Pearson

Mark Scheme (Results)

Summer 2026

Pearson Edexcel GCSE in Chemistry
1CH0/ 1H

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Subject specific marking guidance

Symbols,termsused in the markscheme

• Round brackets ( ): words inside round brackets are to aid understanding of the marking point but are not required to award the point

• Curly brackets { }: indicate the beginning and end of a list of alternatives (separated by obliques) where necessary to avoid confusion

• Oblique /: words or phrases separated by an oblique are alternatives to each other and either answer should receive full credit.

• ecf: indicates error carried forward which means that a wrong answer given in an early part of a question is used correctly to a later part of a question.

You will not see owtte (or words to that effect). Alternative correct wording should be credited in every answer unless the ms has specified specific.

The Additional Guidance column is used for extra guidance to clarify any points in the mark scheme. It may be used to indicate:

- what will not be accepted for that marking point in which case the phrase 'do not accept' will be alongside the relevant marking point
- it might have examples of possible acceptable answers which will be adjacent to that marking point

Question Number	Answer	Additional Guidance	Mark	AO Spec
1(a)(i)	• improve appearance (1) • (increased) resistance to corrosion (1)	accept rusting, sacrificial protection, accept increased strength ignore references to conductivity or cost	**(2)**	**AO1 1** **5.4C**

Question Number	Answer	Mark	AO Spec
1(a)(ii)	**The only correct answer is A Cu2+ + 2e- → Cu** ***B*** *is not correct because it does not show the formation of copper in electrolysis* ***C*** *is not correct because it does not show the formation of copper in electrolysis* ***D*** *is not correct because it does not show the formation of copper in electrolysis*	**(1)**	**AO2 1** **3.27**

Question Number	Answer	Additional Guidance	Mark	AO Spec
1(b)	an explanation linking: • prevents {corrosion / rusting / oxidation} of steel (1) • (because) aluminium is more reactive (than iron / steel) (1) • so aluminium will react before {iron / steel} / aluminium will react first (1)	sacrificial protection ignore references to aluminium oxide layer	**(3)**	**AO2 1** **5.3cC**

(Total for Question 1 = 6 marks)

Question Number	Answer	Additional Guidance	Mark	AO Spec
2(a)	$NH_4Cl \rightleftharpoons NH_3 + HCl$ (2) • $\rightleftharpoons$ (1) • HCl (1)	allow reject = reject ↔ allow any case allow ClH ignore words ignore balancing numbers reject additional reactants or products	**(2)**	**AO2 1** **0.3** **4.13**

Question Number	Answer	Mark	AO Spec
2(b)(i)	**The only correct answer is B corrosive, oxidising, toxic** ***A*** *is not correct because there is no flammable or explosive symbol* ***C*** *is not correct because there is no explosive symbol* ***D*** *is not correct because there is no harmful symbol*	**(1)**	**AO2 1** **0.5**

Question Number	Answer	Additional Guidance	Mark	AO Spec
2(b)(ii)	An explanation linking • heat gently/ heat slowly (1) • so no (risk of liquid) spitting (1) OR • use a water bath/ electric heater (1) • so no (risk of liquid) spitting / OR reduces risk of being burned (1) • • point test tube away (1) so any liquid escaping doesn't OR hit the student (1) • • use a boiling tube/ beaker (1) OR less likely to boil over (1) • • tie hair back / tuck in tie (1) so that {hair/tie} does not catch OR fire (1) • hold at arm's length / clamp test tube (1) • so student does not burn OR themselves (1) • • use anti-bumping granules (1) OR to avoid boiling over (1) • • heat in a fume cupboard (1) so that the student does not breath in any **toxic** fumes (1)	MP2 dependent on MP1 ignore reference to PPE ignore less conc. acid reject add bung / stopper/ cork/ cover ignore use safety flame ignore any other generic safety rules allow test tube holder	**(2)**	**AO3 3b** **0.6**

Question Number	Answer	Additional Guidance	Mark	AO Spec
2(c)	• (2 x39) + (2 x 52) + (7 x 16) (1) • = 294 (1)	294 with or without working scores 2 allow 78 + 104 + 112 allow 1 for correctly **evaluated** expression with **only** 1 error e.g. (2 x 39) + (2 x 52) + (6 x 16) = 276 (1) (2 x 39) + (2 x 53) + (7 x 16) = 296 (1)	**(2)**	**AO2 1** **1.43a**

