Pearson Edexcel

Mark Scheme (Results)

Summer 2023

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**

Question number	Answer	Mark
1(a)	<table><tr><th></th><th>isotope A</th><th>isotope B</th></tr><tr><td>atomic number</td><td>1</td><td>1</td></tr><tr><td>mass number</td><td>1</td><td>2</td></tr><tr><td>number of protons</td><td>1</td><td>1</td></tr><tr><td>number of electrons</td><td>1</td><td>1</td></tr><tr><td>number of neutrons</td><td>0</td><td>1</td></tr></table> all 6 correct (2) 4 or 5 correct (1) 0-3 correct scores 0	**AO1 1 (2)**

Question number	Answer	Additional guidance	Mark
1(b)	An description including • voltage {stays same/ constant/ steady/ stable/ at 1.1(V)} <u>for 60 minutes/ 1hr</u> (1) • and then falls <u>to 0(V)</u> (during the time 60-75 mins) (1)	for MP1 units of voltage not essential (but time span required) allow 1.08-1.12(V) allow power for voltage for MP2 units of voltage not required must specify that V decreases to zero/ nothing (but time span not required) ignore phrases such as 'voltage stops', 'no voltage', 'voltage runs out'	**AO3 1 (2)**

Question number	Answer	Additional guidance	Mark
1(c)	• sodium would react with the {electrolyte / water/ solution} (1) • sulfur does not conduct (electricity) (1)	allow sodium is not inert/ is (very) reactive / reacts with the liquid ignore 'sodium will dissolve'/ will react with air/ loses electrons allow poor conductor/ sulfur is a non-metal/ electrons cannot pass through	**AO2 2 (2)**

Question number	Answer	Additional guidance	Mark
2(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
2(b)	in either order: calcium chloride (1) water (1)	allow phonetic spellings but reject calcium chlor**ine** 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
2(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
2(d)(i)	1	allow 0.9 or 1.1	**AO3 2 (1)**

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

Question number	Answer	Additional guidance	Mark
2(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
3(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
3(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
3(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
3(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
3(c)(i)	ten (times) / 10 (x) / (x) 10	**AO1 1 (1)**

Question number	Answer	Additional guidance	Mark
3(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
4(a)	final answer of 34 with or without working scores 4 • total mass = 191 (1) • $\frac{64}{191}$ = 0.33507 (1) • x 100 = 33.507 (1) • = 34 (1)	allow ecf at MPs 2-4 MP2 must be for 64/ total mass from MP1 note: 63.5/191 is not correct MP3 must be for multiplying fraction from MP2 that has been produced using question data x 100 MP4 for rounding correctly number produced using question data to 2s.f. and **must be** <100% 33.5/ 33.51 scores 3 0.33 scores 2 0.34 scores 3 33 scores 3 64/382 x 100 = 17 scores 3 191/64 x 100 = 298 scores 2 64/127(.5) x 100 = 50 scores 3 191/191 x 100 = 100 scores 1	**AO2 1 (4)**

Question number	Answer	Mark
4(b)	**D** 1910 orange is the only correct answer. **A**, **B** and **C** are incorrect because the melting point of transition metals are high and transition metals have coloured compounds	**AO2 1 (1)**

Question number	Answer	Additional guidance	Mark
4(c)(i)	final answer of 490 with or without working scores 2 400 = 5 (1) 80 5 x 98 = 490 (1) OR 98 =1.225 (1) 80 1.225 x 400 = 490 (1)	 80/ 400 x 98 = 19.6 scores 1 allow ecf for MP2 only if MP1 uses 80 and 98 80/98 x 400 = 326.5 scores 1 allow ecf for MP2 only if MP1 uses 80 and 98 allow 490000 **kg** only if unit given allow 490000000 **g** only if unit given	**AO2 1 (2)**

Question number	Answer	Additional guidance	Mark
4(c)(ii)	final answer of 96% with or without working scores 2 672 = 0.96 (1) 700 x 100 = 96 (1)	 allow 24/25 no ecf for MP2 4 scores 1 104 scores 1	**AO2 1 (2)**

