AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.4.2.1

Reactions of acids with metals

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**37**
Available paper years	**2007–2025**

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.

4.4.2.1 Reactions of acids with metals

Answer 01 · Mark scheme

March 2007 | CHY1A | Original Q7 | Legacy

Seven	**3**	**2**	**4**	**2**

Answer 02 · Mark scheme

June 2007 | CHY1A | Original Q2 | Legacy

Two	**A**	gold (Au)	**3**
	B	lithium (Li)	**4**
	C	calcium (Ca)	**1**
	D	sulfur (S)	**2**

4.4.2.1 Reactions of acids with metals

Answer 03 · Mark scheme

Question 3

question	answers	extra information	mark
(a)	gives out (heat)		1
(b)	D		1
(c)	L		1
(d)	magnesium chloride		1
total			4

4.4.2.1 Reactions of acids with metals

Answer 03 · Mark scheme January 2008 | CHY2F | Original Q3 | Legacy

CHY2F

Answer 04 · Mark scheme June 2008 | CHY1AP | Original Q2 | Legacy

Two	**A**	carbon dioxide	**3**
	B	smoke particles	**2**
	C	sulfur dioxide	**1**
	D	water vapour	**4**

Answer 05 · Mark scheme June 2008 | CHY2F | Original Q2 | Legacy

question	answers	extra information	mark
2(a)	any **two** from: • increases • until reaches maximum / levels off • quickly at first • then more slowly / rate decreases	 owtte allow 'goes up' owtte owtte allow reaction finished ignore rate increases	2
2(b)	use a more concentrated acid use zinc powder	list principle applies	2
Total			**4**

Answer 05 · Mark scheme June 2008 | CHY2F | Original Q2 | Legacy

COMPONENT NUMBER: CHY2F

COMPONENT NAME: Additional Science / Chemistry

STATUS: Final

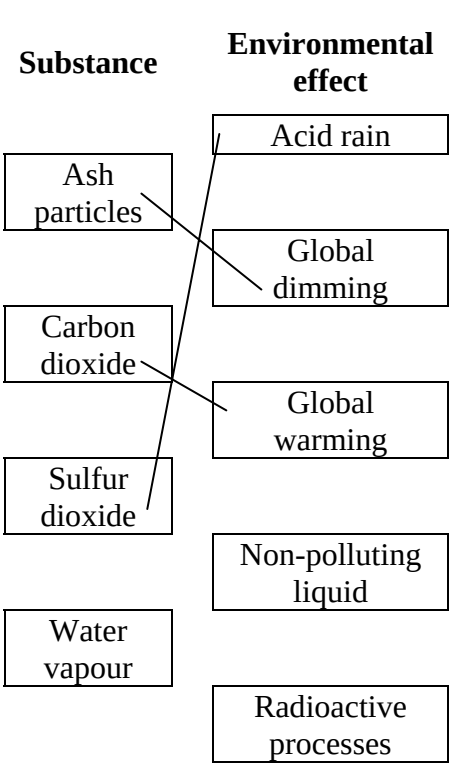
DATE: June 2008

4.4.2.1 Reactions of acids with metals

Answer 06 · Mark scheme

January 2019 | CHY1F | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)(i)	crust		1
3(a)(ii)	radioactive		1
3(b)		all three correct = **3** marks two correct = **2** marks one correct = **1** mark extra line from a statement cancels the mark	3
3(c)	any **one** from: • (tectonic) plates move • faults / plate boundaries • weaknesses in the (Earth's) crust	idea of movement is required	1
Total			**6**

4.4.2.1 Reactions of acids with metals

Answer 06 · Mark scheme January 2010 | CHY1F | Original Q3 | Legacy

CHY1F

Answer 07 · Mark scheme March 2010 | CHY1AP | Original Q1 | Legacy

Question	*Key*		
One	**A**	carbon dioxide	**3**
	B	particles	**2**
	C	sulfur dioxide	**1**
	D	water vapour	**4**

Answer 08 · Mark scheme June 2010 | CHY1AP | Original Q6 | Legacy

Six	**2**	**3**	**1**	**1**

4.4.2.1 Reactions of acids with metals

Answer 09 · Mark scheme

June 2019 | CHY1F | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)	acid rain → sulfur dioxide global warming → carbon dioxide global dimming → carbon particles		1 1 1
3(b)(i)	oxygen		1
3(b)(ii)	carbon monoxide		1
3(c)(i)	decreasing	accept running out / none left	1
3(c)(ii)	any **two** from: • world needs (more) energy • plentiful supply • (many) countries have coal • easy to find / extract • oil / gas is running out • cheap **or** cheaper than oil	it = coal accept population is increasing allow (greater) demand for coal / fuels / energy accept readily available allow coal will 'last longer' accept need to use less oil / gas accept need to use it to replace oil / gas	2
Total			**8**

4.4.2.1 Reactions of acids with metals

Answer 09 · Mark scheme

June 2010 | CHY1F | Original Q3 | Legacy

CHY1F

Answer 10 · Mark scheme

November 2010 | CHY1AP | Original Q5 | Legacy

Five	**A**	uses another metal	**3**
	B	does **not** use a chemical reaction	**2**
	C	could be done in a blast furnace	**4**
	D	is called electrolysis	**1**

	A	B	C	D

4.4.2.1 Reactions of acids with metals

Answer 11 · Mark scheme

Question 3

question	answers	extra information	mark
3(a)	diagram **A**		1
3(b)	the atoms can slide over each other. the atoms are in layers		1 1
3(c)(i)	sulfuric		1
3(c)(ii)	bubbles are produced the magnesium disappears		1 1
3(c)(iii)	crystallisation		1
Total			7

4.4.2.1 Reactions of acids with metals

Answer 11 · Mark scheme

January 2011 | CHY2F | Original Q3 | Legacy

CHY2F

4.4.2.1 Reactions of acids with metals

Answer 12 · Mark scheme

January 2011 | CHY3F | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)(i)	hydrogen		1
3(a)(ii)	partially		1
3(b)(i)	same size / mass / amount / length of magnesium (ribbon) **or** same concentration of acids	allow react for same time ignore repeats ignore volume / amount of acid	1
3(b)(ii)	bubbles / gas given off **or** magnesium disappears / dissolves / reacts slower with ethanoic acid **or** faster with hydrochloric acid		1 1
3(c)(i)	titration	allow titration identified in box if answer line blank	1
3(c)(ii)	burette		1
3(c)(iii)	(indicator) changed colour	allow solution changes colour but not vinegar ignore specific colours	1
Total			8

4.4.2.1 Reactions of acids with metals

Answer 12 · Mark scheme

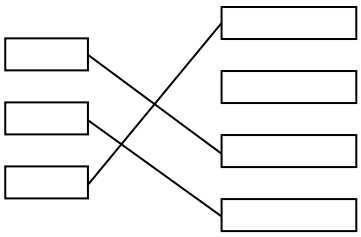
January 2011 | CHY3F | Original Q3 | Legacy

CHY3F

4.4.2.1 Reactions of acids with metals

Answer 13 · Mark scheme

January 2013 | CH1FP | Original Q2 | Legacy

question	answers	extra information	mark
2(a)			1 1 1
2(b)(i)	is on a tectonic plate boundary		1
2(b)(ii)	scientists cannot accurately predict when volcanic eruptions will occur		1
2(c)	global dimming acid rain	must be in this order	1 1
Total			**7**

4.4.2.1 Reactions of acids with metals

Answer 13 · Mark scheme

January 2013 | CH1FP | Original Q2 | Legacy

CH1FP

4.4.2.1 Reactions of acids with metals

Answer 14 · Mark scheme

June 2013 | CH2FP | Original Q6 | Legacy

Question 6

question	answers	extra information	Mark
6(a)	any **two** from: • effervescence / bubbles / fizzing • magnesium disappears / dissolves • heat given off / exothermic • change in pH	 allow gas / hydrogen is given off allow volume of gas allow magnesium floats allow change in mass of magnesium allow temperature change do **not** accept temperature decreases do **not** accept pH decreases	2

6(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5.		6
0 marks	**Level 1 (1-2 marks)**	**Level 2 (3-4 marks)**	**Level 3 (5-6 marks)**
No relevant content.	A simple plan without reference to changing any variable but should include an attempt at measuring rate **or** an attempt at fair testing	A plan including change of concentration / 'volume' of acid **and** should include an attempt at measuring rate **and / or** an attempt at fair testing	A workable plan including change of concentration **and** measurement of rate **and** fair testing

examples of chemistry points made in the response could include:

Plan:

- add magnesium to acid
- time reaction / 'count bubbles' / measure volume of gas
- change concentration / 'volume' of acid

Control Variables:

