AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.4.2.2

Neutralisation of acids and salt production

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**41**
Available paper years	**2008–2025**

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.

4.4.2.2 Neutralisation of acids and salt production

Answer 01 · 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

4.4.2.2 Neutralisation of acids and salt production

Answer 01 · Mark scheme January 2008 | CHY2F | Original Q3 | Legacy

CHY2F

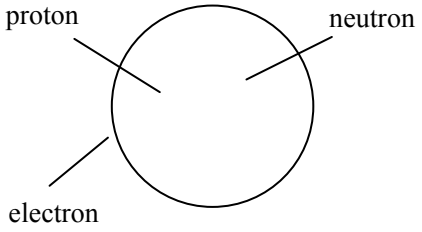
Answer 02 · Mark scheme June 2008 | CHY2F | Original Q1 | Legacy

question	answers	extra information	mark
1(a)(i)	(phosphoric) acid	allow phosphoric acid	1
1(a)(ii)	hydrogen		1
1(b)(i)	faster / quicker / speeds it up (owtte)	allow answers based on activation energy ignore helps it to react	1
1(b)(ii)	most of the starting materials end up as useful products		1
1(b)(iii)	H_2O	allow HOH **or** OH_2	1
Total			**5**

4.4.2.2 Neutralisation of acids and salt production

Answer 03 · Mark scheme

June 2008 | CHY2F | Original Q5 | Legacy

question	answers	extra information	mark
5(a)(i)		all three correct **2** marks one correct **1** mark	2
5(a)(ii)	14		1
5(b)	A		1
5(c)(i)	ammonia can break up to form nitrogen and hydrogen ammonia is made from nitrogen and hydrogen	list principle applies	2
5(c)(ii)	air		1
5(d)	ammonium nitrate		1
Total			**8**

4.4.2.2 Neutralisation of acids and salt production

Answer 03 · Mark scheme June 2008 | CHY2F | Original Q5 | Legacy

COMPONENT NUMBER: CHY2F

COMPONENT NAME: Additional Science / Chemistry

STATUS: Final

DATE: June 2008

Answer 04 · Mark scheme January 2010 | CHY2F | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	fertilisers		1
2(b)	air		1
2(c)(i)	water **and** carbon monoxide on correct side of equation	accept H_2O for water and CO for carbon monoxide	1
2(c)(ii)	speeds up the reaction (owtte)	accept lowers the activation energy	1
2(d)	reversible reaction		1
2(e)(i)	10		1
2(e)(ii)	sulfuric water	accept H_2SO_4 accept H_2O / hydrogen oxide	1 1
Total			**8**

4.4.2.2 Neutralisation of acids and salt production

Answer 04 · Mark scheme

January 2010 | CHY2F | Original Q2 | Legacy

CHY2F

4.4.2.2 Neutralisation of acids and salt production

Answer 05 · Mark scheme

Question 8

question	answers	extra information	mark
8(a)	gas / g	accept low density / low boiling point **or** weak intermolecular forces **or** small molecules **or** simple molecules **or** simple molecular (structure) accept volatile **or** easy to evaporate ignore very light ignore incorrect name of gas	1
8(b)	filter / filtration	accept filter paper accept decant / centrifuge ignore filter funnel / sieving / drained off / funnelling ignore names of compounds ignore evaporation / heating if after filtration do **not** accept crystallisation	1
8(c)	evaporation / crystallisation	accept heating / boiling accept 'leave for a few days' owtte allow cool do **not** allow freeze ignore filtration	1

Question 8 continues on next page

4.4.2.2 Neutralisation of acids and salt production

CHY2F

Question 8 continued

question	answers	extra information	mark
8(d)	candidates can gain marks from any two of the three linked pairs		
	hydrogen chloride escaped / released (into atmosphere) **or** (hydrogen chloride) damaged vegetation / harmful	to get both of these **2** marks hydrogen chloride must be mentioned ignore HCl formed / produced / made	1
	used to make chlorine / bleach	ignore sale of hydrogen chloride	1
	unpleasant smell (of calcium sulfide) **or** waste of calcium (sulfide)	ignore calcium sulphide alone allow calcium / calcium sulfate for calcium sulphide to get both of these 2 marks calcium (sulphide) must be mentioned	1
	converted to sulfur **or** used to make sulfuric acid	ignore sale of calcium sulfide	1
	unreacted coal (1) recycled / burnt / used / sold (1)	must be linked to first coal point	
Total			**7**

4.4.2.2 Neutralisation of acids and salt production

Answer 06 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)(i)	yellow		1
4(a)(ii)	lilac		1
4(a)(iii)	melting point		1
4(b)(i)	barium chloride solid		1 1
4(b)(ii)	white dissolved		1 1
Total			**7**

4.4.2.2 Neutralisation of acids and salt production

Answer 06 · Mark scheme

January 2010 | CHY3F | Original Q4 | Legacy

CHY3F

4.4.2.2 Neutralisation of acids and salt production

Answer 07 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)(i)	H^+		1
1(a)(ii)	OH^-		1
1(a)(iii)	lower than		1
1(b)	with HCl: UI goes red / pink has a pH 0 ,1 ,2 **or** 3 **or** with ethanoic acid: UI goes orange / yellow (1) has a pH 4 / or above (but less than 7) (1)	 allow a comparison eg redder than ethanoic acid allow a comparison eg has pH less than ethanoic acid. do **not** accept an incorrect pH. allow a comparison with HCl allow a comparison with HCl	 1 1
1(c)	completely		1
1(d)(i)	conical flask		1
1(d)(ii)	titration		1
1(d)(iii)	repeat **or** take average	allow compare with another students results	1
Total			**9**

4.4.2.2 Neutralisation of acids and salt production

Answer 07 · Mark scheme

June 2010 | CHY3F | Original Q1 | Legacy

CHY3F

4.4.2.2 Neutralisation of acids and salt production

Answer 08 · Mark scheme

January 2011 | CHY2F | Original Q3 | Legacy

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

4.4.2.2 Neutralisation of acids and salt production

Answer 08 · Mark scheme

January 2011 | CHY2F | Original Q3 | Legacy

CHY2F

4.4.2.2 Neutralisation of acids and salt production

Answer 09 · Mark scheme

June 2011 | CHY1F | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)(i)	heat / high temperature / hot / vaporise	if (fractional) distillation / hydrogenation mentioned as the method = max 1 allow thermal decomposition ignore evaporation do **not** accept 'burns' do **not** accept temperature < 100	1
	catalyst **or** silica / alumina / porous pot **or** steam	ignore other named catalyst allow heat (the vapour) to a very high temperature / >800°C for **2** marks	1
7(a)(ii)	C_2H_3Cl	ignore attempts to balance equation	1
7(a)(iii)	single bonds between C – H, C – Cl **and** C – C	do **not** accept symbols outside the bracket	1
7(b)(i)	so that the amount of plasticiser / (sample of) PVC is the independent / only variable that affects the bending / flexibility of the samples	allow because different sizes would give different results accept because size is a control variable ignore references to reliability / precision etc	1
7(b)(ii)	to improve the reliability (of the investigation)	accept to calculate a mean accept to check for anomalous results **or** to check the range of results ignore accuracy / precision etc	1

