Mark Scheme (Results)

Summer 2024

Pearson Edexcel GCSE
In Combined Science Chemistry
(1SC0) Paper 1CH

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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.

Paper 1CH Higher Tier

Question number	Answer	Mark
1(a)(i)	$Ba(OH)_2(s) + 2HCl(aq) \rightarrow BaCl_2(aq) + 2H_2O(l)$	**(1)** **AO2-1**

Question number	Answer	Additional guidance	Mark
1(a)(ii)	barium hydroxide {disappears / gets smaller} / (it) becomes clear	allow 'solid' for barium hydroxide allow barium hydroxide dissolves ignore any colours mentioned / colour change / any incorrect observations ignore becomes a {liquid/solution} reject bubbles	**(1)** **AO2-2**

Question number	Answer	Additional guidance	Mark
1(b)(i)	pH meter	allow pH probe ignore pH paper / data logger / pH scale	**(1)** **AO3-3b**

Question number	Answer	Additional guidance	Mark
1(b)(ii)	An explanation linking: • to ensure that the mixture is evenly spread (1) • to make substances {react/ dissolve} / to speed up the {reaction / dissolving} (1)	 allow to mix the reactants allow so pH (in mixture) is uniform / concentration is uniform / to get an accurate pH ignore more accurate / valid / fair test allow 'so the reaction is complete' / 'to dissociate all the hydroxide ions'	**(2)** **AO2-2**

Question number	Answer	Additional Guidance	Mark
1(b)(iii)	all points plotted correctly (± half a small square) (2) OR 7/8 points plotted correctly (1) S-shaped line of best fit (1)	 line of best fit must go through 7 points if the points are not visible a line going through **all** correct values scores 3 reject dot-to-dot line / line starting from origin tramlines allowed here but rejected in 1(b)(iv) bar chart scores 0	**(3)** **AO2-1**

Question number	Answer	Additional guidance	Mark
1(b)(iv)	pH reading at 4.5 spatula measures from their line on graph	allow ± half a small square on the **y**-axis ignore any candidate working allow ECF from 1(b)(iii) but if no graph line or multiple lines, cannot score. if bar chart has been drawn for 1(b)(iii), then mark for 2(b)(iv) cannot be awarded	**(1)** **AO3-2a**

Total for Question 1 = 9 marks

Question number	Answer	Mark
2(a)(i)	**B** 2.8 **A** is incorrect as there are too few electrons **C** and **D** are incorrect as there are too many electrons	**(1)** **AO1-1**

Question number	Answer	Additional guidance	Mark
2(a)(ii)	an explanation linking SOLID • has an {(ionic) lattice / ions held by strong (electrostatic) attractions} (1) • so the **ions** {cannot move / are fixed / just vibrate} (1) SOLUTION • in solution the **ions** {can move / are free} (1)	 allow giant structure / regular arrangement / regular structure for lattice allow atoms / (charged) particles in MP1 only ignore electrons for MP1 reject molecules / elements reject electrons allow liquid for solution reject electrons reject intermolecular forces	**(3)** **AO2-1**

Question number	Answer	Additional guidance	Mark
2(b)	43(.4) with or without working scores 3 2x23 + 12 + 3x16 = 106 (1) $\frac{46}{106}$ = 0.4339622642 (1) 0.4339622642 x 100 = 43.4 (1)	43.39622642 rounded correctly to 2 or more sig. fig. scores 3 if M_r incorrect, must show working to allow ECF on MP2 and MP3 $\frac{46}{\text{attempt of } M_r\ Na_2CO_3}$ $\frac{23 \text{ or } 46}{\text{attempt of } M_r\ Na_2CO_3}$ x 100 the following common answers with working are awarded 21.69811321 rounded correctly to 2 or more sig. fig. scores 2 76.6666667 rounded correctly to 2 or more sig. fig. scores 2 48.11320755 rounded correctly to 2 or more sig. fig. scores 1	**(3)** **AO2-1**