- amount / mass / length / same 'size' of magnesium
- volume / amount of acid

Total			8

4.4.2.1 Reactions of acids with metals

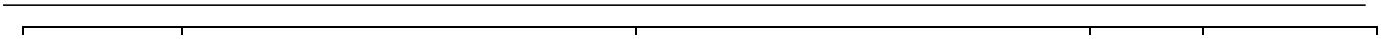
Answer 15 · Mark scheme June 2015 | CH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	sharing/covalent/metallic = max 2 sodium loses (electron) chlorine gains (electron) 1 **or** an (electron)		 1 1 1	**AO1/AO2** 2.1.1b,c,d, e,f
2(b)(i)	Have no overall electric charge		1	**AO1** 2.2.1a,c
2(b)(ii)	Should iodine be added to salt? reason: any **one** from: • cannot be done by experiment • based on opinion / view • ethical **or** economic issue	 accept difficult to get / not enough evidence allow must be done by survey	1 1	**AO3** 2.2.1
2(c)(i)	nitric (acid)		1	**AO1** 2.6.2b
2(c)(ii)	an alkali		1	**AO1** 2.6.2a
2(c)(iii)	indicator	accept any named acid base indicator	1	**AO1** 2.6.1b
2(d)(i)	Crystallisation		1	**AO1** 2.6.1c
2(d)(ii)	fertiliser	allow to help crops grow	1	**AO1** 2.6.2c
2(d)(iii)	any **one** from: • pressure • temperature • catalyst	 allow concentration ignore heat	1	**AO1** 2.2.5a
Total			**12**	

4.4.2.1 Reactions of acids with metals

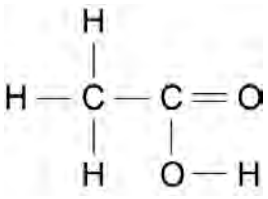
Answer 15 · Mark scheme

June 2015 | CH2FP | Original Q2 | Legacy



4.4.2.1 Reactions of acids with metals

Answer 16 · Mark scheme June 2016 | CH3FP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / SpecRef
5(a)(i)	fizz / effervescence / bubbles	allow calcium carbonate decreases in size or dissolves	1	AO2/AO3 3.4.1d, 3.6.2b
	because carbon dioxide produced / released	allow because gas produced / released	1	
	limewater turns cloudy / milky / white		1	
	because (a precipitate of or solid) calcium carbonate forms	allow because of carbon dioxide if not already credited	1	
5(a)(ii)		allow –OH do not allow lower case 'h'	1	AO1 3.6.2a
5(a)(iii)	acid	must be in this order ignore any name of an acid	1	AO1 3.6.2b
	ester(s)		1	
5(b)	white (precipitate) no change no change no change	all four correct 2 marks any two correct 1 mark	2	AO2 3.4.1e,f
5(c)(i)	lilac	must be in this order allow purple	1	AO1 3.4.1a
	red		1	
5(c)(ii)	colours are masked / changed by each flame colour		1	AO3 3.4.1a
Total			**12**	

4.4.2.1 Reactions of acids with metals

Answer 16 · Mark scheme

June 2016 | CH3FP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / SpecRef
6			6	2AO1 / 3AO2 / 1AO3 3.4.1g

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content.	There is a simple description of using some of the apparatus.	There is a description of an experimental method including addition of acid to alkali which may include an indicator or colour change and may include a measurement of volume.	There is a description of titrations that would allow a comparison to be made between the two solutions of hydrochloric acid.

examples of chemistry points made in the response could include:

- acid in burette **or** flask
- alkali/sodium hydroxide **or** acid in burette or flask
- volume of acid **or** alkali measured using the pipette
- indicator in flask
- white tile under the flask
- slow addition
- swirling/mixing
- colour change of indicator
- burette volume measured

Total		6

4.4.2.1 Reactions of acids with metals

Answer 17 · Mark scheme

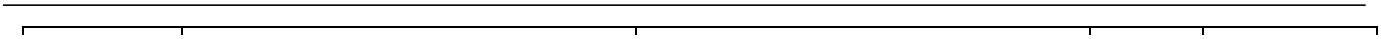
June 2017 | CH1FP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	magnesium oxide	allow MgO but must be correct formula do **not** allow extra products	1	AO2 1.1.3b
3(b)(i)	carbon	ignore C ignore any numbers eg 3 carbon	1	AO1 1.1.1b
3(b)(ii)	loss of oxygen	allow iron gains electrons do **not** allow loss of oxide do **not** allow iron oxide gains electrons	1	AO2 1.3.1d
3(b)(iii)	brittle soft alloys **or** steels		1 1 1	AO1 1.3.2a;b;c
Total			**6**	

4.4.2.1 Reactions of acids with metals

Answer 17 · Mark scheme

June 2017 | CH1FP | Original Q3 | Legacy



Answer 18 · Mark scheme

June 2018 | 8462/1F | Original Q8

The full source mark scheme begins on page 60. Follow original question 8 in that document.

4.4.2.1 Reactions of acids with metals

Answer 19 · Mark scheme June 2018 | 8462/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	83 (cm^3)	allow 83.0 / 83.00	1	AO2 4.6.1.2
07.2	mass of magnesium powder temperature of hydrochloric acid		1 1	AO1 4.6.1.2
07.3	$\frac{(46 + 47 + 49)}{3}$ = 47 (cm^3) (2 sf)	an answer of 47 (cm^3) scores **2** marks allow 47.3(333) (cm^3) for **1** mark an answer of 43 (cm^3) scores **1** mark	 1 1	AO2 4.6.1.1 4.6.1.2
07.4	all points plotted correctly (inc 0,0)	allow a tolerance of ± ½ a square allow ecf from question **07.3** ignore line allow **1** mark for four points plotted correctly	2	AO2 4.6.1.1 4.6.1.2
07.5	$\frac{80}{50}$ = 1.6 (cm^3/s)	an answer of 1.6 (cm^3/s) scores **2** marks allow 80 ± 2 allow 1.60 ± 0.04	 1 1	AO2 4.6.1.1
07.6	rate is greatest at start (then) rate decreases reaction stops	allow rate is faster at start allow (then) rate slows down	1 1 1	AO2 4.6.1.1 4.6.1.2

4.4.2.1 Reactions of acids with metals

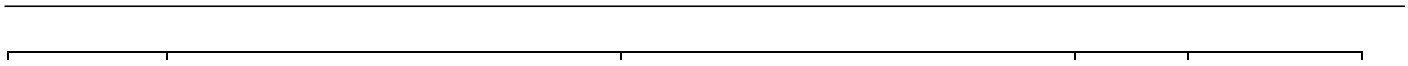
Answer 19 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.7	there are more particle collisions each second there are more particles in the same volume		1 1	AO1 4.6.1.3
07.8	(gas is) not carbon dioxide	ignore does not react with limewater	1	AO3 4.8.2.3
07.9	hydrogen pop sound	allow H_2	1 1	AO1 4.8.2.1
Total			**17**	

4.4.2.1 Reactions of acids with metals

Answer 19 · Mark scheme

June 2018 | 8462/2F | Original Q7



4.4.2.1 Reactions of acids with metals

Answer 20 · Mark scheme

June 2019 | 8462/2F | Original Q9

Question 9

Question	Answers	Mark	AO/ Spec. Ref
09.1	**Level 3**: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.8.2.3 4.8.3.1 4.8.3.3
	Level 2: The design/plan 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 design/plan 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 lithium: • crush tablets or dissolve tablet (in water or acid) • clean wire • place on wire • place in (roaring / blue / non-luminous) flame • observe flame colour • crimson flame carbonate: • add hydrochloric acid • effervescence / fizzing • bubble gas through limewater • limewater becomes cloudy		
09.2	formulation(s)	1	AO1 4.8.1.2

4.4.2.1 Reactions of acids with metals

Answer 20 · Mark scheme

09.3		an answer of 58.3333333 (%) correctly rounded to at least 2 significant figures scores **3** marks		AO2 4.8.1.2
	1.20 g = 1200 mg **or** 700 mg = 0.700 g		1	
	$\frac{700}{1200} \times 100$ **or** $\frac{0.700}{1.20} \times 100$	allow correct use of incorrectly or not converted values from step 1	1	
	= 58.3 (%)	allow 58.3333333 (%) correctly rounded to at least 2 significant figures	1	
Total			**10**	

4.4.2.1 Reactions of acids with metals

Answer 21 · Mark scheme

June 2019 | 8462/2F | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	(aq)	allow aqueous / aq	1	AO1 4.2.2.1 4.2.2.2
10.2	(gas) syringe stopclock / stopwatch	allow measuring cylinder (and water trough) allow balance allow timer / clock / watch	1 1	AO1 4.6.1.1
10.3	all points plotted correctly line of best fit	allow a tolerance of ± ½ a small square allow at least 3 points plotted correctly for **1** mark. allow correctly drawn line of best fit for incorrectly plotted points	2 1	AO2 4.6.1.1
10.4	(rate) decreases (rate decreases) more slowly as time increases (rate) becomes zero at 60 s	allow slows down allow (rate decreases) at a non-linear rate allow the reaction stops at 60 s allow ecf from question **10.3**	1 1 1	AO3 4.6.1.1
10.5	more bubbles were produced in the first 10 seconds the magnesium was used up more quickly		1 1	AO2 4.6.1.2
Total			**11**	