Question 7 continues on the next page

4.4.2.2 Neutralisation of acids and salt production

Question 7 continued

question	answers	extra information	mark
7(b)(iii)	23	correct answer with or without working = **2** marks if answer is incorrect allow $\frac{22+23+24}{3}$ **or** 21 for **1** mark	2
7(b)(iv)	(PVC) sample had been stretched / used / tested in first three tests	accept higher temperature allow worn **or** become weaker ignore (human) error ignore more flexible / softer ignore intermolecular forces	1
7(c)	does not bend (easily / much) **or** it is not flexible **or** it is rigid	ignore non-biodegradable / low maintenance ignore sturdy / stronger / harder	1
Total			**10**

The AQA UMS Conversion Calculator is available on the Results statistics page of the AQA Website

4.4.2.2 Neutralisation of acids and salt production

Answer 10 · Mark scheme June 2011 | CHY3F | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)(i)	sodium hydroxide solution blue		1 1
3(a)(ii)	barium chloride white		1 1
3(b)	fully ionised in water		1
3(c)(i)	H^+ ions		1
3(c)(ii)	lower than		1
3(d)(i)	(indicator) changed colour / goes colourless	ignore clear / discoloured	1
3(d)(ii)	13.9 **or** (titration) 2		1
3(d)(iii)	13.2	ecf from 3(d)(ii)	1
Total			**10**

4.4.2.2 Neutralisation of acids and salt production

Answer 10 · Mark scheme

June 2011 | CHY3F | Original Q3 | Legacy

CHY3F

4.4.2.2 Neutralisation of acids and salt production

Answer 11 · Mark scheme

June 2012 | CH2FP | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)	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 2, and apply a 'best-fit' approach to the marking.		6

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 a laboratory procedure for obtaining potassium chloride.	There is a clear description of a laboratory procedure for obtaining potassium chloride from potassium hydroxide solution and hydrochloric acid that does not necessarily allow the procedure to be completed successfully by another person. The answer must include the use of an indicator or a method of obtaining crystals.	There is a detailed description of a laboratory procedure for obtaining potassium chloride from potassium hydroxide solution and hydrochloric acid that can be followed by another person. The answer must include the use of an indicator and a method of obtaining crystals

examples of the chemistry points made in the response:

- One reagent in beaker (or similar)
- Add (any named) indicator
- Add other reagent
- Swirl or mix
- Add dropwise near end point
- Stop addition at change of indicator colour
- Note volume of reagent added
- Repeat without indicator, adding same volume of reagent **or** remove indicator using charcoal
- Pour solution into basin / dish
- Heat (using Bunsen burner)
- Leave to crystallise / leave for water to evaporate / boil off water

Accept any answers based on titration

Question 7 continues on the next page . .

CH2FP

Question 7 cont'd..

question	answers	extra information	mark
7(b)	nitric (acid)	allow HNO_3 ignore incorrect formula	1
7(c)(i)	because it is a fertiliser / helps plants grow	allow plant food do **not** accept pesticide / herbicide / neutralising soil	1
7(c)(ii)	tick by: 'Should farmers stop using ammonium nitrate on their land?' any **two** 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 if top box ticked allow **1** mark for drinking water varies from place to place	1 2
Total			**11**

UMS Conversion Calculator www.aqa.org.uk/umsconversion

4.4.2.2 Neutralisation of acids and salt production

Answer 12 · Mark scheme

January 2013 | CH2FP | Original Q5 | Legacy

question	answers	extra information	mark
5(a)(i)	sulfuric		1
5(a)(ii)	1		1
5(a)(iii)	to speed up the reaction		1
5(b)	because copper oxide in excess **or** because acid all used up / neutralised	allow copper oxide unreacted	1
5(c)	evaporation **or** crystallisation	allow heating allow cooling allow leave (to evaporate) do **not** accept freezing	1
5(d)	Some copper sulfate may have been lost during the experiment		1
Total			**6**

4.4.2.2 Neutralisation of acids and salt production

Answer 12 · Mark scheme

January 2013 | CH2FP | Original Q5 | Legacy

January 2013

CH2FP

4.4.2.2 Neutralisation of acids and salt production

Answer 13 · Mark scheme

question	answers	extra information	mark
7(a)	because sulfur / S forms which is insoluble / a solid / a precipitate		1 1
7(b)(i)	32	correct answer with or without working gains **2** marks accept evidence of 31 + 33 / 2 for **1** mark allow 35 for **1** mark	2
7(b)(ii)	reaction rate increases because of more particles (per unit volume) and because there is an increase in frequency of collisions	if incorrect reference to energy = max **2** allow because particles are closer together accept because particles are more likely to collide **or** higher chance of collision ignore more (successful) collisions	1 1 1
Total			**7**

4.4.2.2 Neutralisation of acids and salt production

Answer 13 · Mark scheme

January 2013 | CH2FP | Original Q7 | Legacy

January 2013

CH2FP

4.4.2.2 Neutralisation of acids and salt production

Answer 14 · Mark scheme

January 2013 | CH2FP | Original Q8 | Legacy

question	answers	extra information	mark
8(a)(i)	because they are positively charged	accept they are positive / H^+ accept oppositely charged **or** opposites attract ignore they are attracted	1
8(a)(ii)	gains one / an electron	accept $H^+ + e^- \rightarrow H$ or multiples allow gains electrons	1
8(b)	3 bonding pairs 1 lone pair	 accept 2 non-bonding electrons on outer shell of nitrogen	1 1
8(c)(i)	hydroxide / OH^-	do **not** accept sodium hydroxide	1
8(c)(ii)	$H^+ + OH^- \rightarrow H_2O$	ignore state symbols ignore word equation	1

4.4.2.2 Neutralisation of acids and salt production

January 2013

CH2FP

question	answers	extra information	mark
8(d)	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.	There are basic descriptions of advantages or disadvantages of the electrolysis cells.	There are clear descriptions of environmental or economic advantages or disadvantages of the electrolysis cells. Comparisons may be implied.	There are detailed descriptions of environmental and economic advantages and disadvantages, comparing the electrolysis cells.

examples of chemistry points made in the response:

Accept converse where appropriate.