Question Number	Answer	Additional Guidance	Mark	AO Spec
2(d)	substitution (1) • $\frac{2 \times 39}{194} \times 100$ evaluation (1) • = 40.206	40.206/ 40.21 / 40.2/ 40 with or without working scores 2 allow 2 or more sig. fig. $\frac{39}{194} \times 100 = 20.103$ (1) no other ECF	**(2)**	**AO2 1** **1.43b**

(Total for Question 2 = 9 marks)

Question Number	Answer	Additional Guidance	Mark	AO Spec
3(a)	selenium	allow Se reject any other names or symbols	**(1)**	**AO2 1** **1.17**

Question Number	Answer	Additional Guidance	Mark	AO Spec
3(b)	An explanation linking any two from: • they are in same group/ both in group 2 (1) • they have {2/ same number} **outer** electrons (1) • they lose {2/ same number} electrons (when reacting) / they form 2+ ions (1)	reject protons reject protons	**(2)**	**AO2 1** **1.17** **1.24**

Question Number	Answer	Mark	AO Spec
3(c)	**The only correct answer is D magnesium sulfide** ***A****is incorrect because an* S^{2-} *ion is called sulfide* ***B****is incorrect because an* S^{2-} *ion is called sulfide* ***C****is incorrect because an* S^{2-} *ion is called sulfide*	**(1)**	**AO2 1** **1.25**

Question Number	Answer	Mark	AO Spec
3(d)	**The only correct answer is A in order of relative atomic mass** ***B****is incorrect because this is how the modern periodic table is arranged* ***C****is incorrect because elements were arranged in order of mass* ***D****is incorrect because this is how the modern periodic table is arranged*	**(1)**	**AO1 1** **1.15**

Question Number	Answer	Additional Guidance	Mark	AO Spec
3(e)	• group 7 / VII / seven (1) • period 3 / III / three (1)	allow group 17 ignore halogens for group 7	**(2)**	**AO3 1a** **AO3 1b** **1.19** **1.20**

Question Number	Answer	Additional Guidance	Mark	AO Spec
3(f)	$Ca(OH)_2$	allow $(OH)_2$ Ca reject $CA(OH)_2$, reject $Ca(Oh)_2$, reject $Ca(oH)_2$ reject $ca(OH)_2$ reject $CaOH_2$ reject CaO_2H_2 reject superscripts reject charges	**(1)**	**AO1 1** **1.26**

Question Number	Answer	Additional Guidance	Mark	AO Spec
3(g)	$(3 \times 6.02 \times 10^{23}) = 1.806 \times 10^{24}$	1.806×10^{24} with or without working scores 1 mark allow 1.8×10^{24}, 1.81×10^{24} allow 18.06×10^{23}, 18.1×10^{23}, 18×10^{23}	**(1)**	**AO2 1** **1.51b**

(Total for Question 3 = 9 marks)

Question Number	Answer	Additional Guidance	Mark	AO Spec
4(a)(i)	Haber (process)		**(1)**	**AO1 1** **5.19C**

Question Number	Answer	Mark	AO Spec
4(a)(ii)	**The only correct answer is B iron** ***A*** *is incorrect because aluminium will not catalyse in this reaction* ***C*** *is incorrect because lead will not catalyse in this reaction* ***D*** *is incorrect because the catalyst used in the Haber process is iron*	**(1)**	**AO1 1** **5.19C** **4.16c**

Question Number	Answer	Additional Guidance	Mark	AO Spec
4(b)(i)	a description including: OVERALL TREND • increasing pressure increases the yield (1) CHANGE IN GRADIENT • (yield) increase {occurs at decreasing rate/ slows} (as pressure increases) (1)	allow as yield increases, pressure increases allow {graph/ line/increase} is {non-linear/ curved/ gets less steep/ gradient falls/levels off/ plateaus} yield is directly proportional to pressure scores MP1 only	**(2)**	**AO3 1a** **AO3 1b** **5.19C**

