Mark Scheme (Results)

November 2020

Pearson Edexcel GCSE
In Chemistry (1CH0) Paper 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.

Mark schemes have been developed so that the rubrics of each mark scheme reflects the characteristics of the skills within the AO being targeted and the requirements of the command word. So for example the command word 'Explain' requires an identification of a point and then reasoning/justification of the point.

Explain questions can be asked across all AOs. The distinction comes whether the identification is via a judgment made to reach a conclusion, or, making a point through application of knowledge to reason/justify the point made through application of understanding. It is the combination and linkage of the marking points that is needed to gain full marks.

When marking questions with a 'describe' or 'explain' command word, the detailed marking guidance below should be consulted to ensure consistency of marking.

Assessment Objective		**Command Word**	
Strand	**Element**	**Describe**	**Explain**
AO1*		An answer that combines the marking points to provide a logical description	An explanation that links identification of a point with reasoning/justification(s) as required
AO2		An answer that combines the marking points to provide a logical description, showing application of knowledge and understanding	An explanation that links identification of a point (by applying knowledge) with reasoning/justification (application of understanding)
AO3	1a and 1b	An answer that combines points of interpretation/evaluation to provide a logical description	
AO3	2a and 2b		An explanation that combines identification via a judgment to reach a conclusion via justification/reasoning
AO3	3a	An answer that combines the marking points to provide a logical description of the plan/method/experiment	
AO3	3b		An explanation that combines identifying an improvement of the experimental procedure with a linked justification/reasoning

*there will be situations where an AO1 question will include elements of recall of knowledge directly from the specification (up to a maximum of 15%). These will be identified by an asterisk in the mark scheme.

Question number	Answer	Additional guidance	Mark
1(a)	An explanation linking • (18 carat gold) contains atoms of different sizes/ORA (1) • disrupts structure of metal / prevents layers from {slipping / sliding /moving} over one another (1)	reject molecules once allow particles/ions for atoms allow particles / atoms / sheets / rows for layers	**(2)**

Question number	Answer	Additional guidance	Mark
1(b)	final answer of 14 with or without working (3) OR $\frac{2.9}{5.0}$ = 0.58 (1) 0.58 x 100 = 58% (1) 14 (1)	allow ECF allow 13.8-14.0	**(3)**

Question number	Answer	Additional guidance	Mark
1(c)	final answer of 1.2(04) x 10^{22} with or without working (2) OR $\frac{3.94}{197}$ = 0.02 (1) 0.02 x 6.02 x 10^{23} = 1.2(04) x 10^{22} (1)	allow ECF allow 0.12(04) x 10^{23}	**(2)**

Question number	Answer	Additional guidance	Mark
2(a)(i)	A description including • apply lighted splint (1) • gas burns / (squeaky) pop (1)	 allow flame / ignite gas ignore 'squeaky pop test' / glowing splint second mark is dependent on first	**(2)**

Question number	Answer	Mark
2(a)(ii)	**B** oxygen **The only correct answer is B** **A**, **C** & **D** these gases are not produced in the electrolysis of sodium sulfate solution	**(1)**

Question number	Answer	Additional guidance	Mark
2(a)(iii)	• electrical energy / electricity (1) • {decomposes / breaks down / splits} {electrolytes / (ionic) compounds / substances} (1)	allow electric current allow **<u>separates</u>** ions reject decomposing elements for MP2	**(2)**

Question number	Answer	Additional guidance	Mark
2(b)	final answer of 114 (g dm^{-3}) with or without working (3) OR <u>28.4</u> (1) (= 0.1136) 250 0.1136 x 1000 (1) (= 113.6) = 114 (g dm^{-3}) (1)	allow ECF throughout <u>250</u> (dm^3) (1) (= 0.250 (dm^3)) 1000 <u>28.4</u> (1) (= 113.6) 0.250 OR <u>1000</u> (1) = 4 250 4 x 28.4 (1) (= 113.6) Must have 3sf for MP3 0.114 scores 2 Lose MP1 if rounded incorrectly e.g, to 0.11 or 0.113 but mark on	**(3)**