Total for Question 2 = 7 marks

Question number	Answer	Additional guidance	Mark
3(a)	Any two advantages of recycling metals • preserves ore reserves/ ores are finite (1) • prevents waste of the metal (1) • uses less energy (1) • less fossil fuels burned (1) • less {carbon dioxide/ greenhouse gases} emitted (1) • less waste material formed (1) • mining causes {loss of habitat/ noise/ dust} • doesn't fill up landfill (1)	allow uses less electricity ignore less land used for mining/ visual pollution ignore cost arguments ignore vague statements about 'environment' or 'pollution' or 'sustainable'	**(2)** AO1-1

Question number	Answer	Additional guidance	Mark
3(b)(i)	An explanation linking • reduction and oxidation occurring (1) • {Zinc (atoms)/ Zn} lose electrons **and** are oxidised (1) • {Cadmium **ions**/ Cd^{2+}} gain electrons **and** are reduced (1)	ignore numbers of electrons correct or otherwise MP1 scores even if wrong (or no) species identified reject zinc ions reject cadmium (atoms) gains electrons allow half-equations for gain/loss of electrons part of answer For MP2 and MP3 if both marks not scored: {Zinc (atoms)/ Zn} lose electrons **and** {Cadmium **ions**/ Cd^{2+}} gain electrons (1) **OR** {Zinc (atoms)/ Zn} are oxidised **and** {Cadmium **ions**/ Cd^{2+}} are reduced (1)	**(3)** AO1-1

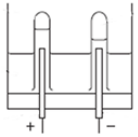
Question number	Answer	Mark
3(b)(ii)	**C** $Cd_3(PO_4)_2$ is the only correct answer **A**, **B** and **D** are incorrect formulae of cadmium phosphate	**(1)** AO1-1

Question number	Answer	Additional guidance	Mark
3(c)	very slow / low yield / {toxic substances / acids / sulfuric acid} can be produced / (leachate) needs further processing	allow time consuming allow inefficient ignore vague statements such as 'damages the environment' or 'causes pollution' or 'produces harmful substances' ignore cost	**(1)** AO1-1

Question number	Answer	Additional guidance	Mark
3(d)	A plan to include a suitable method • add {carbon / hydrogen / methane} (1) • and heat (1) OR • electrolyse (1) • solution formed <u>with acid</u> (1)	MP2 depends on MP1 allow '<u>more</u> reactive {metal / element} ' or sensible named metal e.g. zinc but not sodium allow any named acid allow {liquid / molten} lead oxide / after melting (1)	**(2)** AO3-3a

Total for Question 3 = 9 marks

Question number	Answer	Additional guidance	Mark
4(a)(i)	An explanation linking • it contains (hydrogen / sulfate) **ions** (1) • which can move (1)	MP2 depends on MP1 reject electrons for MP1 and MP2 allow formula for {hydrogen ion / sulfate ions} even if incorrect allow charged particles / cations / anions allow hydrogen or sulfate ions even if charge or formula is incorrect allow which are dissociated / are free / in a liquid / in a solution / go to electrodes ignore 'it conducts electricity'	**(2)** AO1-1

Question number	Answer	Mark
4(a)(ii)	**A**  **B**, **C** and **D** are incorrect because they show the incorrect ratio of gases that are produced	**(1)** AO2-2

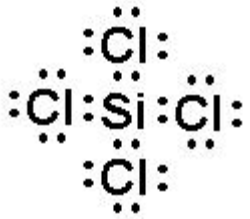
Question number	Answer	Additional guidance	Mark
4(a)(iii)	$4OH^- \rightarrow O_2 + 2H_2O + 4e^{(-)}$ (2)	correct species (1) balancing of only correct species (1) allow incorrect cases / subscripts allow 1 mark for $O_2 + 2H_2O$ on RHS allow 1 mark for $+ 4e^{(-)}$ on RHS	**(2)** AO2-1

Question number	Answer	Additional guidance	Mark
4(b)(i)	A description to include • wash / rinse (1) • dry / leave to dry / allow any solvent to evaporate (1)	mark independently reject clean with sandpaper / scrape off the copper for both marks allow dip in {propanone / water} ignore wipe / clean allow water, propanone for solvent allow pat dry	**(2)** AO1-2