Question Number	Answer	Mark	AO Spec
4(b)(ii)	62 (%)	**(1)**	**AO3 1b** **5.19C**

Question Number	Answer	Additional Guidance	Mark	AO Spec
4(c)(i)	ammonium sulfate	accept ammonium sulphate reject ammonia sulfate, ammonium sulfide, ammonium sulfite, ammonium sulfur ignore formulae	**(1)**	**AO1 2** **5.9C** **5.24aC**

Question Number	Answer	Additional Guidance	Mark	AO Spec
4(c)(ii)	• methyl orange (1) • from yellow (1) • to orange (1) OR • phenolphthalein (1) • from magenta / pink (1) • to colourless (1)	allow to red/ pink-red reject any other colours ignore clear allow • UI = reject for MP1 • from blue/ purple (1) • to green (1) allow • litmus = reject for MP1 • from blue (1) • to purple/ red (1) For each indicator, inc. UI and litmus, if colours reversed in MP2 and MP3 allow 1 MP2 and MP3 for the colours for any named indicator.	**(3)**	**AO1 2** **5.9C** **3.3**

Question Number	Answer	AdditionalGuidance	Mark	AO Spec
4(c)(iii)	• $\frac{24.70+24.60+24.60}{3}$ (1) • =24.63(1)	24.63withorwithout workingscores2marks allow 73.90 (1) allow**2ormore**d.p. allowecfforMP2only if 1errorinoneofthe **three** values	**(2)**	**AO1 2** **5.9C**

(TotalforQuestion 4 = 11 marks)

Question Number	Answer	Additional Guidance	Mark	AO Spec
5(a)(i)	• (each) calcium (atom) **loses 2** electrons (1) • (each) chlorine (atom) **gains 1** electron (1)	allow suitable diagrams allow forms Ca^{2+} allow forms Cl^{-} ignore calcium is oxidised and chlorine is reduced reject sharing of electrons for MP1 **AND** MP2 if MP1 and MP2 not scored then calcium (atoms) **lose** electrons AND chlorine (atoms) **gain** electrons / electrons transferred **from** calcium **to** chlorine (1)		**AO1 1**
	• form an ionic {lattice / bond / compound} / (strong) electrostatic attraction between (opposite) ions (1)	reject covalent for MP3 only	**(3)**	**1.21** **1.24**

Question Number	Answer	Additional Guidance	Mark	AO Spec
5(a)(ii)	an explanation linking: • (solid) calcium contains {free / delocalised} **electrons** (1) • (solid) calcium chloride contains **ions** (1) • (because)electrons can {flow / move} / ions {are fixed / cannot move} (1)	allow calcium chloride is an ionic compound / has ionic structure ignore 'carry a charge'	**(3)**	**AO2 1** **1.33b** **1.40**

Question Number	Answer	Additional Guidance	Mark	AO Spec
5(b)	amethod to include, **in this order**: • add water to the mixture (1) • filter (1) • crystallisation (1)	ignore heating before filtering allow description of filtration ignore any reasons for filtering allow description / evaporating allow add **HCl** and crystallise (2)	**(3)**	**AO3 3a** **2.8** **3.19c,e**

(Total for Question 5 = 9 marks)

Question Number	Answer	Mark	AO Spec
6(a)(i)	**The only correct answer is B an electrolyte** ***A*** *is not correct because sodium chloride solution is a mixture* ***C*** *is not correct because sodium chloride solution is a mixture* ***D*** *is not correct because sodium chloride solution is a mixture*	**(1)**	**AO1 1** **3.22**

Question Number	Answer	Additional Guidance	Mark	AO Spec
6(a)(ii)	they are inert / unreactive / do not react	ignore other properties of graphite e.g. soft, flaky ignore references to free/delocalised electrons do not allow low reactivity	**(1)**	**AO1 2** **3.25**

Question Number	Answer	Additional Guidance	Mark	AO Spec
6(a)(iii)	Cl^- **and** OH^-	both correct formulae including charges required for the mark reject any incorrect formulae	**(1)**	**AO1 1** **3.24b**