- mercury cell is more expensive to construct
- mercury is recycled but membranes must be replaced
- mercury is toxic but membrane / polymer is not
- removing traces of mercury from waste is expensive
- mercury cell uses more electricity
- mercury cell produces chlorine that is purer
- mercury cell produces higher concentration / better quality of sodium hydroxide (solution)

Total			12

UMS conversion calculator www.aqa.org.uk/umsconversion

4.4.2.2 Neutralisation of acids and salt production

Answer 15 · Mark scheme

June 2013 | CH1FP | Original Q3 | Legacy

Question 3

question	answers	extra information	Mark
3(a)(i)	magnesium oxide		1
3(a)(ii)	decomposition		1
3(b)(i)	bar chart		1
3(b)(ii)	more		1
3(b)(iii)	limewater turns cloudy / milky	 accept forms a white precipitate	1 1
Total			6

4.4.2.2 Neutralisation of acids and salt production

Answer 16 · Mark scheme

Question 2

question	answers	extra information	Mark
2(a)	11		1
2(b)(i)	nitric		1
2(b)(ii)	neutralisation		1
2(c)	fertiliser	accept helps plants grow accept provide nitrogen	1
2(d)(i)	nitrate iodide	must be in this order	1 1
2(d)(ii)	precipitate		1
2(d)(iii)	filtration/filtering		1
2(d)(iv)	crystallisation	allow evaporation / heat / cooling do **not** accept freezing ignore “leave it” if unqualified	1
Total			**9**

4.4.2.2 Neutralisation of acids and salt production

Answer 17 · 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

4.4.2.2 Neutralisation of acids and salt production

Answer 18 · Mark scheme

June 2013 | CH3FP | Original Q2 | Legacy

Question 2

question	Answers	extra information	Mark
2(a)(i)	yellow		1
2(a)(ii)	lilac		1
2(b)	(bubble through) limewater cloudy	 allow white / milky	1 1
2(c)(i)	silver nitrate solution		1
2(c)(ii)	white		1
Total			6

4.4.2.2 Neutralisation of acids and salt production

Answer 19 · Mark scheme June 2014 | CH2FP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
4(a)(i)	14		1	2 / 2.3.1c	G
4(a)(ii)	isotope		1	1 / 2.3.1d	G
4(a)(iii)	(very) small	*accept smaller / tiny / (very) little*	1	1 / 2.3.1b	G
4(b)(i)	C		1	1 / 2.1	A
4(b)(ii)	NH_3		1	1 / 2.1.1g	A
4(c)(i)	nitric (acid)		1	1 / 2.6.2b	G
4(c)(ii)	indicator		1	1 / 2.6.1b	E
4(c)(iii)	crystallisation **or** evaporation	allow by heating **or** cooling **or** leave (on windowsill) *do not accept freezing*	1	1 / 2.6.1c	E
4(c)(iv)	any **one** from: • grass grows faster • grass grows taller **or** thicker	*allow grass grows better / greener*	1	3 / 2.6.2c	E
4(d)	potassium (atom) loses (an electron) chlorine (atom) gains (an electron) 1 (electron) electron	reference to incorrect bonding or particle = max **3** ignore references to full outer shells	1 1 1 1	1 + 2 / 2.1.1c/d/e	E
Total			**13**		

4.4.2.2 Neutralisation of acids and salt production

Answer 19 · Mark scheme

June 2014 | CH2FP | Original Q4 | Legacy



4.4.2.2 Neutralisation of acids and salt production

Answer 20 · Mark scheme June 2015 | CH1FP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	(calcium) carbonate	ignore $CaCO_3$	1	1 / 1.2.1a
5(a)(ii)	(thermal) decomposition		1	1 / 1.2.1b
5(a)(iii)	water	allow H_2O allow hydrogen oxide	1	1 / 1.2.1d
5(a)(iv)	alkali	allow base	1	1 / 1.2.1d
5(b)(i)	straight line through the first, second and fourth points straight line through the last four points	 allow a straight line through the last three points if the first straight line extrapolates below point four	1 1	2+3 / 1.2.1g
5(b)(ii)	repeat the experiment (at each mass of aggregate) (use the results to) calculate a mean / average value (for each mass of aggregate)	do not allow repeat at other masses	1 1	3 / 1.2.1g

4.4.2.2 Neutralisation of acids and salt production

Answer 20 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(b)(iii)	line drawn to y axis showing extrapolation		1	2+3 / 1.2.1g
	correct value read from graph	allow +/- one small square do not allow 0 award 1 mark for a value of 34-40 if no extrapolation shown	1	
5(b)(iv)	at first, the force needed to break a concrete beam increases	allow values allow at first the statement is correct	1	3 / 1.2.1g
	but the force needed to break a concrete beam then decreases	allow values	1	
	mention of 400 g as the point at which the force needed changes or value from graph	allow 400g if there is no intercept on graph	1	
Total			**13**	

4.4.2.2 Neutralisation of acids and salt production

Answer 20 · Mark scheme

June 2015 | CH1FP | Original Q5 | Legacy



4.4.2.2 Neutralisation of acids and salt production

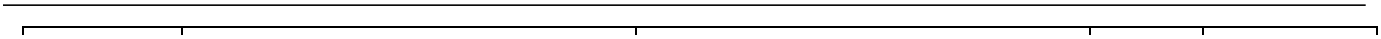
Answer 21 · Mark scheme

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**	

4.4.2.2 Neutralisation of acids and salt production

Answer 21 · Mark scheme

June 2015 | CH2FP | Original Q2 | Legacy



4.4.2.2 Neutralisation of acids and salt production

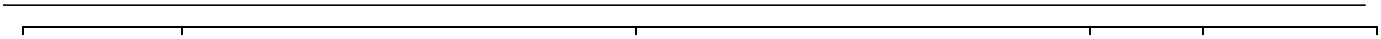
Answer 22 · Mark scheme June 2015 | CH3FP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)	copper (II) → blue iron (III) → brown	more than one line from any box negates the mark	1 1	**AO1** 3.4.1.c
6(b)	aluminium	allow correct answer shown in box if answer line blank	1	**AO1** 3.4.1.b
6(c)(i)	yellow	allow orange	1	**AO1** 3.4.1.a
6(c)(ii)	lilac	allow purple	1	**AO1** 3.4.1.a
6(c)(iii)	one colour masks the other	allow colours mixed	1	**AO2** 3.4.1.a
Total			**6**	