Question number	Answer	Additional guidance	Mark
4(c)(iii)	Any two of the following • incomplete reaction • loss {of substance/reactant/product} (during practical)/ practical losses • unwanted reactions/ side-reactions	ignore impure reactants/ contaminants/ reaction conditions/ human error/ measurement errors/ reversible reaction allow reaction incomplete/ reactant left over/ not all reactants used allow reasonable examples e.g. left in apparatus/ in transfer/ escape to air/ not in a closed system/ lost to surroundings ignore incompetence e.g. spillages allow reasonable example e.g product reacts with air ignore waste products/ by-products	**AO1 1 (2)**

Question number	Answer	Additional guidance	Mark
5(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
5(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
5(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
5(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
5(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
6(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
6(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
6(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
6(c)	7.015×10^{20} with or without working scores 3 • mass copper in g = $\frac{74}{1000}$ = 0.074 / 7.4×10^{-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 6.02×10^{23} = 7.015×10^{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. 7.015×10^{23} scores 2 7.015×10^{26} scores 2 2.829×10^{24} scores 2 2.829×10^{27} scores 1	**AO2 1 (3)**

Question number		Additional guidance	Mark
7(a)(i)	• ammonia (solution) (1) • nitric acid (1)	allow ammonium hydroxide for ammonia. ignore any formulae	**AO1 1 (2)**

Question number	Answer	Mark
7(a)(ii)	**D** hydrogen, nitrogen, oxygen and phosphorus only is the only correct answer **A**, **B** and **C** are incorrect because they each lack one of the elements	**AO2 1 (1)**

Question number	Answer	Additional guidance	Mark
7(b)(i)	• two readings: **27.75** and **1.45** (1) • 27.75 – 1.45 = **26.30** (1)	MP1 for these values only MP2 for correct subtraction of 2 volumes (to 1 or 2 d.p.) but answer must be **2 d.p.** Any 1 d.p. answer including 26.3 does not score MP2. Answers with **NO** working 26.30 (2); any other answer (0) 26.30 with working may score 2 (if 2 correct values used) or score 1 (e.g. 27.78 – 1.48 = 26.30; 27.8 – 1.5 = 26.30)	**AO3 1 (2)**

Question number	Answer					Mark
7(b)(ii)		25.90	24.90	24.60	25.00	**AO3 2 (1)**
			✓		✓	

Question number	Answer	Additional Guidance	Mark
7(b)(iii)	An answer including any three from • rinse the burette with titrant (1) • fill the jet / tip (1) • do not fill burette over 0 cm^3 / overfill/ run liquid out until volume at or below 0 cm^3 (1) • add drop by drop only near {end point/ colour change} (1)	 allow clean/ wash the burette / wash with water allow rinse with (named) acid or alkali ignore dry the burette allow indication of this part of apparatus e.g. below tap allow ensure no gas bubbles/ air note: diagram shows overfilled burette ignore measure start volume allow do not fill to top allow rough titration first (then add similar volume before going dropwise) ignore any remarks about taking readings ignore additional method points e.g. use funnel, clamping burette	**AO3 3 (3)**

Question number	Answer	Additional Guidance	Mark
7(c)	 from: pink-blue/ pink-purple/ blue-purple/ purple to **red**	in colours allow any qualifiers e.g. light/ dark etc FROM allow any type of purple alone e.g lilac allow any combination of pink/blue/purple reject blue <u>alone</u> or pink <u>alone</u> reject any red TO Reject any other colours with red	**AO1 2 (1)**

Question number	Answer	Additional Guidance	Mark
7(d)	None / volume the same	Must be clear there is NO effect e.g. 'little to no change' (0)	**AO1 2 (1)**

Question number	Answer	Additional Guidance	Mark
8(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
8(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
8(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
8(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
8(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
8(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
9(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
9(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
9(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
***9(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)

Question number	Answer	Additional Guidance	Mark
10(a)(i)	a description to include • reaction of a metal (1) • with oxygen/ oxidation (1)	 allow specified metals ignore 'rusting' allow to form oxide/ air for oxygen ignore mention of water oxidation of a metal scores 2 when a metal oxide forms scores 2	**AO1 1** **(2)**