Question number	Answer	Additional guidance	Mark
4(b)(ii)	An explanation linking • {copper **ions** / **cations** / **positive ions**} **and** {gain electrons/ are reduced} (1) • to form {copper / atoms} (on cathode) (1)	 allow incorrect size of positive charge on copper ion half-equation (even if incorrect size of positive charge on copper ion or incorrectly balanced) can score MP1 and MP2 if no other marks awarded allow max 1 for {copper **ions** / **cations** / **positive ions**} go to cathode	**(2)** AO1-1

Question number	Answer	Additional guidance	Mark
4(b)(iii)	An explanation linking: • {Cu^{2+} / cations / ions} enter solution (from anode) and leave solution (at cathode) (1) • no change in {concentration / amount / number} of {Cu^{2+}/ cations / ions} (1)	 allow constant / same concentration of {Cu^{2+}/cations / ions} allow concentration of copper sulfate	**(2)** AO3-2

Total for Question 4 = 11 marks

Question number	Answer	Additional guidance	Mark
5(a)(i)	 (2) all **four** bond pairs (1) rest of molecule correct (1)	MP2 dependent on MP1 electrons may be shown as dots or crosses or any combination electrons can be shown in any overlapping part of intersecting shells allow atoms unlabelled ignore inner shells, whether correct or otherwise	**(2)** AO2-1

Question number	Answer	Additional guidance	Mark
5(a)(ii)	An explanation linking • weak forces **between molecules/ intermolecular forces** (1) • little {**heat** / **energy**} needed (1)	MP2 can score even if MP1 not scored allow **intermolecular** bonds / bonds **between molecules** reject forces between {atoms / bonds / ions} for MP1 only ignore **less** energy needed / 'easy' to break ignore low temperature	**(2)** AO1-1

Question number	Answer	Mark
5(b)	**D** 693 1340 is the only correct answer **A** has a boiling point showing a liquid at room temperature **B** and **C** although solids at room temperature would melt very easily	**(1)** AO2-1

Question number	Indicative content	Mark
***5(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. **AO1 (6 marks)** electrical conductivity • diamond – all 4 outer shell electrons of carbon form (covalent) bonds • each carbon joined to four other carbon atoms • no free electrons available for electrical conductivity • graphite – 3 outer shell electrons of carbon form (covalent) bonds • each carbon joined to three other carbon atoms • 1 free electron for each carbon atom • delocalised electrons • are between the layers • delocalised electrons move to carry current hardness • diamond - strong (covalent) bonds • between all carbon atoms • in 3D lattice / giant (covalent) lattice / tetrahedral structure • requires a very high amount of energy to overcome • graphite – giant (covalent) lattice • strong (covalent) bonds between all carbon atoms within each layer • weak forces between layers / allow weak intermolecular forces • layers can slide	**(6)** AO1-1

Total for Question 5 = 11 marks

Level	Mark	Descriptor
	0	• No awardable content
Level 1	1-2	• Demonstrates elements of chemical understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3-4	• Demonstrates chemical understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5-6	• Demonstrates accurate and relevant chemical understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Level	Mark	Descriptor	Possible candidate response
Read whole answer. Ignore all incorrect / irrelevant material and reject any contradictory material.			
	0	No rewardable material.	
Level 1	1–2	Additional Guidance explains fully one property **OR** describes structure of diamond **or** graphite	Possible candidate response • Diamond has strong bonds (1) • Diamond is hard because the strong covalent bonds need a lot of energy to break (2) • Graphite has layers of carbon atoms with delocalised electrons between layers (2)
Level 2	3–4	Additional Guidance explains fully two properties **OR** describes fully structure of diamond **and** graphite	Possible candidate response • Graphite conducts electricity because the delocalised electrons can move but diamond does not because it does not have free electrons (3) • Graphite conducts electricity because the free electrons can move between layers and graphite is soft because the layers of atoms can slide because of weak forces between the layers (4) • Graphite has layers of carbon atoms with delocalised electrons between layers and diamond has a giant lattice with each carbon atom bonded to four others (4)
Level 3	5–6	Additional Guidance explains fully three properties using the structure and bonding of diamond **and** graphite	Possible candidate response • Graphite has layers of carbon atoms so it is flaky because the layers slide; and diamond has a giant lattice with each carbon atom bonded to four others with strong bonds, so it is hard because the carbon atoms need energy to separate and does not conduct because there are no free electrons (5) • Graphite has layers of carbon atoms held with weak intermolecular forces with delocalised electrons between layers so it is flaky because the layers easily slide off and conducts electricity because the free electrons move; and diamond has a giant lattice with each carbon atoms bonded to four others, so it is hard because the covalent bonds between the carbon atoms need a lot of energy to break (6)