4.4.2.2 Neutralisation of acids and salt production

Answer 22 · Mark scheme

June 2015 | CH3FP | Original Q6 | Legacy



4.4.2.2 Neutralisation of acids and salt production

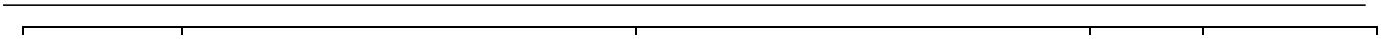
Answer 23 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)(i)	(19.5 + 18.5 + 19.0)/3	allow (23.0 +19.5 + 18.5 + 19.0)/4 for **1** mark	2	**AO2/ AO3** 3.4.1.g
7(a)(ii)	R P Q	allow Q P R for **1** mark	2	**AO3** 3.4.1.g
7(b)	any **two** from: • repeat more times • calculate a mean • measure to one decimal place		2	**AO3** 3.4.1.g
7(c)	both students get similar results / similar pattern		1	**AO3** 3.4.1.g
Total			**7**	

4.4.2.2 Neutralisation of acids and salt production

Answer 23 · Mark scheme

June 2015 | CH3FP | Original Q7 | Legacy



4.4.2.2 Neutralisation of acids and salt production

Answer 24 · Mark scheme June 2016 | CH2FP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / SpecRef
6(a)	endothermic		1	AO1 2.5.1d
6(b)	82 (%)	correct answer with working gains **3** marks if 17 or 34 not shown in working **max 2** marks accept 82.4 accept 82.35 to full calculator display (82.35294...) correctly rounded to at least 2 sf if no answer or incorrect answer, then (M_r =) 17 gains **1** mark **or** 14/17 gains **2** marks **OR** ($2M_r$ =) 34 gains **1** mark **or** 28/34 gains **2** marks **OR** 14/their M_r shown gains **1** mark **or** correct calculation of 14/their M_r gains **2** marks	3	AO2 2.3.3a, 2.3.1f
6(c)(i)	7 / seven		1	AO1 2.6.2d
6(c)(ii)	$H^+ + OH^- \rightarrow H_2O$		1	AO1 2.6.2e
6(c)(iii)	ammonium chloride	allow NH_4Cl ignore an incorrect formula	1	AO1 2.6.2b

Question 6 continues on the next page

Answer 24 · Mark scheme

Question 6 continued

Question	Answers	Extra information	Mark	AO / SpecRef
6(d)			6	2AO2 / 4AO3 2.6.2c

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.	Suggestion with a reference to a graph.	Suggestion with reasons referring to more than one graph.	Suggestion with reasons from all three graphs, and linking of ideas which may explain a compromise.

Examples of chemistry points made in response:

A reasonable suggested amount of fertiliser would be in the region of 200 kg (per ha). Accept any suggestion from about 180 kg (per ha) to 500 kg (per ha).

Yield:

- Using fertiliser improves yield.
- Yield improved most up to about 200 kg (per ha) of fertiliser.
- Yield only increased slightly above about 200 kg (per ha).

Profit:

- About 200 kg of fertiliser gives the most profit.
- Above about 200 kg (per ha) of fertiliser profit declines.

Run off:

- Run off is at low levels until about 300 kg (per ha) of fertiliser.
- Above about 300 kg (per ha) of fertiliser, run off increases.

Examples of linking of ideas:

- Overall 200 kg gives high crop yield and most profit.
- In conclusion 200 kg gives high crop yield and low run off.
- 200 kg gives most profit and low run off.

Examples of compromise:

- Profits go down after about 200 kg (per ha) of fertiliser because cost of fertiliser is not covered by increased yield.
- 200 kg gives the highest profit although it is not the highest yield.
- 500 kg gives the best yield but has the most runoff.

Total			13

4.4.2.2 Neutralisation of acids and salt production

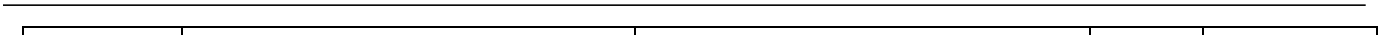
Answer 25 · Mark scheme June 2017 | CH2FP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1 (a)(i)	the ink would run / smudge / smear	accept converse	1	**AO1** 2.3.2b
1 (a)(ii)	below		1	**AO1** 2.3.2b
1 (a)(iii)	any **two** from: • contains red • does not contain blue • contains two other colours • contains three colours in total	do **not** accept contains red and blue	2	**AO3** 2.3.2b
1(b)(i)	separated		1	**AO1** 2.3.2c
1(b)(ii)	6/six		1	**AO2** 2.3.2c
1(b)(iii)	any **one** from: • accurate • sensitive • rapid / fast • small sample.	do **not** accept more precise do **not** accept more reliable	1	**AO1** 2.3.2a
Total			**7**	

4.4.2.2 Neutralisation of acids and salt production

Answer 25 · Mark scheme

June 2017 | CH2FP | Original Q1 | Legacy



4.4.2.2 Neutralisation of acids and salt production

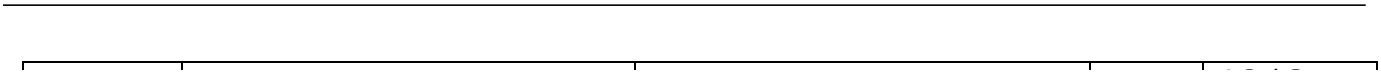
Answer 26 · Mark scheme June 2017 | CH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)(i)	s		1	**AO2** 2.6.1a
2(a)(ii)	to speed up the reaction		1	**AO2** 2.6.1b
2(a)(iii)	tick (✓) by: 1		1	**AO1** 2.6.2d
2(a)(iv)	tick (✓) by: To make sure all the sulfuric acid has reacted		1	**AO1** 2.6.1b
2(b)(i)	funnel	accept filter funnel	1	**AO1** 2.6.1b
2(b)(ii)	heat / evaporate / boil	accept cool accept leave (to evaporate) do **not** accept heat until all water gone	1	**AO1** 2.6.1b
2(c)	tick (✓) by: The student left some copper sulfate crystals in the apparatus.		1	**AO3** 2.3.3d
2(d)(i)	white	accept grey	1	**AO1** 2.5.1d
2(d)(ii)	it goes blue	accept steam / water vapour ignore unspecified colour change	1	**AO1** 2.5.1d
2(e)(i)	polymers		1	**AO1** 2.2.5a
2(e)(ii)	as wealth decreases, ethene production decreases	accept converse	1	**AO2** 2.6; 3.7.12
2(e)(iii)	no relationship		1	**AO2** 2.6; 3.7.12
Total			**12**	

