.6 (g)		1	AO2 5.4.3.1 5.4.3.2

5.4.2.1 Reactions of acids with metals

Answer 10 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	(conversion 30.0 cm^3 =) 0.030 dm^3		1	AO2 5.3.2.5
	(mass =) 0.030 × 180	allow correct use of incorrect / no conversion of volume	1	
	= 5.4 (g)		1	
	OR			
	1000 cm^3 contains 180 g $MgCl_2$ (1)			
	30 cm^3 contains $\frac{180}{1000}$ × 30 (g) (1)			
	(30 cm^3 contains) 5.4 (g) (1)			
	OR			
	(ratio of volume $\frac{1000}{30}$ =) 33.3 (1)			
	(so ratio of mass) = $\frac{180}{33.3}$ (1)			
	= 5.4 (g) (1)			

Total Question 5	11

5.4.2.1 Reactions of acids with metals

Answer 11 · 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

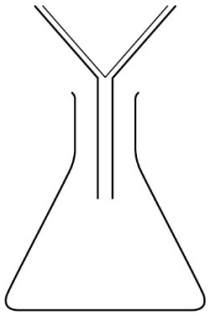
Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	H^+		1	AO1 5.4.2.4

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

5.4.2.1 Reactions of acids with metals

Answer 11 · Mark scheme

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

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

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

Total Question 5	**11**

5.4.2.1 Reactions of acids with metals

Answer 01 · Examiner comments June 2018 | 8464/C/1F | Original Q3

Question 3 (low & standard demand)

No reportable questions.

Answer 02 · Examiner comments

June 2018 | 8464/C/1F | Original Q6

Question 6 (standard demand)

06.1 This question discriminated well with 27% of students achieving some degree of credit. Many students did not consider the most obvious difference and similarity in the electronic structures of sodium and chlorine. Students often used the periodic table shown in the stem of the question to answer this question, but most of these students referred to periods or rows and groups or columns and so failed to gain any marks.

06.2 This question discriminated well. 23% of students achieved all four marks, often with concise statements about the transfer of the outer electron of sodium to chlorine.

Some students contradicted their description by mentioning covalent bonding, or the sharing of electrons, which restricted the number of marks they could attain. Poor expression and the use of incorrect terms were the main problem for most students. It was common to see the term ‘atom’ used instead of ‘electron’. 19% of students did not attempt to answer this question.

06.3 This question discriminated well. 26% of students achieved both marks; whereas 185 of students achieved a single mark. It was common for students to have incomplete reaction profile diagrams, by failing to include a horizontal line for the products.

Some students confused the two types of energy changes (endothermic and exothermic), while others provided a wide range of incorrect diagrams. Labels were ignored because they were not required to answer the question. 20% of students did not attempt to answer this question.

5.4.2.1 Reactions of acids with metals

Answer 06 · Examiner comments

November 2021 | 8464/C/1F | Original Q7

Question 7 (standard demand)

07.1 Approximately one quarter of students were able to give the colour change, 'green to red', as the observed change when nitric acid is added to a mixture of universal indicator and water.

07.2 Many students appeared to confuse the increase in acidity when nitric acid is added to water with an increase in pH, which proved to be a strong distractor.

07.3 Very few students were able to give (aq) as the state for a substance dissolved in water.

07.4 The required practical activity of making a soluble salt starts by reacting either an insoluble metal oxide or metal carbonate with an acid. The word equation was provided to help students with this question although many students found difficulty in making links between this and the resulting observations. Since carbon dioxide is produced, initial observations would be fizzing and white solid disappearing. Excess zinc carbonate would result in all the nitric acid reacting; fizzing would stop and excess solid would collect at the bottom. Just under one fifth of students gained a mark.

07.5 Zn_2NO_3 proved a more commonly seen response than $Zn(NO_3)_2$, the correct answer. Just under one quarter of students answered this correctly.

07.6 Students had difficulty in describing the essential steps of the method of making a soluble salt from an insoluble metal oxide and an acid. Most failed to select the correct chemicals, copper oxide and hydrochloric acid, without these the method would not lead to a valid outcome. Just under one third of students gave a level one answer and very few got into level two.

Answer 06 · Examiner comments

November 2021 | 8464/C/1F | Original Q7

Concluding Remarks

The demand of this paper was similar to those previously set for this specification. Students should note that two-mark questions require two answer points and so on.

15% of marks are based upon the required practical activities; students should question 'what and why' is happening in each step of these procedures. Answers should be chemically accurate, e.g. crystals are produced from salt solutions when the solution is heated (partially evaporated to produce a more concentrated solution) and then left to crystallise, rather than implying that 'all the water was evaporated'.