4.4.2.1 Reactions of acids with metals

Answer 22 · Mark scheme

November 2020 | 8462/1F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	nitric acid		1	AO2 4.4.2.2 RPA 1
07.2	zinc oxide		1	AO2 4.4.2.2 RPA 1
07.3	magnesium bromide		1	AO2 4.1.1.1
07.4		allow a tolerance of 1 cm^3 on volumes allow a tolerance of 0.2 on pH values		AO2 4.4.2.4
	(from 0) to 20 cm^3 the pH increases (gradually)	allow increase from pH 1 to pH 3	1	
	at 20 cm^3 the pH changes from pH 3 to pH 11	allow sudden / steep increase at 20 cm^3 allow sudden / steep increase from pH 3 to pH 11	1	
	from 20 cm^3 the pH increases (gradually)	allow (gradual) increase from pH 11 if no other marks awarded allow **1** mark for a description of the three stages with no values used.	1	

Question 7 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	20 (cm^3)	allow 20.0 (cm^3)	1	AO3 4.4.2.4
07.6	red		1	AO3 4.4.2.4
07.7	$\frac{0.06}{25(.0)} \times 100$ = 0.24 (%)		1 1	AO2 4.4.2.5
07.8	(pipette) measures volume more accurately **or** (pipette has a) smaller (percentage) uncertainty	allow (pipette is) more accurate	1	AO3 4.4.2.5 RPA 2
Total			**11**	

4.4.2.1 Reactions of acids with metals

Answer 23 · Mark scheme

November 2020 | 8462/1F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	they form ions with different charges		1	AO1 4.1.3.1 4.1.3.2
	they have high melting points		1	
09.2	the (grey) crystals are silver		1	AO3 4.4.1.2
	the copper ions (produced) are blue	allow the copper nitrate / compound (produced) is blue	1	
	(because) copper displaces silver		1	

4.4.2.1 Reactions of acids with metals

Answer 23 · Mark scheme

November 2020 | 8462/1F | Original Q9

Question 9 continued

Question	Answers	Mark	AO/ Spec. Ref
09.3	**Level 2:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	3–4	AO1 AO3 4.4.1.2 4.5.1.1 RPA 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 **Key steps** • add the metals to (dilute) hydrochloric acid • measure temperature change **or** compare rate of bubbling **or** compare colour of resulting solution for copper: • no reaction • shown by no temperature change **or** shown by no bubbles for magnesium and iron: • magnesium increases in temperature more than iron **or** magnesium bubbles faster than iron **or** magnesium forms a colourless solution and iron forms a coloured solution **Control variables** • same concentration / volume of hydrochloric acid • same mass / moles of metal • same particle size of metal • same temperature (of acid if comparing rate of bubbling)		

4.4.2.1 Reactions of acids with metals

Answer 23 · Mark scheme

November 2020 | 8462/1F | Original Q9

Question 9 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	$\frac{(203 \times 30) + (205 \times 70)}{100}$ **or** $\frac{6090 + 14\,350}{100}$ = 204.4	 ignore units	1 1	AO2 4.1.1.6
Total			**11**	

4.4.2.1 Reactions of acids with metals

Answer 24 · Mark scheme November 2021 | 8462/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	$\frac{54 + 50 + 55}{3}$ = 53 (°C)	if no other mark awarded allow **1** mark for $\frac{54 + 50 + 37 + 55}{4}$ = 49 (°C)	1 1	AO3 AO2 4.4.1.2 4.5.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	(most reactive) magnesium zinc (least reactive) cobalt	allow ecf from question **04.1**	1	AO3 4.4.1.2 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	(18 ±) 2 (°C)		1	AO2 4.3.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	control		1	AO1 4.4.1.2 4.5.1.1 RPA4

4.4.2.1 Reactions of acids with metals

Question 4 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	use the same mass of metal / powder		1	AO3 4.4.1.2 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	(A) progress of reaction (B) activation energy (C) products		1 1 1	AO1 4.5.1.2

Total			**9**

4.4.2.1 Reactions of acids with metals

Answer 25 · Mark scheme

November 2021 | 8462/1F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	48 (cm^3)		1	AO2 4.4.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	(change in y =) 70 (cm^3) (change in x =) 0.4 (g) (gradient =) $\frac{70}{0.4}$ = 175 (cm^3/g)	 allow correct use of incorrectly derived values for change in y and / or change in x 	1 1 1 1	AO2 4.4.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	hydrochloric acid		1	AO2 4.4.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	carbon dioxide		1	AO1 4.4.2.2

Question 6 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	to evaporate water		1	AO1 4.4.2.3 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	using a (boiling) water bath **or** using an electric heater		1	AO1 4.4.2.3 RPA1

Total			**9**

4.4.2.1 Reactions of acids with metals

Answer 26 · Mark scheme

November 2021 | 8462/2F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	(diagram) gas syringe **or** inverted measuring cylinder over water		1	AO3 4.6.1.2 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	(error) (delivery) tube is in (sulfuric) acid (problem) (sulfuric) acid will travel up tube **or** no hydrogen / gas will be collected		1 1	AO3 4.6.1.2 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	line of best fit	must include 0, 0	1	AO2 4.6.1.1 4.6.1.2 RPA5

4.4.2.1 Reactions of acids with metals

Question 5 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	(volume of gas =) 45 (cm^3)	allow a tolerance of ± ½ a small square allow volume from drawn curve	1	AO2 4.6.1.1 4.6.1.2 RPA5
	(rate =) $\frac{45}{60}$	allow correct use of incorrectly determined volume at 60 seconds	1	
	= 0.75		1	
	cm^3/s		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	the line of best fit for higher concentration would have a steeper slope		1	AO1 4.6.1.1 4.6.1.2 RPA5

Total			**9**

4.4.2.1 Reactions of acids with metals

Answer 27 · Mark scheme

June 2022 | 8462/1F | Original Q3

Question 3

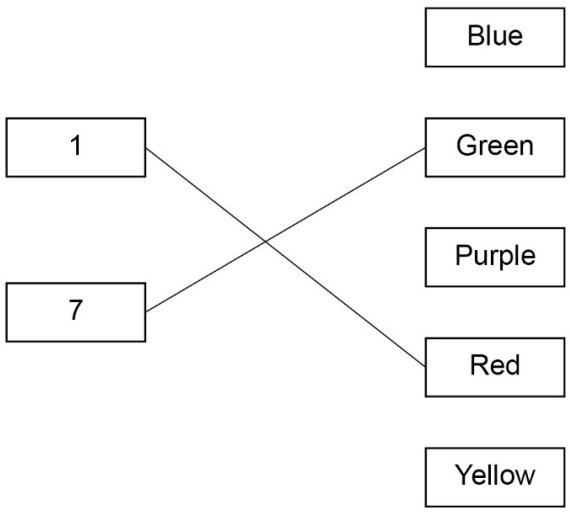
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	B		1	AO3 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	C		1	AO3 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	zinc (oxide) sulfuric (acid)	allow ZnO allow H_2SO_4	1 1	AO2 4.4.2.2

4.4.2.1 Reactions of acids with metals

Answer 27 · Mark scheme June 2022 | 8462/1F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	**pH** / **Colour of universal indicator**  do **not** accept more than one line from a box on the left		1 1	AO1 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	neutralisation		1	AO1 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	burette		1	AO1 4.4.2.5 RPA2

Total Question 3		**8**

4.4.2.1 Reactions of acids with metals

Answer 28 · Mark scheme

June 2022 | 8462/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	hydrogen		1	AO1 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	length of magnesium ribbon		1	AO2 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	any **one** from: • volume of (hydrochloric) acid • concentration of (hydrochloric) acid • width / thickness of magnesium ribbon	allow temperature of (hydrochloric) acid allow temperature of solution	1	AO3 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	(trial) 1	allow 19 (cm^3)	1	AO3 4.4.2.1

4.4.2.1 Reactions of acids with metals

Answer 28 · Mark scheme

June 2022 | 8462/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	any **one** from: • some gas escaped before the stopper was put in • apparatus leaked • reaction not finished (when reading taken) • less than 25cm^3 of (hydrochloric) acid used • magnesium (ribbon) not long enough	allow the stopper was not replaced quickly enough	1	AO3 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6 **View with Figure 8**	all six points correctly plotted line of best fit	allow a tolerance of ± ½ a small square allow **1** mark for four or five points correctly plotted	2 1	AO2 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	increases		1	AO2 4.4.2.1

Total Question 5		**9**

4.4.2.1 Reactions of acids with metals

Answer 29 · Mark scheme

June 2023 | 8462/1F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	Fe_2O_3 + 3 C → **2** Fe + **3** CO	allow multiples allow **1** mark for 2 Fe **or** allow **1** mark for 3 CO	2	AO2 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	(iron oxide) loses oxygen	ignore references to gain of electrons	1	AO2 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	(M_r =) (2 × 56) + (3 × 16) = 160	allow 112 + 48	1 1	AO2 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	(percentage atom economy =) $\frac{63.5}{2 + 79.5} \times 100$ = 77.9 (%)	 allow 77.914110 (%) correctly rounded to at least 2 significant figures	1 1	AO2 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	any **one** from: • colour change (in solution) • colour change (in metal) • change of temperature	 allow bubbles	1	AO3 4.1.1.1 4.4.1.2

4.4.2.1 Reactions of acids with metals

Answer 29 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	(most reactive) **D** **B** **A** (least reactive) **C** (reason) more reactive (metals) displace less reactive (metals)	 allow **D** has most (displacement) reactions **and C** does not react allow the more reactive metals have more (displacement) reactions	1 1	AO3 4.4.1.2