Question number	Answer	Additional guidance	Mark
6(a)(i)	A description to include • bubbles formed {slowly / steadily / quite quickly} / some bubbles form (1) • some metal remains (1)	 allow bubbling faster than F / more bubbles than F/ bubbling slower than D / fewer bubbles than D allow some metal has reacted allow metal looks changed mark anything written in table **only** if answer lines blank	**(2)** AO3-1a/1b

Question number	Answer	Additional guidance	Mark
6(a)(ii)	An explanation linking dilute: • low concentration (1) • of the {solute / acid / (hydrogen) ions / H^+} (1) strong acid • acid <u>fully</u> {dissociated / ionised} (1) • forming {hydrogen/ H^+} ions (1)	MP2 depends MP1 allow low {mass/ amount} ignore 'not concentrated' ignore 'weak concentration' if no MP1 or MP2. allow 'dilute acid has more water in it'/ 'has had water added' for 1 mark only mark MP3 and MP4 independently ignore all references to pH	**(4)** AO1-1

Question number	Answer	Additional guidance	Mark
6(b)	4.515×10^{23} scores 4 with or without working relative formula mass $Pb(C_2H_3O_2)_2$ $207 + 2 \times (2\times12 + 3\times1 + 16\times2) = 325$ (1) moles of $Pb(C_2H_3O_2)_2$ $\frac{16.25}{325} = 0.05$ (1) no of "$Pb(C_2H_3O_2)_2$" $0.05 \times 6.02 \times 10^{23} = 3.01 \times 10^{22}$ (1) no of atoms $15 \times 3.01 \times 10^{22} = 4.515 \times 10^{23}$ (1)	allow ECF at all stages for ECF using Avogadro's number, must x previously calculated **attempt at moles using the data in the question** allow any number of sig figs except one with correct rounding 3.01×10^{22} with working scores 3 1.204×10^{25} with working scores 2 1.9565×10^{26} with working scores 1	**(4)** AO2-1

Question number	Answer	Additional guidance	Mark
6(c)	moles Fe = $\frac{2.24}{56.0}$ = 0.04 (1) moles Cu = $\frac{3.81}{63.5}$ = 0.06 (1) ratio moles Fe : moles Cu = 2 : 3 or 1 : 1.5 **and so equation 2** (1) **OR** moles Fe = $\frac{2.24}{56.0}$ = 0.04 (1) moles Cu if equation 1 = 0.04 (1) expected mass Cu equation 1 = 0.04 x 63.5 = 2.54g **and** so not equation 1, **equation 2** (1) **OR** moles Fe = $\frac{2.24}{56.0}$ = 0.04 (1) moles Cu if equation 2 = 0.04 x 3/2 = 0.06 (1) expected mass Cu equation 2 =0.06 x 63.5 = 3.81g **and** so **equation 2** (1)	**must state Equation 2 to score MP3** stating Equation 2, with no calculation to justify, scores 0 No ECF in this question moles of "2Fe" = $\frac{2.24}{112}$ = 0.02 scores 0, BUT: with either: moles of "3Cu" = $\frac{3.81}{190.5}$ = 0.02 these are same so equation 2, scores 3 or: mass of Cu = 3 x 63.5 x 0.02 = 3.81g so equation 2, scores 3	**(3)** AO3-1a/b

Total for Question 6 = 13 marks