4.4.2.2 Neutralisation of acids and salt production

Answer 26 · Mark scheme

June 2017 | CH2FP | Original Q2 | Legacy



4.4.2.2 Neutralisation of acids and salt production

Answer 27 · Mark scheme

June 2019 | 8462/1F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	B		1	AO2 4.1.1.1 4.1.1.2
03.2	D		1	AO2 4.1.1.1 4.1.1.2
03.3	E		1	AO2 4.1.1.1 4.1.1.2
03.4	chromatography – blue food colour from a mixture of food colours chromatography – copper from an alloy of copper and zinc crystallisation – copper sulfate from copper sulfate solution crystallisation – ethanol from a mixture of ethanol and water additional line from a box negates the mark for that box		1 1	AO2 4.1.1.2
03.5	(filter) funnel containing filter paper suitable vessel for collecting filtrate sand **and** water labelled in correct place		1 1 1	AO1 AO1 AO2 4.1.1.2
03.6	100 °C		1	AO2 4.1.1.2

4.4.2.2 Neutralisation of acids and salt production

Answer 27 · Mark scheme

03.7	any **four** from: • solution is heated • water evaporates • the vapour cools in the condenser • the vapour condenses **or** the vapour turns to a liquid • (pure) water collects in the beaker	allow water boils / vaporises	4	AO1 4.1.1.2
Total			**13**	

4.4.2.2 Neutralisation of acids and salt production

Answer 28 · Mark scheme

June 2019 | 8462/1F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	H^+		1	AO1 4.4.2.4
09.2	hydrochloric (acid) water	allow HCl allow H_2O	1 1	AO2 4.4.2.2
09.3	burette	do **not** accept biuret	1	AO1 4.4.2.5
09.4	27.6 (cm^3)	allow 27.60 (cm^3)	1	AO2 4.4.2.5

Question 9 continued

Question	Answers	Mark	AO/ Spec. Ref
09.5	**Level 3**: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO3 AO1
	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	AO1 x 2
	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	AO1 x 2
	No relevant content	0	
	Indicative content allow converse using acid added to alkali Key steps • measure the volume of acid • add indicator to the acid • add sodium hydroxide solution • until the colour changes • record volume of sodium hydroxide solution added • repeat procedure with the other acid Use of results • compare the two volumes of sodium hydroxide solution to find which sample **P** or **Q** is more concentrated Other points • pipette to measure volume of acid • use a few drops of indicator • swirl • use a white tile • rough titration to find approximate end point • add dropwise near the endpoint • read volume from bottom of meniscus • repeat and take a mean		4.4.2.5
Total		**11**	

4.4.2.2 Neutralisation of acids and salt production

Answer 29 · Mark scheme

November 2020 | 8462/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(negative electrode) solid produced	allow the electrode changes colour ignore metal produced	1	AO3 4.4.3.4 RPA 3
	(positive electrode) bubbles / fizzing / effervescence	ignore gas produced	1	
04.2	potassium nitrate		1	AO3 4.4.3.4 RPA 3
	hydrogen is not a metal	allow hydrogen is a gas allow hydrogen is not a solid allow the products at both electrodes are gases allow the product at the negative electrode is not potassium allow potassium is more reactive than hydrogen	1	
04.3	(graphite) conducts (electricity)	allow (graphite) has delocalised / free electrons	1	AO1 4.2.3.2 4.4.3.4 RPA 3
	(graphite) is inert	allow (graphite) is unreactive	1	
04.4	the ions move towards the positive electrode		1	AO3
	the electrode attracts ions of the opposite charge	allow opposite charges attract	1	AO1 4.4.3.1
Total			8	

4.4.2.2 Neutralisation of acids and salt production

Answer 30 · 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	

4.4.2.2 Neutralisation of acids and salt production

Answer 30 · Mark scheme

November 2020 | 8462/1F | Original Q7

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**	

4.4.2.2 Neutralisation of acids and salt production

Answer 31 · 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)		1	AO2 4.4.2.2
	(change in x =) 0.4 (g)		1	
	(gradient =) $\frac{70}{0.4}$	allow correct use of incorrectly derived values for change in y and / or change in x	1	
	= 175 (cm^3/g)		1	

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**

4.4.2.2 Neutralisation of acids and salt production

Answer 32 · Mark scheme

November 2021 | 8462/1F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	by filtration		1	AO3 4.1.1.2

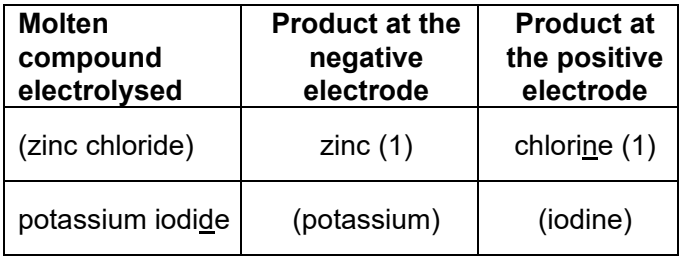
Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	10 minutes per 2 cm on x-axis	allow 5 minutes per 1 cm on x-axis	1	AO2 4.4.3.4
	all points plotted correctly	allow a tolerance of ± ½ a small square allow **1** mark for 3 or 4 points plotted correctly	2	
	line of best fit	allow line of best fit drawn using incorrect plots	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3		allow ecf from question **07.2**		AO2 4.4.3.4
	0.14 (g)	allow a tolerance of ± ½ a small square	1	

Question 7 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	(copper sulfate solution) pink / orange / red / brown solid (sodium chloride solution) bubbles / effervescence / fizzing	 allow copper plating allow metal for solid if no other mark awarded allow **1** mark for copper **and** hydrogen	 1 1	AO2 4.4.1.2 4.4.3.4 RPA3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	toxic / poisonous (fumes)	allow harmful / corrosive (fumes) ignore dangerous / deadly / lethal	1	AO3 4.4.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	 allow **1** mark if zinc and chlorine the wrong way round		 2 1	AO2 4.4.3.2

Total			12

4.4.2.2 Neutralisation of acids and salt production

Answer 33 · 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

4.4.2.2 Neutralisation of acids and salt production

Answer 33 · Mark scheme June 2022 | 8462/1F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	**pH** / **Colour of universal indicator** 1 → Green 7 → Red Blue Purple Yellow 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**