In chemistry 20% are marks are for questions assessing mathematical skills. In these questions, students should show their working for each step. If an error is made, such as an incorrect evaluation of values in the question, credit can be awarded for each correct step shown. Students should be encouraged to think about their answers; in **01.5** a small number gave percentages in excess of 100. In **01.7** students did not always disregard the anomalous result but were able to get a mark for the correct division of all four values. A few were unable to give the answer to two significant figures. In **02.6** students needed to use all the data provided and to use the ratio of volumes to evaluate the mass. In **04.4** a minority of students multiplied, rather than adding, the relative atomic masses. In **06.5** not all students used all the data provided to evaluate the relative atomic mass, a weighted mean of the mass numbers.

5.4.2.1 Reactions of acids with metals

Answer 06 · Examiner comments

November 2021 | 8464/C/1F | Original Q7

Mark Ranges and Award of Grades

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

5.4.2.1 Reactions of acids with metals

Answer 07 · 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 08 · Examiner comments — June 2022 | 8464/C/1F | Original Q2

Question 2 (Low demand)

02.1 More than a third of students correctly drew a dot and cross diagram for hydrogen chloride. The most commonly awarded mark was for the two shared electrons in the overlap between the atoms. Many failed to show that there are six unshared electrons.

02.2 Only 20% of students gained this mark for correctly identifying sodium chloride as one of the products of the reaction between hydrochloric acid and sodium hydroxide. The most common error was identifying the product as sodium chlorine. Some students also attempted to add other products to the equation.

02.3 Only 20% of students gained the mark for calculating the correct mass. Many students added the three masses together rather than recognising that in a reaction the mass of reactants equals the mass of products.

02.4 More than three-quarters of the students correctly read the temperature reading on the thermometer scale.

Answer 08 · Examiner comments — June 2022 | 8464/C/1F | Original Q2

02.5 Just under a quarter of students knew that when the temperature of a reaction increases an exothermic reaction is taking place. The most common error described the reaction as endothermic.

02.6 30% of students correctly identified that Na^+ and OH^- ions are present in sodium hydroxide.

5.4.2.1 Reactions of acids with metals

Answer 09 · Examiner comments

June 2022 | 8464/C/1F | Original Q7

Question 7 (Standard demand)

07 This question discriminated well with around 20% of students achieving level two or above. It was based upon Required Practical Activity 10. Students were asked to plan an investigation to find the order of reactivity of three metals using the temperature change recorded when each metal reacts with hydrochloric acid.

To access level 3, the method would need to lead to a valid outcome. This required students controlling variables such as the mass of metal and the volume of acid reacting, determining a temperature change having recorded the initial and final temperatures and repeating the method for each metal.

To access level 2 the method would not necessarily lead to a valid outcome. Common omissions were to add the metal to the acid before taking the initial temperature or failing to take the initial temperature altogether or not to control variables which would not ensure a fair test. Weaker responses could gain credit for either correctly identifying apparatus or for explaining the link between the expected results and the reactivity of the metal.

5.4.2.1 Reactions of acids with metals

Answer 09 · Examiner comments

June 2022 | 8464/C/1F | Original Q7

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

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

Answer 10 · Examiner comments

June 2024 | 8464/C/1F | Original Q5

Question 5 (low demand)

05.1 Just over two thirds of students knew that hydrogen gas is produced when a metal reacts with an acid. A quarter of students selected the distractor nitrogen.

