Mark Scheme (Results)

Summer 2023

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

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Summer 2023
Publications Code 1SC0_1CH_2306_MS

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

Question number	Answer	Additional guidance	Mark
1(a)	stir/ swirl/ shake (the beaker)	allow mix, warm/ heat ignore wait (until reaction over/ until powder disappears)	AO1 2 (1)

Question number	Answer	Additional guidance	Mark
1(b)	in either order: calcium chloride (1) water (1)	allow phonetic spellings but reject calcium chlorine allow $CaCl_2$ but formula must be correct for the mark ignore 'solution'/ any state symbols allow H_2O but formula must be correct for the mark if three products given, allow (1) only if both correct products are given. four or more products scores (0)	AO2 1 (2)

Question number	Answer	Mark
1(c)	C s aq is the only correct answer A, B and D are not correct because the calcium hydroxide is a solid and the acid is an aqueous solution.	AO2 1 (1)

Question number	Answer	Additional Guidance	Mark
1(d)(i)	1	allow 0.9 or 1.1	AO3 2 (1)

Question number	Answer	Mark
1(d)(ii)	0.74 (g)	AO3 2 (1)

Question number	Answer	Additional guidance	Mark
1(d)(iii)	An explanation linking: START • solution is acidic / acids have low pH / high {concentration/ amount} of H^+ ions/ excess H^+ ions (1) REACTION • neutralisation/ $H^+ + OH^- \rightarrow H_2O$/ {the hydroxide/ alkali} <u>reacts</u> with the {acid/ H^+} (1) END • {amount/ concentration} of H^+ ions has reduced/ {amount/ concentration} of OH^- ions has increased / excess OH^- ions/ (excess of) hydroxide ions have pH > 7 (1)	allow for low pH: pH less than 7 / pH 1-6 / pH =1 ignore there is no alkali ignore references to 'strong' or weak' allow acid → neutral → alkali (2) allow calcium hydroxide is {an alkali/a base} ignore description of pattern – as calcium hydroxide added pH increases (0) ignore 'becomes alkaline'/ is alkaline/ is less acidic	AO2 1 (3)

Question number	Answer	Mark
2(a)	A calcium is the only correct answer B, C and D are incorrect because copper, silver and gold do not react with cold water	AO1 1 (1)

Question number	Answer	Additional guidance	Mark
2(b)(i)	MAGNESIUM many bubbles / bubbles produced quickly / bubbles vigorously OR test tube feels hot / warm / warmer than with zinc (1) IRON few bubbles / bubbles produced slowly / some bubbles OR test tube feels <u>very</u> slightly warm (1)	Mark answer lines first, if blank or only contain statements that can be ignored, then look at the table. Ignore hydrogen / gas / reactivity of metal reject incorrect additional observations for each metal allow 'magnesium disappears/ dissolves' ignore steady bubbling / slightly warm ignore steady bubbling / no bubbling allow does not feel warm ignore test tube feels slightly warm	AO3 2 (2)

Question number	Answer	Additional guidance	Mark
2(b)(ii)	a description to include the following points • apply lighted splint (to the gas) (1) • (squeaky) pop (1)	 allow apply flame / ignite ignore 'squeaky pop test' reject glowing splint MP2 depends on MP1	AO1 2 (2)

Question number	Answer	Additional guidance	Mark
2(b)(iii)	$Mg + 2HCl \rightarrow MgCl_2 + H_2$ H_2 (1) 2 (1)	 reject H2, H^2, 2H, 2h, h_2, h^2	AO2 1 (2)

Question number	Answer	Mark
2(c)(i)	ten (times) / 10 (x) / (x) 10	AO1 1 (1)

Question number	Answer	Additional guidance	Mark
2(c)(ii)	0.05 (g) OR 0.005 x factor from (c)(i)	0.05 scores whether (c)(i) correct or not. if answer not 0.05, only then apply ecf and no working is required e.g x2 AND 0.01 (1); x100 AND 0.5 (1)	AO3 1 (1)

Question number	Answer	Additional guidance	Mark
3(a)(i)	$N_2 + 3H_2 \rightleftharpoons 2NH_3$ (3)	MP1: three formulae and no others on correct sides of an equation. allow incorrect cases and subscripts e.g. n^2 (1) MP2 depends on MP1: balancing these correct formulae, allow multiples (1) MP3: stand alone mark: equilibrium symbol, allow ⇄, ⇋ (1) allow equation written in reverse	AO2 1 (3)

Question number	Answer	Mark
3(a)(ii)	D 450 200 is the only correct answer A, B and C are incorrect because the temperature is 450℃ and the pressure is 200 atm.	AO1 1 (1)

Question number	Answer	Additional guidance	Mark
3(a)(iii)	catalyst/ increase rate of reaction(s)/ lower activation energy/ increase rate of attainment of equilibrium	ignore provide an alternative route for the reaction	AO1 1 (1)