Answer 34 · 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

4.4.2.2 Neutralisation of acids and salt production

Answer 35 · Mark scheme

June 2024 | 8462/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	(**A**) pipette (**B**) conical flask (**C**) burette		1 1 1	AO1 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	methyl orange (solution) **or** phenolphthalein (solution)	allow litmus (solution) do **not** accept universal indicator	1	AO1 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	colour change	ignore clear	1	AO1 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	any **two** from: • swirl • add the acid drop by drop • read (burette) at eye level • ensure no bubbles in burette • use a white tile • repeat **and** take a mean	allow read (burette) at the bottom of the meniscus	2	AO1 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	16.6 cm^3		1	AO2 4.4.2.5 RPA2

4.4.2.2 Neutralisation of acids and salt production

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	trial 2 and trial 3		1	AO3 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	$BaCl_2$		1	AO2 4.1.1.1 4.4.2.2

Total Question 2	**10**

4.4.2.2 Neutralisation of acids and salt production

Answer 36 · 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

4.4.2.2 Neutralisation of acids and salt production

Answer 36 · 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 = % yield × $\frac{\text{max theoretical mass}}{100}$	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

4.4.2.2 Neutralisation of acids and salt production

Answer 37 · Mark scheme

June 2024 | 8462/1F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	(similarity) both have one outer (shell) electron	allow energy level for shell allow same number of outer (shell) electrons	1	AO1 4.1.2.1
	(difference) sodium has 3 shells but potassium has 4 shells	allow potassium has more shells allow (different) number of shells	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	any **two** from: • effervescence / bubbles / fizzing • (potassium) floats • (potassium) moves around • (potassium) becomes smaller • (potassium) melts • flame • explosion	ignore gas produced allow (potassium) forms a ball ignore colour of flame	2	AO1 4.1.2.5 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	blue / violet / purple		1	AO2
	(the solution is) alkaline	allow (the solution) contains OH^- (ions) allow (the solution) contains hydroxide ions allow the solution is basic	1	AO1 4.1.2.5 4.4.2.4

4.4.2.2 Neutralisation of acids and salt production

Answer 37 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	all five points correctly plotted	allow a tolerance of ± ½ a small square allow **1** mark for three or four points correctly plotted	2	AO2 4.1.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	3.4 (mg/cm^3)	allow a value in the range 3.0 to 3.8 (mg/cm^3)	1	AO3 4.1.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	chlorine and potassium bromide		1	AO2 4.1.2.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.7	relative molecular mass increases and boiling point increases		1	AO1 4.1.2.6

Total Question 9	**11**

4.4.2.2 Neutralisation of acids and salt production

Answer 38 · Mark scheme

June 2024 | 8462/2F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	(test) flame test (result) yellow (flame) **OR** (test) flame emission spectroscopy (1) (result) lines match sodium spectrum (1)	 allow FES	1 1	AO1 4.8.3.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	(test) (add acidified) silver nitrate (solution) (result) white precipitate	 MP2 is dependent upon the award of MP1	1 1	AO1 4.8.3.4 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	to ensure that all the water has evaporated		1	AO3 4.10.1.2 RPA8

4.4.2.2 Neutralisation of acids and salt production

Answer 38 · Mark scheme

June 2024 | 8462/2F | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	mass of evaporating dish and dry contents – mass of empty evaporating dish		1	AO1 4.10.1.2 RPA8

4.4.2.2 Neutralisation of acids and salt production

Answer 38 · Mark scheme

June 2024 | 8462/2F | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	(mean concentration of NaCl =) $\frac{35.2 + 34.6 + 36.4 + 33.8}{4}$ **or** $\frac{140}{4}$ = 35.0 (g/dm^3)	allow **1** mark for $\frac{35.2 + 34.6 + 33.8}{3} = 34.5$	1 1	AO2 4.10.1.2 RPA8
	(mean concentration of Na$^+$ =) $35.0 \times \frac{39.3}{100}$	allow correct use of an incorrectly determined mean concentration of sodium chloride	1	
	= 13.8 (g/dm^3)	allow 13.755 correctly rounded to at least 3 significant figures	1	
	alternative approach 1:			
	(total concentration of NaCl = 35.2 + 34.6 + 36.4 + 33.8 = 140 total concentration of Na+ =) $140 \times \frac{39.3}{100}$ (1) = 55.02 (g/dm^3) (1)	allow **1** mark for (35.2 + 34.6 + 33.8 = 103.6) $103.6 \times \frac{39.3}{100} = 40.71$		
	(mean concentration of Na$^+$ =) $\frac{55.02}{4}$ (1) =13.8 (g/dm^3) (1)	allow correct use of an incorrectly determined total concentration of Na$^+$ allow 13.755 correctly rounded to at least 3 significant figures		

	alternative approach 2: (concentrations of Na^+ =) $35.2 \times \frac{39.3}{100}$ $34.6 \times \frac{39.3}{100}$ $36.4 \times \frac{39.3}{100}$ $33.8 \times \frac{39.3}{100}$ (1) = 13.83 13.60 14.31 13.28 (1) (mean concentration of Na^+ =) $\frac{13.83 + 13.60 + 14.31 + 13.28}{4}$ (1) =13.8 (g/dm^3) (1)	allow **1** mark if a concentration of 36.4 is treated as an anomaly and not used allow correct use of incorrectly determined concentration(s) of Na^+ allow 13.755 correctly rounded to at least 3 significant figures		

Total Question 8	**10**

4.4.2.2 Neutralisation of acids and salt production

Answer 39 · 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

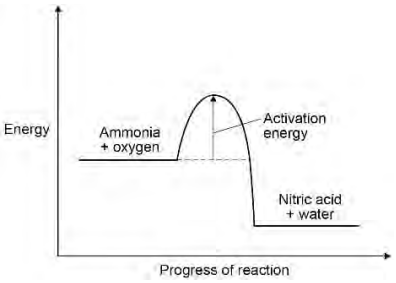
Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	iron	allow Fe	1	AO1 4.6.1.4 4.10.4.1