Question number	Answer	Additional Guidance	Mark
10(a)(ii)	61 000 / 60 923 cm^3 with or without working scores 4 • amount of sodium azide = 110/65 = 1.692… mol (1) • amount of nitrogen = 3/2 x 1.692 = 2.538… mol (1) • volume of nitrogen = 24 x 2.538 = 60.923… dm^3 (1) • volume in cm^3 = 60.923 x 1000 = 60923/ 61 000 cm^3 (1)	allow ecf and correct rounding at each stage 110/130 does not score MP1 but 110/130 x 3 = 2.538 scores MP1 and MP2 130g NaN_3 → 84g N_2 then 110g NaN_3 → 71g N_2 scores MP1, then mark on MP3 for attempt at moles of nitrogen worked out using data in question x 24 MP4 for attempt at volume of nitrogen worked out using data in question x 1000 Allow 2 s.f. or more 30462 scores 3 40615 scores 3 40.615 scores 2 20308 scores 2 20.308 scores 1	**AO2 1** **(4)**

Question number	Indicative content	Mark
***10(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. Marks can be awarded for suitable diagrams. **AO1 (6 marks)** **METAL PROPERTIES** • good conductors of heat • good conductors of electricity • malleable • ductile • shiny (when pure) • copper is unreactive • aluminium samples are resistant to corrosion due to oxide layer • aluminium has low density **ALLOY PROPERTIES** • good conductors of heat • good conductors of electricity • malleability is lower than pure metal • ductility lower than pure metal • specific properties of magnalium e.g. low density (ignore light) • specific properties of brass **METAL USES** • aluminium for cooking foil, food trays • copper for water pipes, electrical wires, roofing **ALLOY USES** • aluminium alloys for aircraft parts, vehicles, ladders	**(6)** **A01 1**

	• copper alloys for coins, brass instruments, jewellery, plug prongs **COMPARE/ SIMILARITIES <u>between metal and alloy</u>** • both exist as lattices of ions with delocalised electrons • conduct heat because delocalised electrons in both to carry thermal energy • conduct electricity because delocalised electrons in both can move • high melting and boiling points due to strong metallic bonds **CONTRAST/ DIFFERENCES <u>between metal and alloy</u>** • layers of ions/ atoms/ particles in alloys disrupted • harder for layers to slide • therefore alloys typically stronger, less malleable and less ductile • alloys can be more corrosion resistant • pure aluminium used (e.g. cooking foil) where conducting heat required but strength not needed • aluminium alloy used (e.g aircraft, ladders) where low density required but greater strength of alloy needed • pure copper used (e.g. electrical wires) where conducting electricity needed but high strength not required • copper alloys used (e.g.plug pins) where conducting electricity needed but needs to be harder than pure copper • metals have fixed melting point but alloys a range as a mixture	

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 (**Descriptions)** A basic description of at least **three different** properties and/or uses of either aluminium, copper and/or their alloys OR A basic description of the structure of a metal and/or or alloy	Possible candidate response Aluminium (alloy) is used to make aircraft (1) Copper alloys are used to make coins (1) Alloys are stronger than pure metals (1) Copper and aluminium have high melting points. (1) Copper and aluminium conduct electricity and are malleable, and copper is used to make water pipes. (2) Alloys have different sized atoms in their structure so are strong (2)
Level 2	3–4	Additional Guidance **(Similarity or difference)** A description covering (a) property of metals, (b) a different property of alloys, (c) three uses including at least one metal and at least one alloy. AND An explanation of a similarity or difference.	Possible candidate response Metals are malleable. Alloys are strong. Alloys and metals have high melting points because they have strong metallic bonds. Copper is used to make pipes. (3) Alloys are stronger than metals. This is because alloys have different sized atoms in their structure which stops the layers from sliding. Copper is a good conductor so is used in wires. Copper is also used to make trumpets. Aluminium alloys have low density and are used to make aircraft bodies. (4)
Level 3	5–6	Additional Guidance **(Similarity AND difference)** One description and one explanation covering at least (a) one similar property of pure metals and alloys, and (b) one difference. Three uses including at least one metal and an at least one alloy given.	Possible candidate response Metals and alloys conduct electricity, but alloys are stronger than metals. This is because alloys have different sized atoms in their structure. Ladders and aircraft are made from aluminium and copper alloys make coins. (5) Metals and alloys conduct electricity, but alloys are stronger than metals. This is because alloys have different sized atoms in their structure which stops the layers from sliding. Copper alloys are used to make coins and brass instruments and aluminium us used to make cooking foil. (6)