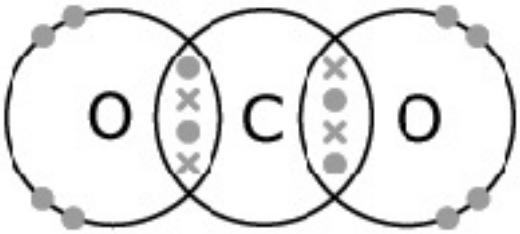
Question number	Answer	Additional guidance	Mark
2(c)	Na_2SO_4	allow SO_4Na_2 allow upper case A ignore any charges on ions reject non-subscript 2 & 4	**(1)**

Question number	Answer	Additional guidance	Mark
3(a)(i)	Left : H_2SO_4 (1) Right : $CuSO_4$ (1)	reject superscript numbers reject superscript numbers incorrect balancing max 1	**(2)**

Question number	Answer	Mark
3(a)(ii)	63.5 + 12 + 3x16 (1) = 123.5 (1)	**(2)**

Question number	Answer	Mark
3(a)(iii)	**A** bubble the gas through limewater, limewater turns cloudy **The only correct answer is A** **B** is not correct because test shows only an acidic gas **C** is not correct because test shows only that the gas does not support combustion **D** is not correct because test shows only an acidic gas	**(1)**

Question number	Answer	Additional guidance	Mark
3(b)	Any TWO from • no more bubbles / fizzing (1) • no further change in colour (1) • {solid / copper carbonate} remains at bottom of flask / no more {solid / copper carbonate} dissolves (1)	 ignore references to pH allow cloudy/opaque liquid ignore no more copper carbonate will react	**(2)**

Question number	Answer	Additional guidance	Mark
3(c)	 (2) or • CO_2 with one correct double bond (1) • rest of structure correct (1)	ignore any inner electrons shown remaining electrons on oxygen either singly or paired allow all dots or all crosses 2nd mark dependent on 1st	(2)

Question number	Answer	Additional guidance	Mark
4(a)(i)	K, L, J, N, M		(1)

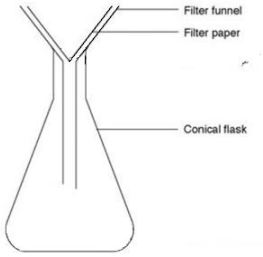
Question number	Answer	Additional guidance	Mark
4(a)(ii)	(volumetric) pipette	allow burette reject dropping pipette ignore balance	(1)

Question number	Answer	Additional guidance	Mark
4(b)(i)	An explanation linking • solution from titration contains an indicator (1) • therefore second solution used with no indicator / indicator would contaminate salt (1)	MP2 dependant on MP1 allow original mixture was contaminated by indicator so doesn't form a pure salt (2)	(2)

Question number	Answer	Additional guidance	Mark
4(b)(ii)	final answer of 120% with or without working (2) OR $\frac{0.84}{0.70}$ (=1.2) (1) $\frac{0.84}{0.70}$ x 100 (=120(%)) (1)	 allow any fraction x100 (1)	**(2)**

Question number	Answer	Additional guidance	Mark
4(b)(iii)	{the salt/solid/potassium chloride} was still wet/ not all of the water had been evaporated off		**(1)**

Question number	Answer	Additional guidance	Mark
4(b)(iv)	final answer of 80.5 with or without working (4) OR total mass: 56 + 36.5 (=92.5) / 74.5 + 18 (=92.5) (1) $\frac{74.5}{92.5}$ (= 0.8054) (1) $\frac{74.5}{92.5}$ x 100 (=80.540) (1) = 80.5 (1)	allow ECF throughout 92.5 seen (1) incorrect answer with working to 1 decimal place (1) 50.0/100.0 does not score MP4	**(4)**

Question number	Answer	Additional guidance	Mark
5(a)(i)	 (2) OR diagram: funnel with separate filter paper and (conical) flask (1) labels: (filter) **funnel and filter paper and** (conical) flask (1)	reject diagram with funnel 'closed' at bottom/top but can score MP2 allow 'closed' filter paper allow any suitable apparatus for conical flask e.g. beaker 'flask' label should be appropriate to apparatus drawn ignore labelling of filtrate/residue etc	(2)