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

4.4.2.2 Neutralisation of acids and salt production

Answer 39 · 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

4.4.2.2 Neutralisation of acids and salt production

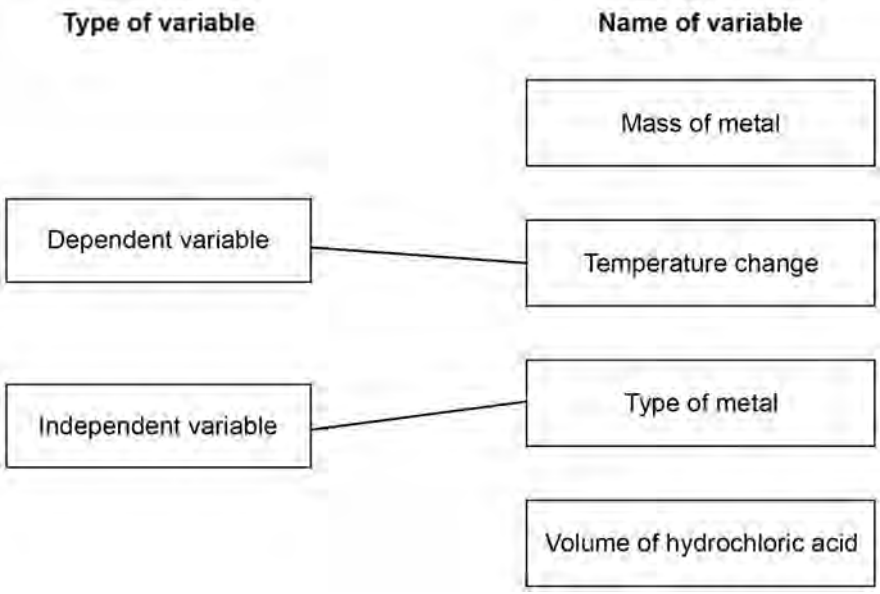
Answer 40 · Mark scheme

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

Answer 40 · Mark scheme

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

4.4.2.2 Neutralisation of acids and salt production

Answer 41 · Mark scheme

June 2025 | 8462/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	titration		1	AO1 4.4.2.5 RPA 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	indicator	allow any named indicator	1	AO1 4.4.2.5 RPA 2

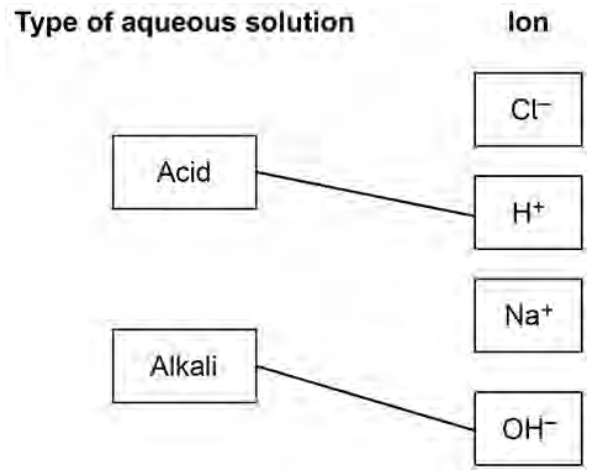
Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	burette		1	AO1 4.4.2.5 RPA 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	add the acid dropwise (near the end point) **or** swirl the flask		1	AO3 4.4.2.5 RPA 2

4.4.2.2 Neutralisation of acids and salt production

Answer 41 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	use of 8.95, 9.00 and 8.85 **only**		1	AO3
	(mean volume =) $\frac{8.95 + 9.00 + 8.85}{3}$	allow (mean volume =) $\frac{26.80}{3}$ allow correct use of incorrect values of volume	1	AO2
	= 8.933333 (cm^3)		1	AO2
	= 8.93 (cm^3)	allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses the values in the question	1	AO2 4.4.2.5 RPA 2

Question	Answers	Mark	AO / Spec. Ref.
04.6	 do **not** accept more than one line from a box on the left	1 1	AO1 4.4.2.4

Total Question 4	10

4.4.2.2 Neutralisation of acids and salt production

Answer 27 · Examiner comments

June 2019 | 8462/1F | Original Q3

Question 3 (low and standard demand)

03.1 This question tested recognition of a diagram representing only one compound.

Almost half of the students identified the correct option.

The diagram representing only one element was a strong distractor.

03.2 This question tested recognition of a diagram representing a mixture of elements.

Approximately 55% of students identified the correct option.

03.3 This question tested recognition of a diagram representing a mixture of an element and a compound.

Approximately 60% of students identified the correct option.

03.4 This question tested students' ability to apply their knowledge and understanding of chromatography and crystallisation.

Approximately two-thirds of students scored both marks.

03.5 The diagram showing how a mixture of sand and water can be separated by filtration was often drawn and labelled clearly enough to score all 3 marks. The most common omissions were a filter funnel or filter paper.

03.6 Approximately two-thirds of students correctly predicted the temperature of 100 °C.

Answer 27 · Examiner comments

June 2019 | 8462/1F | Original Q3

03.7 This question which required a description of distillation was generally answered well. Almost 60% of students scored at least 3 marks.

The marks for the solution being heated and for the water being collected in the beaker were the most often scored.

Marks for the vapour cooling in the condenser and for the vapour condensing were the least often scored. Here, the term vapour / gas / steam needed to be used rather than, for example, evaporated water.

4.4.2.2 Neutralisation of acids and salt production

Answer 28 · Examiner comments — June 2019 | 8462/1F | Original Q9

Question 9 (standard demand)

09.1 Approximately 50% of students correctly identified H^+ as the ion produced by all acids in aqueous solution.

The most common incorrect response was OH^-

09.2 Approximately 15% of students scored both marks for completing the word equation.

The correct answers 'hydrochloric' (acid) and 'water' were seen in approximately equal numbers.

Common incorrect responses included:

- chloric / chlorine (for the reactant)
- hydrogen (for the product).

09.3 The name 'burette' was not well known with only approximately a third of students scoring the mark. Phonetic equivalents of this word also scored the mark but not 'biuret' (as this is a reagent used in biology).

Common incorrect responses included:

- thermometer
- pipette

Answer 28 · Examiner comments — June 2019 | 8462/1F | Original Q9

- syringe
- measuring cylinder.

09.4 Approximately 50% of students were able to take a correct reading from the burette scale.

The most common incorrect answer was 28.4 cm^3.

09.5 Even though this extended response question drew on their experience of a required practical activity, approximately 20% of students did not attempt it. A similar proportion scored 0 marks.

Approximately 10% of students achieved a Level 3 mark.

In many cases, at least one of the key steps in this titration was omitted, which therefore meant that students were not able to access Level 3.

4.4.2.2 Neutralisation of acids and salt production

Answer 33 · 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.

4.4.2.2 Neutralisation of acids and salt production

Answer 34 · 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.