Total Question 8	**10**

4.4.2.1 Reactions of acids with metals

Answer 30 · Mark scheme

June 2023 | 8462/1F | Original Q11

Question 11

Question	Answers	Mark	AO/ Spec. Ref
11.1	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 4.4.2.2 4.4.2.3 RPA1
	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 • use zinc carbonate and hydrochloric acid • **add zinc carbonate to the (hydrochloric) acid** • in a beaker • stir • **continue adding until the zinc carbonate is in excess** • shown by excess solid • and no more effervescence • **filter (the reaction mixture)** • to remove the excess zinc carbonate • **heat the solution** • using a water bath or electric heater • to crystallisation point • **leave the solution to crystallise** • pat crystals dry with filter paper		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.2	any **two** from: • zinc • zinc oxide • zinc hydroxide	allow Zn allow ZnO allow $Zn(OH)_2$	2	AO2 4.4.2.3

Total Question 11	8

4.4.2.1 Reactions of acids with metals

Answer 31 · Mark scheme

June 2023 | 8462/2F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	to reduce the escape of gas		1	AO3 4.6.1.1 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	(mean rate =) $\frac{0.78 + 0.81 + 0.81}{3}$	allow $\frac{0.78 + 0.81 + 0.68 + 0.81}{4}$	1	AO3
	0.80 (cm^3/s)	= 0.77 (cm^3/ s) for **1** mark	1	AO2
	$0.80 = \frac{20}{\text{mean time taken}}$	allow correct use of incorrectly determined mean rate	1	AO2
	(mean time taken =) $\frac{20}{0.80}$		1	AO2
	= 25 (s)		1	AO2 4.6.1.1 RPA5
	alternative approach: $0.78 = \frac{20}{\text{time}}$ **or** $0.81 = \frac{20}{\text{time}}$ (1)			
	(trial 1 time = $\frac{20}{0.78}$ =) 25.6 (1)			
	(trial 2 and 4 time = $\frac{20}{0.81}$ =) 24.7 (1)			

	(mean time =) $\frac{25.6 + (2 \times 24.7)}{3}$ (1) = 25 (s) (1)	allow correct use of incorrectly determined value(s) for time allow $\frac{25.6 + 29.4 + (2 \times 24.7)}{4}$ = 26.1 (s) for **1** mark		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	use a lower temperature use sulfuric acid of a lower concentration		1 1	AO1 4.6.1.2 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	(test) burning / lit splint (result) burns with a (squeaky) pop sound	MP2 is dependent upon MP1 being awarded allow flame do **not** accept glowing splint allow pops	 1 1	AO1 4.8.2.1

Total Question 8	10

4.4.2.1 Reactions of acids with metals

Answer 32 · Mark scheme

June 2023 | 8462/2F | Original Q10

Question 10

Question	Answers	Mark	AO/ Spec. Ref
10.1	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 4.8.3.1 4.8.3.4 RPA7
	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 (potassium ions) • **place sample on (clean metal) wire** • **introduce into (blue / non-luminous) flame** • using (Bunsen) burner • **observe lilac flame colour** • which shows presence of potassium (ions) (bromide ions) • **dissolve sample** • in (distilled) water • in test tube • add (dilute) nitric acid • **add silver nitrate (solution)** • using (dropping) pipette • **observe cream precipitate (formed after addition of silver nitrate solution)** • which shows presence of bromide (ions)		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	flame emission spectroscopy		1	AO1 4.8.3.7

4.4.2.1 Reactions of acids with metals

Answer 32 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	any **one** from: • (more) accurate • (more) sensitive • fast(er) • determine the concentration of ions present	allow requires a small(er) sample	1	AO1 4.8.3.6

Total Question 10	**8**

4.4.2.1 Reactions of acids with metals

Answer 33 · Mark scheme

June 2024 | 8462/1F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	copper sulfate water	allow $CuSO_4$ allow H_2O	1 1	AO2 AO1 4.4.2.2 4.4.2.3 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	solid remains (in the mixture) **or** no more effervescence / bubbles / fizzing	ignore references to colours allow copper carbonate remains (in the mixture)	1	AO1 4.4.2.3 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	to remove copper carbonate	allow to remove excess (copper carbonate)	1	AO1 4.1.1.2 4.4.2.3 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	electric heater **or** water bath	ignore Bunsen burner	1	AO1 4.4.2.3 RPA1

4.4.2.1 Reactions of acids with metals

Answer 33 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	$92.8 = \frac{\text{mass produced}}{12.5} \times 100$	allow mass produced = $\%\text{ yield} \times \frac{\text{max theoretical mass}}{100}$	1	AO2 4.3.3.1
	(mass produced) = $\frac{92.8}{100} \times 12.5$		1	
	= 11.6 (g)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	(copper) does not react with (sulfuric) acid	allow is unreactive allow will not displace hydrogen allow is below hydrogen in the reactivity series ignore is not reactive enough	1	AO1 AO3 4.4.1.2 4.4.2.3
	(sodium) could explode **or** could get too hot	allow (the reaction is) dangerous	1	

Total Question 8	10

4.4.2.1 Reactions of acids with metals

Answer 34 · Mark scheme

June 2024 | 8462/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	increases		1	AO3 4.9.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	(mass =) $\frac{7000}{3000}$ = 2.33 (kg)	 allow 2.333333 correctly rounded to at least 2 significant figures	1 1	AO2 4.9.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	rain		1	AO1 4.9.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	five points plotted correctly line of best fit	allow a tolerance of ± ½ a small square allow three or four points plotted correctly for **1** mark	2 1	AO2 4.9.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	increases		1	AO3 4.9.3.2

4.4.2.1 Reactions of acids with metals

Answer 34 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	dimming		1	AO1 4.9.3.2

Total Question 2	**9**

4.4.2.1 Reactions of acids with metals

Answer 35 · Mark scheme

June 2024 | 8462/2F | Original Q9

Question 9

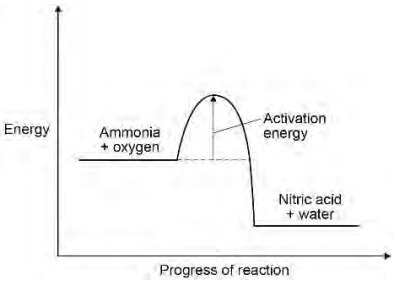
Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	to recycle (remaining) nitrogen and hydrogen	allow to recycle unreacted gases allow to return nitrogen and hydrogen to the reactor	1	AO1 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	iron	allow Fe	1	AO1 4.6.1.4 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	(test) glowing splint (result) (splint) relights	 MP2 is dependent upon MP1 being awarded	 1 1	AO1 4.8.2.2

4.4.2.1 Reactions of acids with metals

Answer 35 · Mark scheme June 2024 | 8462/2F | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	labelled vertical arrow from dotted line to peak ammonia **and** oxygen on left **and** nitric acid **and** water on right	ignore arrow heads allow NH_3 for ammonia allow O_2 for oxygen allow HNO_3 for nitric acid allow H_2O for water an answer of  scores **2** marks	1 1	AO2 4.6.1.4 4.10.4.1 4.10.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	the line would reach a higher peak		1	AO1 4.6.1.4 4.10.4.1 4.10.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	fertilisers	allow explosives allow sports injury packs	1	AO3 4.10.4.1 4.10.4.2

Total Question 9	**8**

4.4.2.1 Reactions of acids with metals

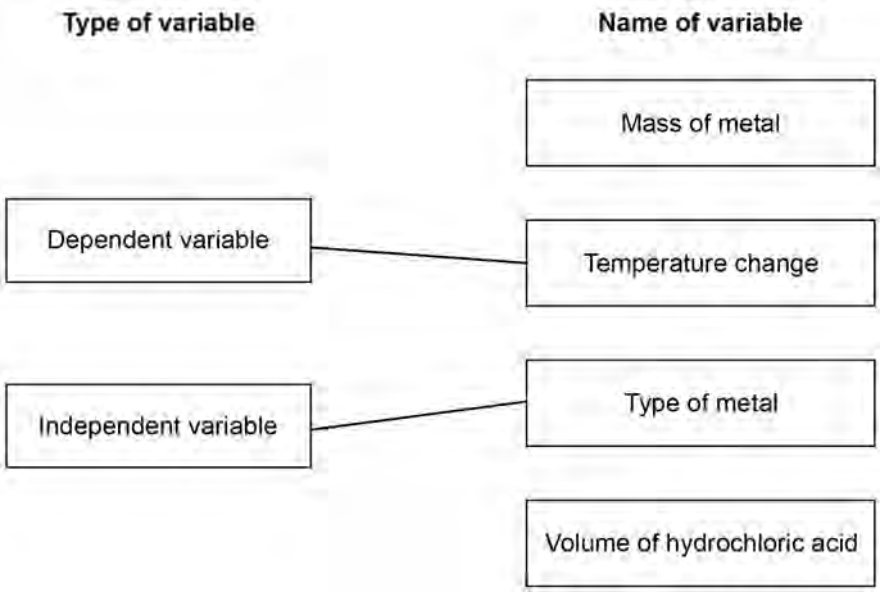
Answer 36 · Mark scheme

June 2025 | 8462/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	magnesium chloride		1	AO2 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	hydrogen		1	AO1 4.4.2.1