Question number	Answer	Additional guidance	Mark
5(a)(ii)	a description including any three from: • heat solution (to concentrate) (1) then either • leave solution {in warm place / to crystallise} (1) • scrape crystals (from container) / pat dry between filter papers (1) OR • leave solution {to crystallise / to cool} (1) • filter off crystals / decant liquid from the crystals / pat dry between filter papers / dry in oven (1)	if no other marks are scored , allow max 1 for crystallisation (1)	(3)

Question number	Answer	Additional guidance	Mark
5(b)(i)	0.6 or $\frac{3.9}{6.5}$		**(1)**

Question number	Answer	Additional guidance	Mark
5(b)(ii)	longer paper/ different {medium/ paper}	ignore repeat experiment ignore more accurate ruler	**(1)**

Question number	Answer	Additional guidance	Mark
5(b)(iii)	An explanation linking use a different solvent (1) so that the ink will dissolve (1)	 allow any suitable named solvent allow because the ink does not dissolve in water	**(2)**

Question number	Answer	Additional guidance	Mark
6(a)	final answer of 47.91 / 47.9 with or without working (3) All percentages given as: Ti–46 = 8 Ti–47 = 7 Ti–48 = 75 Ti–49 = 6 Ti–50 = 4 (1) 46 x 8 = (368) 47 x 7 = (329) 48 x 75 = (3600) 49 x 6 = (294) 50 x 4 = (200) (= 4791) (1) $\frac{4791}{100}$ = 47.91 (1)	48 without working = 0 allow 7-7.5 for Ti-47 (7.5 gives 48.145) allow ECF for MP2 [Note: answer of 48 can score MP3 but must have correct working] Allow ECF but answer for MP3 must be between 46 and 50	**(3)**

Question number	Answer	Additional guidance	Mark
6(b)(i)	**D** oxidation Answers **A** and **B** are physical processes rather than chemical reactions. **C** is wrong because it is not neutralisation.		**(1)**

Question number	Answer	Additional guidance	Mark
6(b)(ii)	A description linking any three from: • lift lid from time to time/ leave small gap between crucible and lid (1) • find mass (of crucible, lid and product) (1) • {repeat / heat} to constant mass (1) • final mass – start mass = mass of oxygen (1)	 allow 'weigh' allow find the change in mass	**(3)**

Question number	Answer	Additional guidance	Mark
6 (c)	$\frac{2.24}{56.0} = 0.04$ and $\frac{0.96}{16.0} = 0.06$ (1) 1 : 1.5 / 2 : 3 (1) Fe_2O_3 (1) $4Fe + 3O_2 \rightarrow 2\mathbf{Fe_2O_3}$ (1)	allow ECF for MP2 and MP3 only. allow $\frac{2.24}{56.0} = 0.04$ and $\frac{0.96}{32.0} = 0.03$ (1) 1.33 : 1 / 4 : 3 (1) Fe_2O_3 (1) $4Fe + 3O_2 \rightarrow 2\mathbf{Fe_2O_3}$ (1) NOTE: equation alone gains no marks.	**(4)**

Question number	Answer	Additional guidance	Mark
7(a)(i)	an explanation linking • shift equilibrium to right / in forward direction (1) • increase yield of {product / hydrogen / carbon monoxide} (1)	 allow favours forward/endothermic reaction ignore references to decreasing amounts of reactants. marks are independent	**(2)**

Question number	Answer	Additional guidance	Mark
7(a)(ii)	final answer of 2.4 with or without working (3) OR $\frac{0.4}{16} = 0.025$ (1) 0.025 x 4 = 0.1 (1) 0.1 x 24 = 2.4 (1)		**(3)**

Question number	Indicative content	Mark
***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 outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **A01 and A02 (6 marks)** advantages • once set up, fuel cells require no maintenance • chemical cells will need to be replaced / chemical cells have a limited lifetime • fuel cells operate as long as reactants are supplied • voltage drops in chemical cells as reactants are used up • once used chemical cells cannot be used again or need re-charging • used chemical cells take up valuable space on spacecraft • new chemical cells need to be transported to spacecraft • used chemical cells need to be transported back to earth • water produced in the fuel cell is the only product • water can be used on the spacecraft as drinking water disadvantages • hydrogen and oxygen must be supplied • gas tanks need to transported by spacecraft • storage of hydrogen is difficult because it is a gas • hydrogen is flammable • fuel cells are expensive to manufacture conclusion • either cell can be chosen as the preferable one but suitable reasons must be given	**(6)**