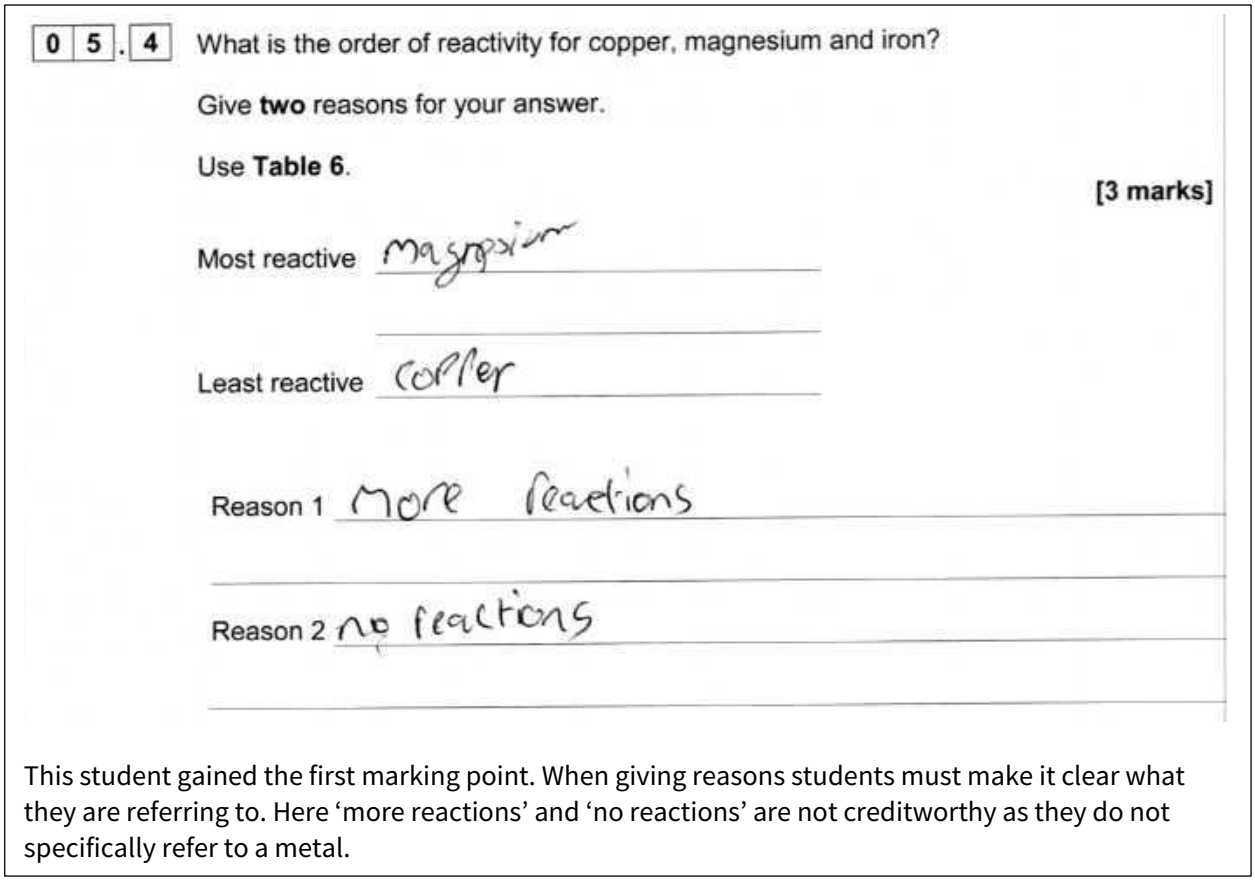
05.2 Nearly two-thirds of students knew molten magnesium chloride is a liquid, which is represented by the state symbol (l). A quarter of students incorrectly selected (g) as the state symbol.

05.3 10% of students gained both marks and students were awarded 1 mark if both elements were correct but reversed. Chlor*ide* is not creditworthy although was a common response.

Many students wrote the formula of the ions that were attracted to the electrodes rather than the element that is discharged. Nearly 20% of students did not attempt this question.

05.4 More than half of students gained 2 or 3 marks for correctly deducing the order of reactivity, with magnesium being the most reactive and copper the least reactive and giving one or two reasons. Students were able to give a reason associated with each metal eg iron only reacts with copper chloride solution or copper does not react.

Common incorrect responses included magnesium reacts with both metals (rather than both metal chloride solutions) or reasons which were not clearly linked to a metal (see example below).



0 5 . 4 What is the order of reactivity for copper, magnesium and iron?

Give **two** reasons for your answer.

Use **Table 6**.

[3 marks]

Most reactive magnesium

Least reactive copper

Reason 1 More reactions

Reason 2 no reactions

This student gained the first marking point. When giving reasons students must make it clear what they are referring to. Here 'more reactions' and 'no reactions' are not creditworthy as they do not specifically refer to a metal.

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5.4.2.1 Reactions of acids with metals