Question	Answers	Mark	AO / Spec. Ref.
02.3	 do **not** accept more than one line from a box on the left	1 1	AO1 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	a polystyrene cup		1	AO3 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	2 °C		1	AO3 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	increases		1	AO1 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	**A**		1	AO1 4.5.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	**C**		1	AO1 4.5.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.9	**B**		1	AO1 4.5.1.2

Total Question 2	10

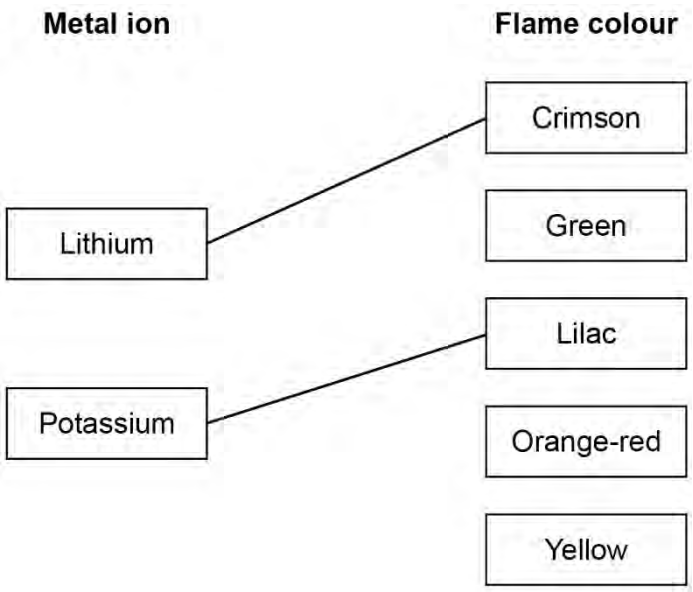
4.4.2.1 Reactions of acids with metals

Answer 37 · Mark scheme

June 2025 | 8462/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	put sample on (metal) wire hold wire in (blue / non-luminous) flame	ignore references to cleaning	1 1	AO1 4.8.3.1 RPA7

Question	Answers	Mark	AO / Spec. Ref.
01.2	 do **not** accept more than one line from a box on the left	1 1	AO1 4.8.3.1 RPA7

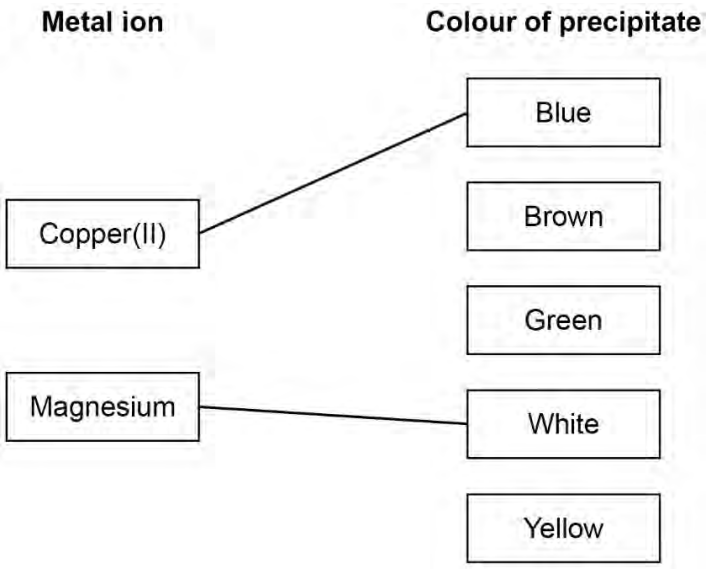
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	carbon dioxide		1	AO1 4.8.3.3

4.4.2.1 Reactions of acids with metals

Answer 37 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	barium chloride solution		1	AO1 4.8.3.5 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	solid		1	AO1 4.2.2.1 4.8.3.5

Question	Answers	Mark	AO / Spec. Ref.
01.6	 do **not** accept more than one line from a box on the left	1 1	AO1 4.8.3.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	yellow		1	AO1 4.8.3.4

Total Question 1	10

4.4.2.1 Reactions of acids with metals

AQA

GCSE
CHEMISTRY

8462/1F - PAPER 1 FOUNDATION TIER

Mark scheme

8462

June 2018

Version/Stage: 1.0 Final

4.4.2.1 Reactions of acids with metals

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

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Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. Full marks can, however, be given for a correct numerical answer, without any working shown.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ecf in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do not accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this.

The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

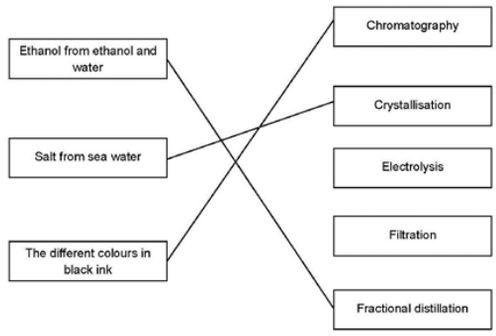
Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do **not** have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1			1 1 1	AO1 4.1.1.2
01.2	include a (filter) funnel	allow funnel drawn on the diagram ignore clamp stand	1	AO3 4.1.1.2
01.3	evaporate condense	must be this order	1 1	AO1 4.1.1.2
01.4	$\frac{2}{20} \times 100$ = 10 (%)	an answer of 10 (%) scores **2** marks an answer of 11.1(%) **or** 90 (%) scores **1** mark	1 1	AO2 4.2.2.7
01.5	an alloy		1	AO1 4.2.2.7
01.6	the layers in the mixture are distorted		1	AO1 4.2.2.7

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	8000 nm^3		1	AO2 4.2.4.1
Total			**11**	

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	7		1	AO1 4.1.2.6
02.2	small molecule		1	AO2 4.1.2.6 4.2.2.4
02.3	F_2		1	AO1 4.1.1.1 4.1.2.6
02.4	the reactivity decreases (going down Group 7) (because) chlorine displaces bromine and iodine (and) bromine displaces iodine **or** iodine does not react	allow the reactivity decreases from chlorine to iodine allow (because) chlorine has two reactions allow (because) neither bromine nor iodine can displace chlorine allow (and) bromine has one reaction **or** iodine has no reactions allow (and) iodine cannot displace bromine	1 1 1	AO1 4.1.2.6 AO3 4.1.2.6 AO3 4.1.2.6
02.5	80		1	AO2 4.3.1.2

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	(1.2 kg =) 1200 (g) **or** (900 g =) 0.9 (kg)	an answer of 75 (%) scores **2** marks	1	AO2 4.3.3.1
	$(\frac{900}{1200} \times 100) = 75(\%)$ **or** $(\frac{0.9}{1.2} \times 100) = 75(\%)$	allow an answer correctly calculated from: $(\frac{900}{\text{incorrect attempt at conversion of 1.2}} \times 100)$ **or** $(\frac{\text{incorrect attempt at conversion of 900}}{1.2} \times 100)$	1	
Total			**9**	

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	nucleus neutron neutron electron proton	must be in this order	1 1 1 1 1	AO1 4.1.1.3 4.1.1.4 4.1.1.5
03.2	(A_r) $\frac{(63 \times 70) + (65 \times 30)}{100}$ = 63.6	an answer of 63.6 scores **2** marks	1 1	AO2 4.1.1.6
03.3	copper / Cu	allow ecf from answer to question **03.2**	1	AO2 4.1.1.1
03.4	$\frac{1.2 \times 10^{-10}}{10\,000}$ **or** $1.2 \times 10^{-10} \times 1 \times 10^{-4}$ $= 1.2 \times 10^{-14}$ (m)	an answer of 1.2×10^{-14} (m) scores **2** marks a correct answer not in standard form scores **1** mark	1 1	AO2 4.1.1.5
Total			**10**	

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	3.6 (cm^3)		1	AO2 4.4.3.4
04.2	hydrogen line only		1	AO3 4.4.3.4
04.3	both lines		1	AO3 4.4.3.4
04.4	graphite has delocalised electrons		1	AO1 4.2.3.2
04.5	**cathode** zinc (1) **anode** chlorine (1) hydrogen (1) bromine (1)	do **not** accept chloride allow **1** mark if chlorine and zinc the wrong way around do **not** accept bromide allow **1** mark if bromine and hydrogen the wrong way around	1+1 1+1	AO2 4.4.3.2 4.4.3.4
Total			**8**	

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	gas		1	AO1 4.2.2.2
05.2	the gas escapes	allow carbon dioxide escapes do **not** accept references to evaporation	1	AO1 4.3.1.3
05.3	5.12 (g)		1	AO2 4.3.1.3
05.4	4.00 (g) trial 1	allow 2.89 written in either space, or ringed in the table, unless contradicted by mass of copper carbonate or trial number	1	AO3 4.3.1.3
05.5	reheat (and reweigh) until constant mass	 an answer of heat to constant mass scores **2** marks if no other mark scored allow for **1** mark heat for longer **or** (heat at a) higher temperature **alternative approach**: (1) continue heating and pass gas through limewater (1) until the (lime)water stops bubbling **or** until the limewater no longer turns cloudy	1 1	AO3 4.3.1.3