Question Number	Answer	Additional Guidance	Mark	AO Spec
6(a)(iv)	calculation (1) $\frac{6.5}{30}$ = (0.21666.... (dm^3)) unit conversion (1) (0.21666....) x 1000 = 216.66..... (cm^3) 3sf with correct rounding (1)	an answer of 217 with or without working scores 3 multiplying concentration by mass scores 0 calculations involving moles score 0 ecf throughout allow correct unit conversion and calculation in either order 4.62 (1) 4620 (2) 462 (1) 2170 (2) 0.217 (2) 0.000217 (2) 216 (2) 0.216 (1)	**(3)**	**AO2 1** **1.49**

Question Number	Answer	Additional Guidance	Mark	AO Spec
6(b)(i)	(sodium chloride solution) - hydrogen (molten sodium chloride) - sodium	allow H_2 ignore H allow Na	**(1)**	**AO1 1** **3.25b** **3.26**

Question Number	Answer	Additional Guidance	Mark	AO Spec
6(b)(ii)	an answer linking: • hydrogen **ions** in water (form hydrogen) / Na^+ and H^+ present / H^+ (and OH^-) ions form from water / hydrogen is less reactive than sodium (1) • sodium ions are the **only (cat)ions** present in molten sodium chloride (1) •	H^+ discharged in preference to Na^+ accept contains no H^+ ions	**(2)**	**AO1 1** **3.25b** **3.26**

(Total for Question 6 = 9 marks)

Question Number	Answer	Additional Guidance	Mark	AO Spec
7(a)(i)	an explanation linking: • atoms are different sizes in brass / ORA (1) • (atoms in solid) {in irregular pattern / disrupted lattice} in brass / ORA (1) • {layers / rows / atoms} cannot slide easily in brass / ORA (1)	answer may be given in diagrams e.g.  mention of molecules = max 2	**(3)**	**AO1 1** **5.5C**

Question Number	Answer	Additional Guidance	Mark	AO Spec
7(a)(ii)	an explanation linking: • a named use (1) • with a suitable property (1)	examples of uses include: electrical wiring, cooking utensils, plumbing parts. examples of suitable properties include: conductor of electricity, malleability, conductor of heat, unreactive. ignore conductor alone MP2 depends on MP1	**(2)**	**AO1 1** **5.7C**

Question Number	Indicative Content	Mark	AO Spec
***7(b)**	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. AO2 (3 marks) AO3 (3 marks) • **J** is copper carbonate • does not conduct when solid so ionic / not a metal • coloured solution formed on reaction with an acid which is a transition metal compound • coloured so transition metal compound • effervescence is carbon dioxide • blue solution is copper sulfate • **K** is iron (transition metal) • due to grey colour • high melting point • conducts when solid so metal / contains delocalised electrons • coloured solution formed on reaction with acid • has typical transition metal properties • green solution is iron sulfate • **L** is iron (III) oxide • does not conduct when solid so ionic / not a metal • coloured solution formed on reaction with an acid which is a transition metal compound • coloured so transition metal compound • no gas therefore not a carbonate • yellow solution is iron sulfate • **M** is copper (transition metal) • high melting point • conducts when solid so metal / contains delocalised electrons • no reaction with acid so unreactive so not iron • typical transition metal properties	**(6)**	**AO2 2** **AO3 2a** **AO3 2b** **5.1a** **5.1cC** **4.3** **1.33b** **1.42,** **3.11a** **3.11b** **3.11**

Level	Mark	Descriptor
	0	• No rewardable material
Level 1	1-2	• Deconstructs scientific information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. • Judgements are supported by limited evidence. (AO3)
Level 2	3-4	• Deconstructs scientific information and provides some logical connections between scientific concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently. • Judgements are supported by evidence occasionally. (AO3)
Level 3	5-6	• Deconstructs scientific information and provide logical connections between scientific concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently. • Judgements are supported by evidence throughout. (AO3)

Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	
Level 1	1-2	Additional Guidance Correctly identifies one solid (1) Gives one correct statement (1) Correctly identifies at least two solids (2) Correctly identifies one solid with a reason (2) Gives at least two correct reasons but does not correctly identify any solid (2)	Possible candidate response • J is copper carbonate / K is iron (1) • M is a metal as it conducts electricity (1) • Ionic compounds do not conduct electricity when solid (1) • L is iron oxide and M is copper (2) • J is copper carbonate because transition metal compounds are coloured (2)
Level 2	3-4	Additional Guidance Correctly identifies all four solids (3) Correctly identifies two solids with reasons for one of these (3) Correctly identifies all four solids with at least one reason (4) Correctly identifies two solids with different reasons for both (4)	Possible candidate response • K is iron because most metals are grey, L is iron oxide (3) • J is copper carbonate, K is iron, L is iron (III) oxide, M is copper. Copper conducts electricity due to delocalised electrons (4) • J is copper carbonate – form copper sulfate when reacted with acid which is blue. L is iron (III) oxide because transition metal compounds are coloured (4)
Level 3	5-6	Additional Guidance Correctly identifies all four solids with one different reason for at least two (5) Correctly identifies all four solids with one different reason for at least three (6)	Possible candidate response • J copper carbonate, K iron, L iron (III) oxide, M copper – metals conduct electricity when solid, copper is very unreactive (5) • J copper carbonate – bubbles of CO_2 formed when reacted with acid, K iron – grey colour of most metals, L iron (III) oxide – no effervescence as no gas formed, M copper – copper metal is an orange-brown colour (6)

(Total for Question 7 = 11 marks)

Question Number	Answer	Additional Guidance	Mark	AO Spec
8(a)(i)	an answer linking: • copper **ions** / Cu^{2+} (1) • gain **electrons** (1)	ignore copper alone / Cu^{+} / copper oxide allow correct half equation for both marks	**(2)**	**AO1 1** **3.28** **4.2**

Question Number	Answer	Additional Guidance	Mark	AO Spec
8(a)(ii)	an answer linking: • aluminium is **more** reactive than carbon / ORA (1) • carbon cannot displace aluminium / no reaction will occur (1)	ignore reference to electrolysis throughout	**(2)**	**AO1 1** **4.7C**

Question Number	Answer	Additional Guidance	Mark	AO Spec
8(b)(i)	an answer linking: • orange brown {solid / substance} / blue {solution / liquid} loses colour / {yellow / green} {solution / liquid} forms (1) • iron is more reactive than copper / ORA / iron displaces copper (1)	ignore changes colour alone allow brown / red brown / pink / copper **colour** for solid ignore precipitate accept paler / decolourises for blue solution ignore clear	**(2)**	**AO1 2** **4.8**

Question Number	Answer	Additional Guidance	Mark	AO Spec
8(b)(ii)	advantage (max 1) • does not require high temperatures / no {CO_2 / greenhouse gases / SO_2} released / copper reserves will last longer / reduces waste of copper ores disadvantage (max 1) • slow / only produces small amounts of copper / produces toxic substances	accept carbon emissions for CO_2 accept no mining accept uses **less** energy ignore copper reserves will be conserved ignore reference to costs ignore general references to pollutants / hazards / health hazard / environmental damage / renewable / sustainable	**(2)**	**AO1 1** **4.8**

Question Number	Answer	Additional Guidance	Mark	AO Spec
8(c)	there aremanypossiblewaysofcompleting this calculation: **EITHER** mole calculation for A (M)molesFe$_2$O$_3$=13.92=0.087(1) 160 (M)moles Fe =10.08 = 0.18(1) 56.0 ratio moles Fe$_2$O$_3$: moles Fe =0.087: 0.18 or 1 : 2.07 **andsonotequationAbutequation B** (1) **OR** mole calculation for B (M)molesFe$_3$O$_4$=13.92=0.06 (1) 232 (M)moles Fe =10.08 = 0.18(1) 56.0 ratio moles Fe$_2$O$_4$: moles Fe = 0.06 : 0.18 or1:3 **and so equation B** (1)	allowcalculationswhereconverted from tonnes to grams **muststateequationBtoscore MP3** statingequationB,withnocalculation to justify, scores 0 no ECF in this question otherwaysofcompletingthecalculation: molesofFe$_2$O$_3$=13.92=0.087 (1) 160 and molesof2Fe=10.08=0.09(1) 112 (thesearenotthesame)**soequation B** (1) dependent on MP1 and MP2 **OR** molesFe$_3$O$_4$=13.92= 0.06(1) 232 and molesof3Fe=10.08=0.06(1) 168 (thesearethesame)**soequation B** (1) dependent on MP1 and MP2		