Answer 10 · Examiner comments June 2024 | 8464/C/1F | Original Q5

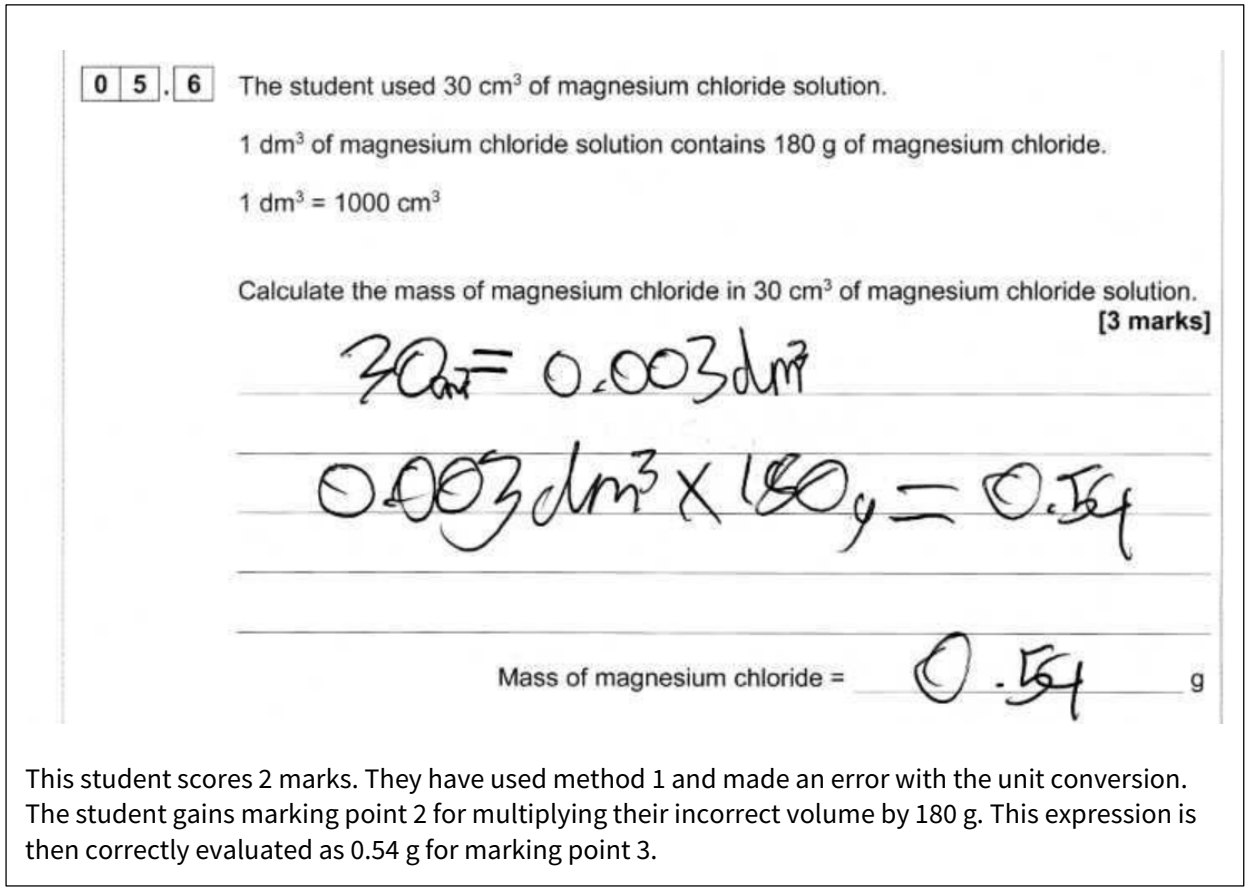
05.5 The law of conservation of mass states that the mass of reactants equals the mass of products. In this question a third of students correctly evaluated that the mass of iron oxide that reacts with 0.72 g of magnesium.

Common incorrect responses were 1.67 (multiplying 0.72 by 2.32) together with 3.2 and 0.31 (evaluated by dividing 2.32 by 0.72 or 0.72 by 2.32 respectively).

05.6 This question required a unit conversion as data is given in dm^3 and needed to be converted to cm^3. This conversion factor was given to lower the demand of the question.

Nearly 30% of students gained all 3 marks. Approximately 10% of students gained 2 marks usually for either not using the conversion factor, for multiplying rather than dividing by 1000 or for using an incorrect factor (eg dividing by 100 rather than 1000). A further 10% of students who gained 1 mark usually calculated the volume correctly in dm^3 but then did not multiply their answer by 180 g or used method 3 in the mark scheme and calculated the ratio of volume as 33.3 but then incorrectly multiplied this by 180 g.

17% of students did not attempt this question.



This student scores 2 marks. They have used method 1 and made an error with the unit conversion. The student gains marking point 2 for multiplying their incorrect volume by 180 g. This expression is then correctly evaluated as 0.54 g for marking point 3.