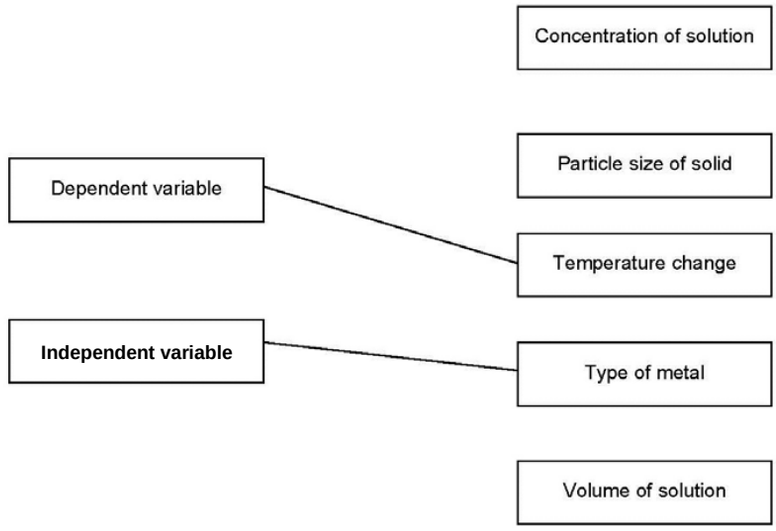
4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	straight line of best fit	must touch at least 5 of the 6 plots	1	AO2 4.3.1.3
05.7	correct value read from line of best fit in Figure 8	allow tolerance of ± ½ small square	1	AO2 4.3.1.3
05.8	(mass =) $168 \times \frac{\text{answer from question } \mathbf{05.7}}{8.4}$	a correctly calculated value from their answer to question **05.7** scores **2** marks allow (mass =) answer from question **05.7** × 20	1	AO2 4.3.1.3
	correctly calculated value (g)		1	
Total			**10**	

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	 allow **one** mark if answers are reversed		1 1	AO1 4.5.1.1
06.2	polystyrene is a better insulator		1	AO3 4.5.1.1
06.3	both bars labelled both bars correctly plotted	 allow tolerance of ± ½ small square ignore width and spacing of bars if no other mark scored, allow **1** mark for any one bar correctly plotted and labelled	1 1	AO2 4.5.1.1

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	temperature increases **or** temperature does not decrease	ignore because it is exothermic allow (because) energy / 'heat' is transferred to the surroundings energy / 'heat' is not taken in from the surroundings allow the energy of the products is less than the energy of the reactants	1	AO3 4.5.1.1
06.5	(most reactive) magnesium (zinc) nickel	this order only	1	AO3 4.5.1.1 4.4.1.2
06.6	suitable method described the observations / measurements required to place in order an indication of how results would be used to place the unknown metal in the reactivity series **approaches that could be used:** **approach 1:** add the unknown metal to copper sulfate solution (1) measure temperature change (1) place the metals in order of temperature change (1)		1 1 1	AO3 4.4.1.2 4.5.1.1

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6 cont.	**approach 2:** add the metal to salt solutions of the other metals **or** heat the metal with oxides of the other metals (1) measure temperature change (only if salt solutions used) **or** observe whether a chemical change occurs (1) compare temperature change or whether there is a reaction to place in correct order (1) **approach 3:** add all of the metals to an acid (1) measure temperature change or means of comparing rate of reaction (1) place the metals in order of temperature change or rate of reaction (1) **approach 4:** set up electrochemical cells with the unknown metal as one electrode and each of the other metals as the other electrode (1) measure the voltage of the cell (1) place the metals in order of voltage (1)			
06.7	D		1	AO1 4.5.1.2
06.8	C		1	AO1 4.5.1.2
Total			**12**	

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	sodium oxide	allow Na_2O	1	AO2 4.1.1.1 4.1.2.5 4.4.1.1
07.2	oxidation		1	AO1 4.4.1.1
07.3	13		1	AO1 4.4.2.4
07.4	sodium hydroxide		1	AO2 4.1.1.1
07.5	OH^-		1	AO1 4.4.2.4
07.6	(volume =) $\frac{250}{1000}$ or ¼ or 0.25 (dm^3) **or** (mass per cm^3 =) $\frac{40}{1000}$ (g) or 0.04 (g) ($\frac{250}{1000}$ × 40 =) 10 (g)	an answer of 10 (g) scores **2** marks	1 1	AO2 4.3.2.5

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.7	all points correct	allow a tolerance of ± ½ a small square allow **1** mark for 3 points correct ignore any attempt at a line of best fit	2	AO2 4.1.2.5
07.8	39 (°C)	allow any value from 34 to 46 (°C)	1	AO2 4.1.2.5
Total			**10**	

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	any **one** from: • metal • (metal) hydroxide • (metal) carbonate • alkali	allow named example allow correct formula ignore base allow ammonium hydroxide allow ammonium carbonate allow soluble base allow ammonia	1	AO1 4.4.2.1 4.4.2.2 4.4.2.3
08.2	$Ca(NO_3)_2$	allow $Ca^{2+}(NO_3^-)_2$	1	AO2 4.4.2.2

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Mark	AO / Spec. Ref.
01.3	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.4.2.3
	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 • use magnesium oxide and sulfuric acid • add sulfuric acid to a beaker • warm sulfuric acid • add magnesium oxide • stir • continue adding until magnesium oxide is in excess • filter • using a filter paper and funnel • to remove excess magnesium oxide • heat solution in an evaporating basin • to crystallisation point • leave to crystallise • pat dry with filter paper credit may be given for diagrams		
Total		**8**	

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	FeS_2	do **not** accept equations	1	AO2 4.2.1.3
09.2	26 30 26	must be this order	1 1 1	AO2 4.1.1.4 4.1.1.5
09.3	any **two** from: • iron has a high(er) melting / boiling point • iron is dense(r) • iron is hard(er) • iron is strong(er) • iron is less reactive • iron has ions with different charges • iron forms coloured compounds • iron can be a catalyst	allow the converse statements for sodium allow transition metal for iron allow Group 1 metal for sodium ignore references to atomic structure ignore iron rusts allow iron is less malleable / ductile allow specific reactions showing difference in reactivity allow iron is magnetic	2	AO1 4.1.2.5 4.1.3.1 4.1.3.2

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	carbon is more reactive (than nickel)	allow converse	1	AO1 4.4.1.2 4.4.1.3
	(so) carbon will displace / replace nickel (from nickel oxide) **or** (so) carbon will remove oxygen (from nickel oxide)	allow (so) nickel ions gain electrons allow (so) carbon transfers electrons to nickel (ions)	1	
09.5		an answer of 67.8 (%) scores **3** marks an answer of 67.8160919 (%) or correctly rounded answer to 2, 4 or more sig figs scores **2** marks an incorrect answer for one step does **not** prevent allocation of marks for subsequent steps		AO2 4.3.3.2
	(total M_r of reactants =) 87		1	
	(percentage atom economy) $= \frac{59}{87} \times 100$	allow (percentage atom economy) $= \frac{59}{\text{incorrectly calculated } M_r} \times 100$	1	
	= 67.8 (%)	allow an answer from an incorrect calculation to 3 sig figs	1	
Total			**11**	

4.4.2.1 Reactions of acids with metals

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	copper, zinc, sodium chloride solution		1	AO2 4.5.2.1
10.2	a reactant is used up	allow the reaction stops allow electrolyte / electrode / ions / metal / metal hydroxide / alkali for reactant	1	AO1 4.5.2.1
10.3	the reaction is not reversible		1	AO1 4.5.2.1
10.4	$2H_2 + O_2 \rightarrow 2H_2O$	allow fractions / multiples allow **1** mark for O_2	2	AO1 AO2 4.1.1.1 4.5.2.2

<table>
<tr><th>Question</th><th>Answers</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td rowspan="5">10.5</td><td>Level 3: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.</td><td>5–6</td><td>AO3</td></tr>
<tr><td>Level 2: Some logically linked reasons are given. There may also be a simple judgement.</td><td>3–4</td><td>AO3</td></tr>
<tr><td>Level 1: Relevant points are made. This is not logically linked.</td><td>1–2</td><td>AO2</td></tr>
<tr><td>No relevant content</td><td>0</td><td></td></tr>
<tr><td>Indicative content

reasons why fuel cells could be judged as better
<table>
<tr><th>from the table</th><th>from other knowledge</th></tr>
<tr><td>• time for refuelling a fuel cell is faster than recharging
or
a fuel cell does not need to be recharged
• a fuel cell has a greater range</td><td>• hydrogen can be renewable if made by electrolysis using renewable energy
• lithium-ion batteries can catch fire
• produces only water
or
no pollutants produced
• lithium-ion batteries may release toxic chemicals on disposal
• lithium-ion batteries (eventually cannot be recharged so) have a finite life</td></tr>
</table>
reasons why the lithium-ion battery could be judged as better
<table>
<tr><th>from the table</th><th>from other knowledge</th></tr>
<tr><td>• lithium-ion uses energy more efficiently
• cost of lithium-ion car much less
• cost of recharging much less than refuelling with hydrogen</td><td>• hydrogen is often made from fossil fuels so is not renewable
• charging points are more widely available than hydrogen filling stations
• hydrogen takes up a lot of space
or
is difficult to store
• hydrogen can be highly flammable / explosive
• no emissions produced
• (catalyst in the hydrogen fuel-cell eventually becomes poisoned so) have a finite life</td></tr>
</table></td><td></td><td>4.4.3.4
4.5.2.1
4.5.2.2</td></tr>
<tr><td>Total</td><td></td><td></td><td>11</td></tr>
</table>

4.4.2.1 Reactions of acids with metals

Answer 18 · Examiner comments

June 2018 | 8462/1F | Original Q8

Question 8 (standard demand)

08.1 33% of students could give a different type of substance. Many suggested a base, but as metal oxides are themselves bases, this was not another type of substance and was ignored. Named examples of correct types of substance were accepted.