Question number	Answer	Additional guidance	Mark
3(a)(iv)	An explanation including any two from: • <u>moves in</u> exothermic direction (1) • moves {right/ forwards / towards ammonia/ to products} (1) • to oppose the temperature reduction / to release heat / to increase the temperature (1)	MP1/ MP2/ MP3 are marked independently reject contradictions within MP2 or within MP3 allow to increase yield ignore just 'to oppose the (temperature) change' allow to increase heat	AO1 1 (2)

Question number	Answer	Additional guidance	Mark
3(b)	A description including METHOD OF HEATING AND COOLING • put tube into hot water (1) • then into cold water/ add cold water/ add ice (1) OBSERVATIONS • colour goes darker AND colour goes lighter/ colourless	steps 1 and 2 can be reversed, but must be practical e.g. ignore 'heat tube up' allow water from kettle reject placing tube in kettle/ heating with steam MP3 is for <u>observation</u> but depends on tube being heated and cooled (even if MP1 and/or MP2 not scored) allow colour changes in <u>both</u> hot and cold ignore clear allow suitable diagram(s) ignore opening of tube ignore attempts at explanation	AO3 3a (3)

Question number		Mark
4(a)	C at the cathode is the only correct answer A, B and D are incorrect because the copper ions are positive so are reduced at the cathode.	AO2 2 (1)

Question number	Answer	Additional Guidance	Mark
4(b)(i)	An explanation including: • as current increases mass increases / the mass is proportional to the current (1) • because the higher the current the more electrons (per second) (1) • so more copper ions {are reduced/ gain electrons/ are discharged} (1)	ignore names of electrodes overall trend required e.g. more mass at 0.4A than 0.2A (0), as current up by 0.2 mass up 0.04 (1), more current, more copper(1) allow positive correlation (between current and mass) allow 'amps' for 'current', 'amount' for mass allow 'greater flow of electrons' allow higher rate of electron transfer allow electrons move faster allow higher (amount of) charge allow $Cu^{2+} + 2e^{-} \rightarrow Cu$ allow more copper ions react if give copper ion symbol, allow any positive charge ignore more copper (atoms) form	AO2 1 (3)

Question number	Answer	Additional Guidance	Mark
4(b)(ii)	A description including: • (rinse and) dry {electrode / cathode} (1) • measure mass of {<u>electrode/ cathode</u>} (on a balance) (and subtract original mass) (1)	MP1 and MP2 independent allow anode/ electrodes allow rinse electrode with solvent/ propanone (and leave for solvent to evaporate) ignore clean/ wipe electrode allow weigh electrode at start and end allow subtract original mass from final mass allow 'find increase in mass of electrode' ignore measure mass of copper before and after scrape off copper and weigh scores 0 marks	AO2 2 (2)

Question number	Answer	Additional Guidance	Mark
4(c)	7.015 x 10^{20} with or without working scores 3 • mass copper in g = $\frac{74}{1000}$ = 0.074 / 7.4 x 10^{-2} g (1) • amount of copper = $\frac{0.074}{63.5}$ = 0.001165…./ 1.165…. x 10^{-3} mol (1) • number of atoms = 0.001165… x 6.02 x 10^{23} = 7.015 x 10^{20} (1)	allow ecf for MP2 and MP3 allow correct rounding at each stage MP2 for $\frac{\text{mass}}{63.5}$ MP3 for number using 74 and 63.5 x Avogadro correctly worked out allow 1 or more sig fig. 7.015 x 10^{23} scores 2 7.015 x 10^{26} scores 2 2.829 x 10^{24} scores 2 2.829 x 10^{27} scores 1	AO2 1 (3)

Question number	Answer	Additional Guidance	Mark
5(a)	water	allow H_2O 2 must be subscript H and O must be capitals ignore copper sulfate/ $CuSO_4$	AO1 1 (1)

Question number	Answer	Additional Guidance	Mark
5(b)	An explanation including OBSERVATION • when some powder remains in the beaker (after stirring) (1) COPPER OXIDE • there is an excess of copper oxide (1) ACID • all the acid {is neutralised/ has reacted}/ no acid remains (1)	MP1, 2 and 3 are independent allow {mixture/ solution} turns black/ copper oxide does not 'dissolve'/ copper oxide remains / solution gets no darker blue ignore fizzing stops ignore copper oxide precipitate allow acid used up allow acid is the limiting reactant ignore reaction complete	AO1 2 (3)

Question number	Answer	Mark
5(c)	C heat the solution with a water bath is the only correct answer. A is incorrect because the solution will not be separated. B is incorrect because a powder forms instead of crystals. D is incorrect because the method would be very slow.	AO1 2 (1)

Question number	Answer	Additional guidance	Mark
5(d)	A description including any three from: SOLUTION • (the ions) are (freely) moving (1) • (the ions) are randomly arranged (1) SOLID • (the ions) are fixed/ not moving/ vibrating (1) • (the ions) are in a regular arrangement/ lattice/ giant structure (1)	allow atoms or particles for ions reject molecules once allow suitable diagrams (could score MP2, MP4) ignore any reference to bonding allow liquid for solution ignore flowing ignore have less energy allow in rows/ tightly packed/ close together	AO1 1 (3)