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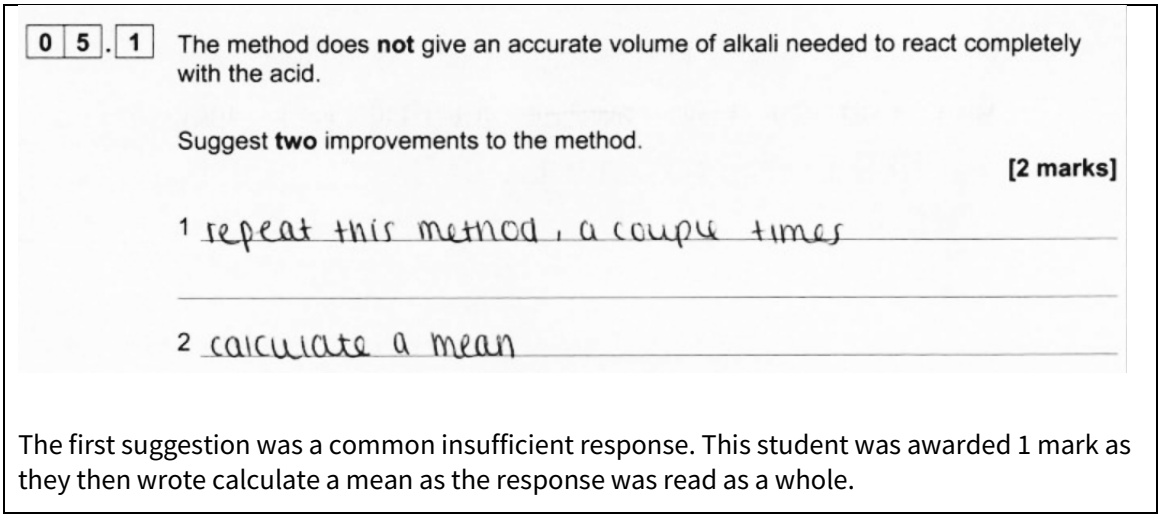
Answer 11 · Examiner comments

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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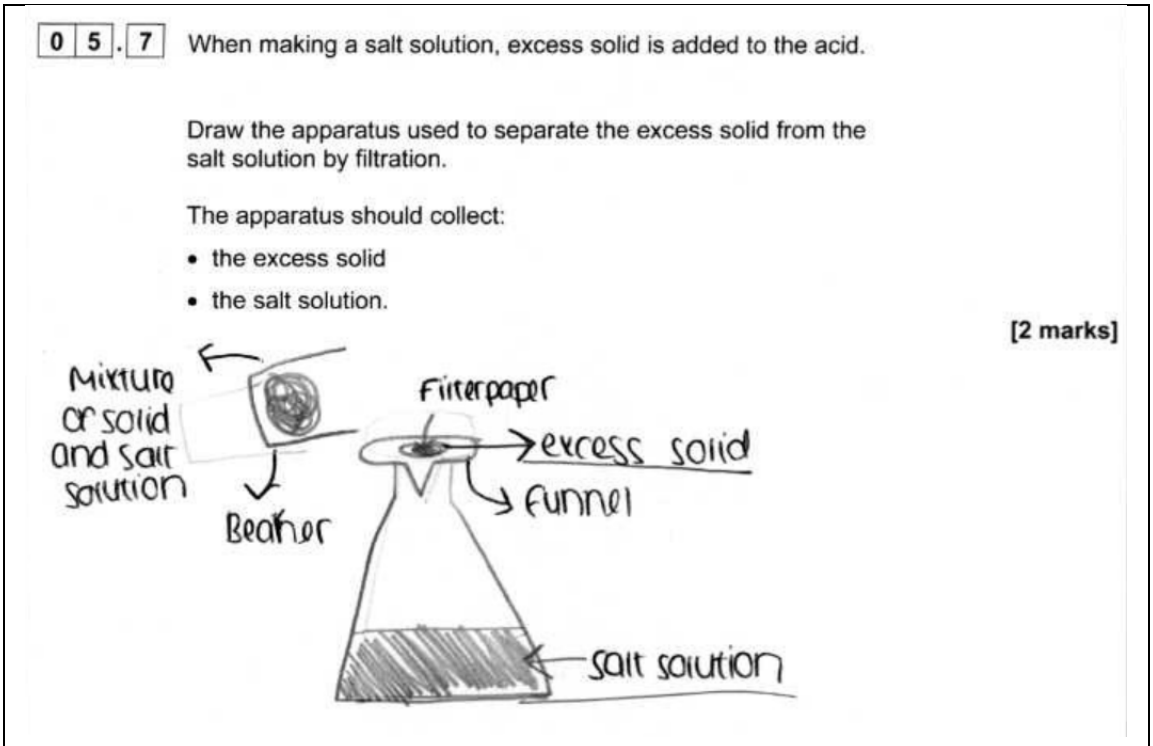
5.4.2.1 Reactions of acids with metals

Answer 11 · Examiner comments June 2025 | 8464/C/1F | Original Q5

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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