08.2 This was not answered well. 2% of students were able to work out that two nitrate ions were required for each calcium ion, or to use correct notation for the resulting formula.

08.3 This was a tough question that discriminated between students very well. 39% of students were able to achieve at least two marks, and 1% achieved all six.

Many students did not start with a metal oxide and an acid. Of those who did, many then added magnesium sulfate, the product, to their mixture, rendering the whole process nonsensical. Most did not name the metal oxide or the acid. Many conflated the reaction to produce the salt with the crystallisation phase, adding the metal oxide and acid together in an evaporating basin and then evaporating it to dryness.

The crystallisation phase was often described very well, and this was where most students scored their marks.

4.4.2.1 Reactions of acids with metals

Answer 19 · Examiner comments

June 2018 | 8462/2F | Original Q7

Question 7 (low demand)

07.1 88% of students read the volume correctly. As for incorrect readings, '80.3 (cm^3)' was the most common.

07.2 This question was found to be fairly difficult, with 31% of students correctly identifying both of the control variables.

07.3 This calculation challenged many students as they often ignored the instruction to not include the anomalous result (30) or included the time (40). Many did not give their answers to two significant figures. 41% of students achieved full marks.

07.4 Generally the graph points were accurately plotted although the final point was occasionally mistakenly taken as 110 (rather than 100). More commonly the origin was omitted. A few students also misread the question and either plotted all the data points rather than just the mean and / or drew a line of best fit.

07.5 The calculation was completed correctly by students who read the volume at 50 seconds, but many chose a different time to that in the question. A significant minority inverted the expression, 50 ÷ 80 rather than 80 ÷ 50.

07.6 Generally, students showed a notable lack of understanding in this question. The graph was volume against time, but the question asked how the rate changed with time. Most responses were either wholly or partially about volume rather than rate. 10% of students achieved full marks, while 14% achieved two.

07.7 Again, this was challenging, with 38% of students correctly identifying both of the reasons for the faster rate of reaction.

4.4.2.1 Reactions of acids with metals

Answer 19 · Examiner comments — June 2018 | 8462/2F | Original Q7

07.8 Most appeared to know that limewater was used to test for carbon dioxide, although many answers did not appear to realise that it was necessary to name the gas that was being tested for.

07.9 The burning splint test was commonly identified correctly as the test for hydrogen and incorrectly for oxygen, carbon dioxide and a whole range of other substances, many of which are not gases.

Answer 27 · Examiner comments — June 2022 | 8462/1F | Original Q3

Question 3 (Low and standard demand)

03.1 This question was answered correctly by the majority of students, who recognised that copper would not react. Incorrect responses were almost equally divided between **A** and **D**.

03.2 This question was answered correctly by nearly all students.

03.3 Fewer than half of students scored both marks, although three quarters named one substance correctly. Most students realised that the appropriate metal oxide would be zinc oxide. However, fewer could correctly name the acid, with hydrochloric acid being a popular response.

03.4 Nearly three-quarters of students scored at least one mark, with nearly half scoring both.

03.5 Nearly 80% of students identified the correct type of reaction.

03.6 Over 80% of students correctly identified the apparatus as a burette. The majority of the rest gave a response of pipette.

4.4.2.1 Reactions of acids with metals

Answer 28 · Examiner comments

June 2022 | 8462/1F | Original Q5

Question 5 (Low and standard demand)

05.1 The majority of students correctly identified hydrogen as the gas produced. Carbon dioxide and chlorine were both popular distractors.

05.2 This was not well answered. Even those who realised the independent variable had something to do with the magnesium often failed to gain the mark. The expected answer was the length of magnesium ribbon. Many students simply referred to 'magnesium ribbon' without the word 'length'. Others used vague terms such as 'amount' of magnesium ribbon, or gave a specified mass of magnesium ribbon, which was not measured. Others referred to only one length of magnesium as if it were not being changed.

05.3 This was not well answered. Many students again referred to the vague 'amount' of hydrochloric acid instead of specifying the same volume. There was apparent confusion between the different types of variable, with many students giving the length of magnesium ribbon as a control variable.

05.4 The vast majority of students correctly identified the anomalous result.

05.5 This was answered better than the questions about the variables, with about 40% of students giving an acceptable source of error. Many students recognised that replacing the stopper too late would lead to a greater loss of the gas and therefore a lower volume measured. Other answers were also acceptable if there was an explanation as to why the result was smaller than expected rather than just different. Thus, having too small a volume of acid was accepted, but just measuring the volume incorrectly was not. There were a lot of vague responses along the lines of measuring something incorrectly or random or human error; these responses were not specific enough and did not gain credit.

05.6 Nearly all students plotted the points accurately. The majority drew a correct line of best fit, but a few had doubled or feathered lines, or had clearly not used a ruler.

05.7 Nearly all students were able to give the correct relationship.

Answer 29 · Examiner comments

June 2023 | 8462/1F | Original Q8

Question 8 (low and standard demand)

08.1 The great majority of students scored at least one mark, with three-fifths scoring both. Most could give the correct coefficient for Fe, but that for CO proved to be more challenging, with values of 5 or 6 being seen quite frequently. This question discriminated well.

08.2 Just over a quarter of students were able to articulate that iron oxide loses oxygen. Many expressed their answer as if decomposition of iron oxide were occurring.

08.3 There were many correct answers, with three fifths of students scoring both marks. However, many students do not realise that all they have to do is add the relative atomic masses of two Fe and three O atoms. 56 x 112 was frequently seen. Some students used three Fe atoms and two O instead of the other way round, misunderstanding the subscripts in the formula. Those who made an arithmetic error but had shown their working were able to score one mark. The question discriminated well.

08.4 This question also discriminated well. Most students could substitute the values correctly into the given expression. However, some did not know how to evaluate that expression and some incorrectly rounded a value of 77.9% to 77% instead of 78%.

08.5 About two thirds of students gave an acceptable observation**.** The majority of students gave bubbling as an observation. This was accepted as bubbles do form as a side reaction to the main displacement reaction. The expected observations of a colour change in either the metal or the solution, or a temperature change, were more rarely seen.

08.6 About three-quarters of students placed the metals in the correct order, but fewer could give a coherent reason. It was common to see the metals listed in reverse order. Students sometimes did not understand the difference between a metal and a metal sulfate, giving incorrect statements such as ‘C had most ticks’.

4.4.2.1 Reactions of acids with metals

Answer 30 · Examiner comments

June 2023 | 8462/1F | Original Q11

Question 11 (standard demand)

11.1 This extended response question discriminated well, although over a fifth of students gave no response. The majority of answers were at Level 1, but some students did reach Level 3. Many students described the crystallisation part of the process, but not how they made the necessary zinc chloride solution in the first place. They merely mixed the reactants and then heated them in a crystallising basin or other receptacle, missing out the essential steps of starting with the acid, adding the zinc carbonate to it until the zinc carbonate is in excess, and filtering to obtain the filtrate. Very few named the acid that is necessary to produce the chloride.

11.2 Few students gave two correct answers, although over a third could suggest one, zinc being the most common correct answer. Nearly a fifth of students did not give an answer.

4.4.2.1 Reactions of acids with metals

Answer 30 · Examiner comments

June 2023 | 8462/1F | Original Q11

Mark Ranges and Award of Grades

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

4.4.2.1 Reactions of acids with metals

Answer 31 · Examiner comments — June 2023 | 8462/2F | Original Q8

Question 8 (Standard demand)

08.1 Around 10% of students gained this mark by recognising that adding the stopper would reduce the loss of gas. Weaker responses tended to be absolutes including stating that no gas would escape.

08.2 The calculation discriminated well. Approximately 30% of students successfully completed the calculation, usually showing full details of their working. Most students gained the first 2 marking points by discarding the anomalous result and calculating the mean. The alternative approach detailed in the mark scheme was seldom seen.

08.3 25% of students gained both marks and more than 45% gained 1 mark. The most frequently seen incorrect responses were those that identified factors that would increase rather than decrease the rate of reaction.

Answer 31 · Examiner comments — June 2023 | 8462/2F | Original Q8

08.4 Only 25% of students were able to give the correct test and result for hydrogen gas. Weaker responses failed to include the test and only described the result usually as a squeaky pop and gained no marks. Incorrect tests were less commonly seen but the most frequent incorrect test used was a glowing splint.