Level	Mark	Additional Guidance	General additional guidance Eg - At each level, as well as content, the scientific coherency of what is stated backed up by planning detail will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	Additional guidance Describes an advantage or disadvantage or states two advantages and/or disadvantages	Possible candidate responses • hydrogen is flammable (1) • new chemical cells need to be brought to the spacecraft (1) • water is the (only) product and can be used by astronauts as drinking water (2) • storage of hydrogen is difficult as hydrogen is a gas (2)
Level 2	3–4	Additional guidance Describes two advantages and/or disadvantages	Possible candidate responses • fuel cells are expensive to manufacture and are difficult to repair if they stop working, but fuels cells will continue to work whilst hydrogen and oxygen are supplied (3) • voltage of chemical cells drops as they are used so the energy produced decreases over time. Fuel cells produce water which can be used on the space craft (4)
Level 3	5–6	Additional guidance Describes three advantages and/or disadvantages **and** Evaluates the advantages and disadvantages to form a conclusion	Possible candidate responses • fuel cells are better than chemical cells. This is because water is the only product from the reaction of hydrogen and water. This water can be used on the space craft as drinking water. Chemical cells will become obsolete when reactants have been used up, therefore more chemical cells will be needed and the waste cells will take up valuable space on the space craft (6)

Question number	Answer	Additional guidance	Mark
8(a)(i)	**A** 20 20 **is the only correct answer** **B**, **C** and **D** are incorrect because calcium does not have 40 protons; calcium does not have 60 neutrons; calcium does not have 60 protons		**(1)**

Question number	Answer	Additional guidance	Mark
8(a)(ii)	an explanation linking • period 4 (1) • four shells of electrons (1)	 reject four <u>outer</u> shells	**(2)**

Question number	Answer	Additional guidance	Mark
8(b)(i)	both form a **hydroxide**	allow formulae ignore observations	**(1)**

Question number	Answer	Additional guidance	Mark
8(b)(ii)	potassium {forms cations / loses (outer) electron} more easily ORA	ignore speed of electron loss / sizes of atoms / number of shells / distance of electrons from nucleus / number of electrons in outer shell	**(1)**

Question number	Indicative content	Mark
***8(c)**	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **A01 (3 marks) and A02 (3 marks)** STRUCTURE • calcium chloride is an ionic compound with lattice of positive and negative ions • calcium is a metal and so has a metallic structure of delocalised electrons and {calcium/Ca^{2+} ions} • chlorine is a simple molecular covalent compound MELTING POINT • there are strong electrostatic forces of attraction/ionic bonds between the ions in calcium chloride • a large amount of heat energy is required to break the electrostatic forces (so calcium chloride has a high melting point) • strong electrostatic forces between ions and delocalised electrons in calcium • a large amount of heat energy is required to break the electrostatic forces (so calcium has a high melting point) • chlorine has weak forces of attraction between its molecules and these weak forces only take a small amount of energy to break down (so chlorine has a low melting point) CONDUCTIVITY WHEN SOLID • ions are fixed in a lattice and so cannot move (therefore calcium chloride cannot conduct a current) • delocalised electrons in metallic structure can move to carry a current (so calcium can conduct a current) • there are no delocalised electrons/ions/charged particles/overall charges in chlorine molecules and (so chlorine cannot conduct a current) CONDUCTIVITY WHEN MOLTEN • however, when molten ions are free to move (and therefore molten calcium chloride can conduct a current) • delocalised electrons in metallic structure can move to carry a current (so calcium can conduct a current) • there are no delocalised electrons/ions/charged particles/overall charges in chlorine molecules and (so chlorine cannot conduct a current) all incorrect information/explanations should be ignored reject contradictory explanations	**(6)**