	OR mass calculation for A (M)moles Fe_2O_3 = $\frac{13.92}{160}$ = 0.087 (1) expected mass Fe (eqn A) = 0.087 x 2 (1) (0.087 x 2) x 56.0 = 9.744 (tonnes) **and** so not equation A, therefore **equation B** (1) **OR** mass calculation for B (M)moles Fe_3O_4 = $\frac{13.92}{232}$ = 0.06 (1) expected mass Fe (eqn B) = 0.06 x 3 (1) (0.06 x 3) x 56.0 = 10.08 (tonnes) **and** so **equation B** (1)	**OR** Fe_2O_3 gives 2Fe for equation A 160 112 13.92 gives 13.92 x $\frac{112}{160}$ (2) = 9.744 (this is not the same as 10.08) **so must be equation B** (1) Fe_3O_4 gives 3Fe 232 168 13.92 gives 13.92 x $\frac{168}{232}$ (2) = 10.08 (these are the same as mass of iron) **so equation B** (1) **OR** ratio of masses 160 : 112 ≠ 13.92 : 10.08 **and** 232 : 168 = 13.92 : 10.08 so equation B scores 3	**(3)**	**AO2 1** **1.53**

(Total for Question 8 = 11 marks)

Question Number	Answer	Mark	AO Spec
9(a)(i)	**The only correct answer is D 11** ***A****is not correct because to neutralise the acid sodium carbonate must have pH >7* ***B****is not correct because to neutralise the acid sodium carbonate must have pH >7* ***C****is not correct because to neutralise the acid sodium carbonate must have pH >7*	**(1)**	**AO1 1** **3.2**

Question Number	Answer	Additional Guidance	Mark	AO Spec
9(a)(ii)	$2\ H^+ + CO^{2-}_3 \rightarrow H_2O + CO_2$ H+ only on left (1) H2O only on right (1) balancing correct formulae (1)	charge on hydrogen ion must be superscript balancing mark depends on correct formulae	**(3)**	**AO2 1** **0.4 3.1 3.11d**

Question Number	Answer	Additional Guidance	Mark	AO Spec
9(b)	3/pH3		**(1)**	**AO3 1b** **3.5**

Question Number	Answer	Additional Guidance	Mark	AO Spec
9(c)	a description to include • (dilute acid contains) few**er** (H^+) ions / (acid) particles (than concentrated) / ORA (1) • in the same volume of water / solvent / solution (1)	allow fewer molecules of acid ignore reference to water molecules ignore reference to concentration allow amount for volume allow per unit volume MP2 depends on MP1 allow (dilute acid contains) same number of (H^+) ions in a larg**er** volume of water / solvent / solution (2) allow (acid) particles are closer together in a more concentrated solution (2)	**(2)**	**AO1 1** **3.7**

Question Number	Indicative Content	Mark	AO Spec
***9(d)**	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. AO2 (3 marks) AO3 (3 marks) PRODUCTS OF REACTION • acid + metal → salt + hydrogen • bubbles are hydrogen • magnesium chloride (magnesium ethanoate not required) UNIVERSAL INDICATOR • red (strong acid) = pH 0 - 2 • orange (weak acid) = pH 3 – 4 • green = neutral • green = pH7 • products of reaction (appear to be) neutral SIMILARITIES AND DIFFERENCES • both start with acid pH and end neutral • hydrochloric acid pH lower than ethanoic acid pH • hydrochloric acid more reactive than ethanoic acid • strong acid fully dissociates • so more hydrogen ions available to react • hence larger temperature rise • weak acid partially dissociates • so fewer hydrogen ions available to react • hence smaller temperature rise	**(6)**	**AO2 2** **AO3 2a** **AO3 2b** **3.3, 3.8, 3.11a**

Level	Mark	Descriptor
	0	• No rewardable material
Level 1	1-2	• Interpretation and evaluation of the information attempted but will be limited with a focus on mainly just one variable. Demonstrates limited synthesis of understanding. (AO3) • The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2)
Level 2	3-4	• Interpretation and evaluation of the information on both variables, synthesising mostly relevant understanding. (AO3) The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2)
Level 3	5-6	• Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3) • The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2)

Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	
Level 1	1-2	Additional Guidance ~~Has identified one~~ product for either reaction (1) Gives a similarity between the two reactions (1) Products in solution are neutral (1) Writes a word equation for either reaction (2) Interprets indicator colours for both acids (2)	Possible candidate response • Magnesium chloride / magnesium ethanoate / hydrogen is formed (1) • Both reactions produce bubbles of gas (1) • After the reaction a neutral solution is formed / a neutralisation reaction took place (1) • Hydrochloric acid has a pH of 1-2, ethanoic acid has a pH of 3-4 (2)
Level 2	3-4	Additional Guidance Identifies the products of both reactions (3) Identifies a product and explains the colour change for one reaction (3) Interprets colours and colour changes of the indicator (3) Identifies the products and explains the colour change for both reactions (4) Identifies full dissociation to H^+ in HCl and partial dissociation to H^+ in ethanoic acid (4)	Possible candidate response • Products are given (accept attempt for magnesium ethanoate) (3) • Red is pH1-2, orange is pH 3-4, green is pH 7, neutralisation has taken place (3) • HCl is a strong acid with pH 1-2, CH_3COOH is a weak acid with pH 3-4, reaction of the acids with Mg gives a neutral solution
Level 3	5-6	Additional Guidance Identify at least one product, how the strength of one acid is affected by dissociation or concentration of H^+, linking to indicator colour or pH change and explain one similarity or difference. (5) Identify at least one product, how the strength of both acids is affected by dissociation or concentration of H^+, linking to indicator colour or pH change and explain at least one similarity or difference. (6)	Possible candidate response • HCl is completely dissociated giving a pH 1-2 (red). The gas formed in both reactions with magnesium is hydrogen. (5) • HCl is completely dissociated giving a pH 1-2 (red). CH_3COOH is partly dissociated giving a pH of 3-4 (orange), both gases react with magnesium to form hydrogen and a salt but the reaction with HCl is more vigorous. (6)

(Total for Question 9 = 13 marks)

Question Number	Answer	Additional Guidance	Mark	AO Spec
10(a)(i)	4800 with or without working scores (3) conversion of kg to g (1) calculation of mols of sulfur (1) 6400 = 200 _____ 32 volume of sulfur dioxide (1) 200 x 24 = 4800 (dm^3)	allow ecf throughout unit conversion does not have to be the first step 4.8 (2) 8.3 (2) 0.0083(1)	**(3)**	**AO2 1** **5.17C**

Question Number	Answer	Additional Guidance	Mark	AO Spec
10(a)(ii)	an answer linking: LOWER TEMPERATURE: • lower rate of / slower (attainment / reaction) (1) • fewer successful collisions / lower {frequency / rate of} collisions / fewer molecules with {activation energy / sufficient energy for reaction} (1) HIGHER TEMPERATURE: • decreased yield of sulfur trioxide (1) • as endothermic reaction favoured (1)	ORA for both marking points for effect of higher temperature ORA for both marking points for effect of lower temperatures	**(4)**	**AO1 1** **5.20aC** **5.21bC** **4.17**

Question Number	Answer	Additional Guidance	Mark	AO Spec
10(b)(i)	11.27 with or without working scores the mark $0.115 \times 98 = 11.27 (g\ dm^{-3})$		**(1)**	**AO2 1** **5.8C**

Question Number	Answer	Additional Guidance	Mark	AO Spec
10(b)(ii)	an answer of 0.169 with or without working scores 4 marks calculation of mols H_2SO_4 (1) $0.115 \times \frac{18.35}{1000} = 0.00211(025)$ ratio 1:2 (1) calculation of mols KOH (1) $2 \times 0.00211025 = 0.0042205$ concentration of KOH (1) $\frac{0.0042205}{(25 / 1000)} = 0.16882$	allow ecf throughout penalise early rounding once allow any number of sf except 1 0.084(41...) (3)	**(4)**	**AO2 1** **5.10C**

(Total for Question 10 = 12 marks)

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