Question number	Answer	Additional Guidance	Mark
5(e)	An explanation including: • the copper (ions are) neither oxidised nor reduced (1) • the copper (ions) do not lose or gain electrons/ Cu^{2+} present at start and end (1)	mark independently with no ecf allow copper oxide not oxidised or reduced allow 'neither' allow copper (ions) have same number of electrons/ have same charge ignore references to spectator ions	AO1 1 (2)

Question number	Answer	Additional Guidance	Mark
5(f)	11.9625 with or without working scores 1 11.9625	11.963/ 11.96/ 12.0/ 12 scores 1	AO2 2 (1)

Question number	Answer	Additional guidance	Mark
6(a)(i)	$C_6H_8N_2SO_2$	Letters can be in any order e.g $C_6N_2H_8O_2S$ (1) must be written as a formula numbers do not have to be subscripts ignore any formula with brackets	AO2 1 (1)

Question number	Answer	Additional Guidance	Mark
6(a)(ii)	A description including: • B is pure and A is impure and C is impure (1) • B has a sharp/ single melting point (1) • A and C have melting points {over a range / lower than (the sharp melting point of) B} (1)	ignore repeats the stem e.g. melting point is 160-164 ignore suggestions about composition e.g B is an element mark independently (can score MP2 and MP3 even if MP1 incorrect) allow fixed / specific / definite/ one/ exact/ no range ignore accurate/ precise melting point allow the melting points vary /gradual change/ not sharp/ not exact ignore these have two melting points/ different melting points (i.e idea that melts at 160 and at 164) reject boiling point only once in MP2 or MP3	AO3 1 (3)

Question number	Answer	Additional Guidance	Mark
6(b)	0.528/ 0.53 with or without working scores 2 • distance = R_f x solvent front distance/ 0.22 x 2.4 (1) • = 0.528/ 0.53 (cm) (1)	 MP1 for rearranged equation or values note : any unambiguous wording accepted in formula If additional calculation steps used, score 0 for whole question. 0.5 scores 2 only with working No ecf for MP2	AO2 1 (2)

Question number	Indicative content	Mark
*6(c)	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. Do not credit separation techniques other than distillation (e.g. crystallisation/ simply evaporating off the water) or additional steps to distillation that would not work. Allow distil off (some) water and then crystallise the remaining (concentrated) sodium chloride solution. Allow fractional distillation. AO1 (6 marks) SODIUM CHLORIDE • ionic compound • giant lattice • positive (sodium) ions and negative (chloride) ions • strong electrostatic attraction between ions • lots of energy to overcome attraction/ bonds WATER • simple covalent/ molecular • strong covalent bonds between atoms in a molecule • weak forces between molecules • little energy needed to overcome the intermolecular forces SEPARATION • use distillation – with condenser or simple apparatus: delivery tube into test tube in ice water • water has much lower boiling point • water will distil but sodium chloride will not • water collected after being condensed • sodium chloride remains in flask	(6) AO1 1 AO1 2

Level	Mark	Descriptor
	0	No rewardable material.
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	Additional Guidance
	0	No rewardable material.	Read whole answer and ignore all incorrect material/ discard any contradictory material then:
Level 1	1–2	Additional Guidance a basic description of one of the types of bonding or the separation technique	Possible candidate response sodium chloride is ionic (1) use distillation (1) sodium chloride has ionic bonding and water has covalent bonding (2) sodium chloride has strong ionic bonds which take a lot of energy to break (2) heat the mixture and condense the water (2)
Level 2	3–4	Additional Guidance a description of two of the aspects: bonding in NaCl/ intermolecular forces in water/ distillation	Possible candidate response water is a simple molecular covalent compound, there are weak intermolecular forces which take little energy to break but sodium chloride is ionic (3) sodium chloride has ionic bonding, there are strong electrostatic forces of attraction between oppositely charged ions, which take a lot of energy to break and the solution is separated by distillation (3) use distillation because water has a lower boiling point than sodium chloride so water will distil but sodium chloride will not, water can be collected after it has been condensed and the sodium chloride will remain in the flask. This is because sodium chloride is ionic with strong bonds. (4)
Level 3	5–6	Additional Guidance An explanation of **both** of the types of bonding **and** of the separation technique	sodium chloride has strong ionic bonds which take a lot of energy to break whereas water has intermolecular forces which does not take a lot of energy to break. Heat the mixture and condense the water, sodium chloride is left in the flask (5) Sodium chloride is ionic, the electrostatic attractions between ions take a lot of energy to break. Water is covalent, not a lot of energy is used to overcome the intermolecular forces. Use distillation because water has a lower boiling point than sodium chloride so water will distil but sodium chloride will not, water can be collected after it has been condensed and the sodium chloride will remain in the flask. (6)