Level	Mark	Additional Guidance	General additional guidance Eg - At each level, as well as content, the scientific coherency of what is stated backed up by planning detail will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	Additional guidance Three structures named OR one structure described OR one property explained for one substance	Possible candidate responses • calcium is metallic, chlorine is a molecule (1) • calcium chloride is ionic with positive calcium ions and negative chloride ions (2) • calcium is metallic, chlorine is covalent, calcium chloride is ionic (2) • calcium is metallic it conducts when solid as it has mobile electrons (2)
Level 2	3–4	Additional guidance Three structures described or three properties explained.	Possible candidate responses • calcium has a metallic lattice of cations and delocalised electrons. Chlorine is made of simple molecules with weak intermolecular forces between them (3) • calcium has a metallic lattice of cations and delocalised electrons. Chlorine is made of simple molecules with weak intermolecular forces between them, this means that chlorine has a low melting point because little energy is needed to overcome these forces. (4)
Level 3	5–6	Additional guidance Six properties explained.	Possible candidate responses • calcium chloride has strong electrostatic forces between the ions so a high melting point and these ions are fixed in a lattice so the solid does not conduct. When melted, the ions are free to move and so the liquid does conduct. There are weak intermolecular forces between chlorine molecules so the melting point is low.(5) • calcium chloride has strong electrostatic forces between the ions so a high melting point and these ions are fixed in a lattice so the solid does not conduct. When melted, the ions are free to move and so the liquid does conduct. There are weak intermolecular forces between chlorine molecules so the melting point is low and molecules are uncharged so chlorine does not conduct electricity when solid or liquid (6)

Question number	Answer	Additional guidance	Mark
9(a)(i)	an explanation linking • fully dissociates (1) • to form {H^+/hydrogen} ions (1)	 allow ionises/splits up	**(2)**

Question number	Answer	Mark
9(a)(ii)	3 / pH 3	**(1)**

Question number	Answer	Additional guidance	Mark
9(b)	$MgO + 2H^+ \rightarrow Mg^{2+} + H_2O$ LHS (1) RHS (1) balancing of correct formulae (1)	allow two marks for $O^{2-} + 2H^+ \rightarrow H_2O$	**(3)**

Question number	Answer	Additional guidance	Mark
9(c)(i)	pH meter/ pH probe	ignore data logger alone reject litmus / phenolphthalein / universal indicator solution / pH paper	**(1)**

Question number	Answer	Additional guidance	Mark
9(c)(ii)	• increases pH (1) • until pH above 7 (1) and an explanation linking REACTION • {magnesium hydroxide / base / alkali / OH^- ions} {reacts with / neutralises} {the acid / the H^+ ions} IONS REMAINING • so the hydrogen ions concentration is reduced / **all** hydrogen ions reacted / there is an excess of hydroxide ions (1)	 allow until pH = 7 ignore until neutral ignore there is an excess of magnesium hydroxide	**(4)**

Question number	Answer	Mark
10(a)(i)	**D** increases does not change **A, B, C** are incorrect because catalysts increase rate of attainment of equilibrium and do not change equilibrium yield	**(1)**

Question number	Answer	Mark
10(a)(ii)	**C** the amounts of nitrogen, hydrogen and ammonia become constant **A, B, D** are incorrect because when the reaction reaches equilibrium the amount of nitrogen, hydrogen and ammonia remain constant	**(1)**

Question number	Answer	Additional guidance	Mark
10(a)(iii)	an explanation linking • equilibrium attained in a shorter period of time / rate of attainment of equilibrium {faster/ increases} (1) • equilibrium yield increases (1) • equilibrium shifts to the {right / forward / to products side} (1) • decrease in number of molecules (1)	allow moves to fewer molecules	**(4)**

Question number	Answer	Additional guidance	Mark
10(b)(i)	both are {soluble/will dissolve} (in water)		**(1)**

Question number	Answer	Additional guidance	Mark
10(b)(ii)	$NH_3 + HNO_3 \rightarrow NH_4NO_3$ LHS (1) RHS (1)	allow multiples	**(2)**

Question number	Answer		Mark
10(b)(iii)	a similarity from : both use sulfuric acid (1) both (are examples of) neutralisation (1) and a difference from : the industrial process is on a much larger scale than the laboratory process / ORA (1) the industrial process involves more stages than the laboratory process / ORA (1) ammonia is a gas in the industrial process but a solution in the laboratory process (1) laboratory preparation uses titration and crystallisation (1)	 ignore both produce ammonium sulfate allow both use same reactants allow both give out heat energy / exothermic (1) allow laboratory preparation is a batch process, industrial preparation is continuous process (1) ignore industrial is more dangerous	**(2)**