4.4.2.2 Neutralisation of acids and salt production

Mark Ranges and Award of Grades

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

Answer 35 · Examiner comments

June 2024 | 8462/1F | Original Q2

Question 2 (low and standard demand)

02.1 Over half of students named all three pieces of equipment correctly, with three quarters scoring at least two marks. The burette was often called a measuring cylinder, and the conical flask a beaker. The burette and pipette were sometimes reversed.

02.2 Students found this difficult – many gave names of acids or alkalis, or substances totally unrelated such as iodine. Of those who did give an indicator, many gave universal indicator, which is not suitable for a titration. The most common correctly named indicator was phenolphthalein; any reasonable attempt at the spelling was accepted.

02.3 This was answered well, with nearly two thirds of students giving 'colour change' or a description of one. 'Clear' is not a description of a colour so was insufficient for a mark.

02.4 A third of students scored one mark, but far fewer scored both. Many students did not realise that they had been given the correct apparatus, and merely had to say what they would do to use that apparatus accurately. Instead, most suggested using other, less accurate, equipment such as a measuring cylinder or a beaker. The most common correct answer was to add the acid drop by drop. A few suggested repeating the experiment, without also saying to take a mean of the results. Some students suggested using a measuring cylinder to measure acid into the burette, not understanding what a burette does.

02.5 Two thirds of students gave the correct reading. The most common distractor was 17.4 cm^3.

02.6 Three quarters of students identified the closest pair of results.

02.7 Students found this standard demand question difficult. Just over a third of students identified the formula of barium chloride, but the distractor Ba_2Cl was even more popular.

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Answer 36 · 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 36 · 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.

4.4.2.2 Neutralisation of acids and salt production

Answer 37 · Examiner comments — June 2024 | 8462/1F | Original Q9

Question 9 (standard demand)

09.1 This question discriminated well, with one in six students scoring both marks and more than two fifths scoring at least one. Many students did not read the question fully and gave similarities and differences in properties rather than electronic structures. These responses gained no credit. Of those who did reference the electronic structure, most stated correctly that both have one electron on the outer shell, but were less successful in giving a correct difference. Sometimes the wrong number of shells was given for the two elements: usually 2 shells for sodium and 3 for potassium. Some stated that potassium has more outer shells than sodium. This is not correct as the phrase 'outer shell' is always taken to mean the single outermost shell.

09.2 More than a third of students could give two correct observations, and more than four fifths could give one, with bubbling, floating and a flame being the most popular. 'Gas produced' did not gain credit as it is not an observation but a deduction from the observation of bubbling. 'Fizzing' is taken to mean effervescence, so fizzing and bubbling are the same thing rather than two different observations. Credit was not given for any observation requiring extra equipment such as a thermometer or an indicator.

09.3 Only two fifths of students could give a correct colour and even fewer could express the reason in terms of the solution being alkaline; many thought it would be neutral. Some students gave purple as the colour, but gave potassium burning with a purple flame as their reason.

09.4 Nearly three fifths of students scored both marks for plotting the data, with the vast majority scoring at least one. The most commonly mis-plotted point was (86, 9.1) which was often plotted at (92, 9.1). There was no expectation that a line of best fit would be drawn.

09.5 Students were good at estimating the missing value, with nearly three quarters scoring the mark. Sometimes incorrect and inappropriate methods were seen which produced values in the allowed range, such as averaging all five values, or finding the difference between the points adjacent to the missing one. These were not given credit.

09.6 Over a third of students identified the reagents. There was an even distribution of incorrect responses.

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Answer 37 · Examiner comments — June 2024 | 8462/1F | Original Q9

09.7 Two fifths of students identified the correct pair of trends. The most popular error was to identify that the boiling point decreases down the group.

4.4.2.2 Neutralisation of acids and salt production

Answer 38 · Examiner comments June 2024 | 8462/2F | Original Q8

Question 8 (standard demand)

08.1 The test for sodium ions and the correct result were not well known with only 10% of students achieving both marks and a further 10% achieving one mark. Some students attempted to describe a flame test but failed to include the flame or how to introduce the sample into the flame in some way. Incorrect flame colours were often seen, particularly orange or crimson. Other incorrect tests that were commonly seen was the use of limewater or universal indicator.

08.2 The specific test for chloride ions is poorly understood with fewer than 1.5% of students achieving any marks. Many students misread the question and correctly described the test for chlorine gas. The mark for the result of the test was dependent upon a mark being awarded for a correct test.

08.3 The majority of students (more than 96%) were not awarded this mark. The use of words such as solution or liquid were common incorrect responses. The removal of **all** of the water was also not included by many students.

08.4 Less than 50% of students correctly identified how the mass of solid sodium chloride was calculated.

08.5 More than one in two students correctly calculated the mean concentration of sodium chloride and gained two marks. Fewer than one in five students correctly calculated the percentage. The remaining students either failed to progress in the calculation or attempted to calculate a percentage, frequently missing multiplying by one hundred, or getting the expression upside down. Many students incorrectly identified one of the concentrations as being anomalous despite this not being asked for in the q uestion. The only possible anomaly would be 36.4g/dm^3 and omitting only this value allowed students access to one of the two marks for the calculation of the mean concentration.

Answer 39 · 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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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.

Answer 40 · 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.

4.4.2.2 Neutralisation of acids and salt production

Answer 41 · Examiner comments — June 2025 | 8462/1F | Original Q4

Question 4 (low and standard demand)

04.1 Nearly three quarters chose the correct answer. Distillation was a very popular distractor.

04.2 Fewer than a third of students realised that the substance should be an indicator or were able to name one. Universal indicator was the most popular named indicator; this was accepted although it is not really appropriate for a titration. Acid and alkali were popular incorrect responses, as was liquid.

04.3 About five sixths of students chose burette as the correct answer.

04.4 Only two fifths of students realised that the acid should be added dropwise and / or that the solution should be swirled. One popular misconception was that the addition should be timed. Stirring was not accepted as an alternative to swirling, but adding the acid slowly was accepted as an alternative to dropwise or drop by drop.

Answer 41 · Examiner comments — June 2025 | 8462/1F | Original Q4

04.5 Most students knew how to calculate a mean, and the majority could round to 3 significant figures. However, some thought that 9.00, rather than 8.45, was the anomalous result; students need to look beyond the first digit. Quite a few placed a dot over the 3 in 8.93 of their final answer, indicating a recurring decimal, which was therefore an infinite number of significant figures not 3. Over two thirds of students scored at least 3 marks, with two fifths scoring full marks.

04.6 Only a quarter of students could identify both ions correctly. The ion present in an acid was known more often than the ion in an alkali. Many knew the correct two ions but had them the wrong way round. A significant number identified the ions in sodium chloride rather than in an acid and an alkali.