Answer 32 · Examiner comments — June 2023 | 8462/2F | Original Q10

Question 10 (Standard demand)

10.1 This extended response question used the command word ‘plan’.

A simplistic approach to the level descriptors might be:

Level 3 – will produce the expected outcomes.
Level 2 – might produce the expected outcomes with additions or modifications.
Level 1 – will not produce the expected outcomes.

However, the marking of extended response questions must always be holistic, so a best-fit approach must always be followed.

Key steps were shown in the indicative content in **bold**.

Most students found this question very difficult with only around 6% of students managing at least a mark in Level 2 and only 25% of students gaining at least 1 mark.

The flame test for the potassium ions was seen more often than the test for the bromide ion, with some students identifying the flame colour but not being able to describe how to carry out the test. Many responses failed to include putting the sample of medicine on the wire or making it clear that the Bunsen was lit. A number of students placed the wire under the Bunsen or did not make it clear that the Bunsen was lit. Some students thought that they needed to sterilise an inoculating loop before using in a flame test.

Many students mixed up the tests by carrying out flame tests on all the reagents.

The test for bromide ions was poorly understood with less than 1% of students recognising that silver nitrate should be added to the medicine and being able to state the correct test result.

Around one-fifth of students scored a Level 1 mark by using the medicine or correct test result in their response and including some relevant points in the correct context from the question.

10.2 The instrumental method was known by very few students with only 1% of students being able to correctly identify flame emission spectroscopy. Most students who attempted the question mentioned laboratory or industrial processes such as fractional distillation or electrolysis. More than a third of the students did not attempt this question.

10.3 Over 30% of students correctly identified an advantage for using an instrumental method over a chemical test. The most popular correct responses were rapidity and accuracy. One quarter of the students did not answer this question.

4.4.2.1 Reactions of acids with metals

Answer 32 · Examiner comments

June 2023 | 8462/2F | Original Q10

Mark Ranges and Award of Grades

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

4.4.2.1 Reactions of acids with metals

Answer 33 · Examiner comments — June 2024 | 8462/1F | Original Q8

Question 8 (standard demand)

08.1 Nearly a half of students gave one correct product, although only about one in seven could give both. Copper sulfate was the most common correct answer but the two words were sometimes split either side of the + sign as if they were two substances. Copper and sulfur was another popular combination.

08.2 About a half of students gave a correct observation that would show that the reaction was no longer proceeding. Many did not realise that they were looking for signs of the reaction having stopped, and gave observations they would make while it was still ongoing.

08.3 Nearly two fifths of students were able to state that filtering is used to remove the excess copper carbonate. However, there were many answers that were expressed vaguely in terms of removing impurities, separating solids from liquids, or even removing the wrong substance such as the acid.

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Answer 33 · Examiner comments — June 2024 | 8462/1F | Original Q8

08.4 Only one in six students could give one of the two methods in the specification, i.e. a water bath or an electric heater. The use of a water bath was by far the more popular correct response. Many, however, simply stated that a Bunsen burner would be used. This was an insufficient response unless a beaker of water was also present.

08.5 Nearly a half of students scored two or three marks. Many could not substitute the correct values into the expression. There were often attempts to bring 50 cm^3 into the calculation. Rearrangement of the equation also proved difficult for some students.

08.6 Students struggled with this question, with fewer than one in five scoring one mark and very few scoring two. Many focused on physical properties of the metals, such as boiling point or conductivity, rather than their reactivity. Of those who did consider reactivity, many had the relative reactivities the wrong way round. Responses were often vague; for example ‘high reactivity’ for sodium was insufficient for the mark, as high reactivity on its own does not explain what the problem is.

4.4.2.1 Reactions of acids with metals

Answer 34 · Examiner comments June 2024 | 8462/2F | Original Q2

Question 2 (low demand)

02.1 This was well answered with nearly all students identifying the effect on the rate of global warming.

02.2 Over 70% of students gained both marks for this calculation with less than 3% obtaining just one mark. The most common incorrect response was to invert the expression or to include additional steps in their calculation neither of which allowed access to either marking point.

02.3 Over 75% of students correctly identified acid rain. A frequently seen incorrect response was acid reflux.

02.4 This was well answered with more than 80% of students obtaining two or three marks. The most common reason for gaining two marks was having omitted to plot the point at (0,0). The majority of students drew a correct line of best fit, but a few had doubled or feathered lines, or had clearly not used a ruler.

02.5 Over 90% of students correctly identified that the mass of sulfur dioxide increases.

02.6 This question assessed a little-known part of the specification with fewer than one in ten students correctly identifying that particulates cause global dimming. By far the most common incorrect response was global warming.

Answer 35 · Examiner comments June 2024 | 8462/2F | Original Q9

Question 9 (standard demand)

09.1 The role of the condenser and the importance of recycling unreacted gases in the Haber process is poorly understood with just over 5% of students gaining credit in this question. A large number of students stated that the ammonia or excess gases or gases alone were returned to the reactor. In addition, a number of students focused their answer on the condenser part of the flow chart and responded with the idea that uncondensed gases needed to be recycled.

09.2 Less than 25% of students correctly identified the catalyst used in the Haber process as iron, with copper, ammonia and hydrogen being frequently seen incorrect responses.

09.3 The test for oxygen gas is poorly understood with less than 25% of students being able to recall the correct test and its result. Many students referred to the splint being lit and then blown out or

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4.4.2.1 Reactions of acids with metals

Answer 35 · Examiner comments June 2024 | 8462/2F | Original Q9

attempted to describe a glowing splint as a small or dying flame. A correct test was needed to allow award of a mark for the test result. The correct test and result for hydrogen gas was frequently seen.

09.4 Over 25% of students either correctly labelled the products and reactants or correctly drew an arrow, labelled the activation energy, and gained one mark. A further 10% of students gained two marks by doing both correctly.

There were many variations of drawing and labelling the arrow for the activation energy. Some students mistakenly labelled the peak as being the activation energy or despite the dotted line drew the arrow too short or at an angle.

Many students incorrectly identified the reactants and products from the equation or used nitrogen, hydrogen, and ammonia from the previous question. Other students were unsure where the reactants and products would be located on a reaction profile diagram.

09.5 One in five students correctly identified that if there was no catalyst used in the reaction the peak would be higher. Many students misread the question and incorrectly answered that the peak would be lower.

09.6 One in six students were able to identify the use of ammonium nitrate in a fertiliser or NPK fertiliser. A small minority stated that it was used in farming or agriculture unqualified. Only a handful of students identified its use in explosives or sports injury packs. Many students misread the question and took salt from the stem of the question and answered in terms or flavouring or preserving food or using salt to de-ice roads.

4.4.2.1 Reactions of acids with metals

Answer 36 · Examiner comments

June 2025 | 8462/1F | Original Q2

Question 2 (low and standard demand)

02.1 More than four fifths chose the correct name. Magnesium nitrate was a more popular distractor than magnesium sulfate.

02.2 Fewer than three fifths chose hydrogen as the correct gas. Chlorine was by far the most popular distractor, and oxygen the least.

02.3 Fewer than two fifths of students could identify both variables, but another third could identify one. More students could identify the independent variable correctly than the dependent variable, with the volume of hydrochloric acid being a popular wrong choice for the dependent variable. Some students identified the correct two variables but had them the wrong way round, and a few drew multiple lines from the same box, which automatically negated any marks.

02.4 More than three fifths gave the correct answer, with the two distractors being approximately equal in popularity.

02.5 Just over a third of students gave 2 °C as the resolution of the thermometer, with the majority incorrectly opting for 20 °C. Many appear to think that the resolution of an instrument is the gap between numbered values on the scale rather than the size of the smallest scale division.

02.6 Fewer than half of responses gave the correct answer, with more than half believing that temperature decreases in an exothermic reaction.

02.7 Nearly three quarters of students were able to identify **A** as the reactants. **C** was the most popular distractor, followed by **B** and **D**.

02.8 More than four fifths could identify **C** as the activation energy, with **A** being the most popular distractor.

02.9 Only a quarter of students were able to identify **B** as the overall energy change, with **E** being by far the most popular response.

4.4.2.1 Reactions of acids with metals

Answer 37 · Examiner comments June 2025 | 8462/2F | Original Q1

Question 1

01.1 Three quarters of students scored at least one mark on this item. The most common mark was for putting the wire into the flame. Students should be encouraged to state that the wire is placed in a blue flame when describing a flame test. Many students described the metal wire as being placed under, over or on a Bunsen with no mention of a flame.

01.2 There were nearly two thirds of students who scored at least one mark for this question. Students knew the flame colour for potassium more frequently than that for lithium.

01.3 Carbon dioxide was identified by two thirds of students.

01.4 Only a quarter of students correctly identified barium chloride solution. Sodium chloride solution was the most common distractor.

01.5 Fewer than 1 in 5 students correctly identified a precipitate as a solid. Most students gave a liquid as the answer.

01.6 Fewer than 20% of students correctly identified both precipitate colours. The most common error was identifying the copper precipitate as green. The magnesium precipitate was given the full range of colours available.

01.7 2 in 5 students correctly identified the iodide precipitate as yellow. The other options were both frequently seen.