

4437-5H MARK SCHEME

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (a)(i)	electrolysis			(1)
1 (a)(ii)	graphite / carbon			(1)
1 (a)(iii)	- on left and + on right			(1)
1 (a)(iv)	aluminium oxide / alumina cryolite	accept correct formulae ignore bauxite		1 1 (2)
1 (a)(v)	electricity (ignore qualifications) / electrical energy (not energy alone)	Anode/positive electrode replacement	Cathode /electrode replacement	(1)
1 (b)(i)	oxygen			(1)
1 (b)(ii)	•carbon dioxide / carbon monoxide •graphite/carbon/electrode oxidised/burned/reacts with oxygen	accept correct formulae (ignore lower case)	lists equation	1 1 (2)
				9
2 (a)(i)	Any two from: •same or similar chemical properties / same functional group • gradation in physical properties •neighbouring/successive members differ by CH ₂	Gradation of specified physical property (eg: boiling point/bp(t), melting point/mp(t), viscosity)	NOT a specified chemical property different/same physical properties	(2)
2 (a)(ii)	alkene			(1)
2 (b)(i)	•(H) one electron shown •(C) two electrons in first shell and four in second shell	Accept any symbol for electrons.	Electrons on nucleus	1 1 (2)
2 (b)(ii)	•all five atoms and four shared pairs of electrons •no extra outer electrons.	IGNORE inner electrons		1 1 (2)
2 (c)(i)	•(compounds with) same molecular formula •(but) different structural formulae /displayed formula/structure / atoms arranged differently (same) elements = 0 marks	Mark independently	same chemical formula. Reject substances.	1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)(ii)	Correct structures of butane and methylpropane. ALL bonds shown Penalise sticks with missing H once only			1 1 (2)
				11
3 (a)(i)	any two from •effervescence / fizzing / bubbles • cloudiness / white precipitate /milky / white suspension •Ca get smaller / disappears (ignore dissolves). •Ca moves up and down	ignore gas made ignore floats/moves	List	(2)
3 (a)(ii)	Ca(OH) ₂			(1)
3 (a)(iii)	•blue •alkali / OH ⁻ / hydroxide / pH >7 (ignore base) •stated pH value in range 8-14		purple	1 1 (2)
3 (b)(i)	•grey / silver(y) •white			1 1 (2)
3 (b)(ii)	any two from •over/through water / downward displacement of water • (gas) syringe •upward delivery / downward displacement of air	a description of this suitable diagrams	gas cylinder	(2)
3 (b)(iii)	hydrogen + oxygen → water / steam	ignore heat	formulae	(1)
				10
4 (a)(i)	diffusion			(1)
4 (a)(ii)	•mention of particles (if particles named, must be correct) in correct context •moving (randomly)	(accept molecules/ ions) move (from high to low concentration)		1 1 (2)
4 (b)(i)	•(blue) ppt - colour not needed but penalise ppt if colour is wrong •deep/dark/royal blue •solution / dissolves	ignore changes to colour of solution	Dark/royal/de ep blue ppt	1 1 (3)
4 (b)(ii)	[Cu(H ₂ O) ₂ (NH ₃) ₄] ²⁺ / [Cu(NH ₃) ₄ (H ₂ O) ₂] ²⁺	Formulae without []		(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
				7
5 (a)(i)	Any three from <ul style="list-style-type: none"> •float/on surface •fizz/bubble (ignore gas) •move/dart about •melt/form sphere/ball •Na gets smaller / disappears (ignore dissolves) 	ignore references to flames / igniting	Apply list rule	(3)
5 (a)(ii)	$2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ <ul style="list-style-type: none"> •correct formulae •balancing (dependent on first mark being awarded) 	Na(OH) any multiple		(2)
5 (a)(iii)	Moves/bubbles faster/(more) violent/more vigorous/catches fire/flame/ explodes		Reaction faster/ it is faster	(1)
5 (b)(i)	<ul style="list-style-type: none"> •sodium loses electron(s) • oxygen gains electrons •correct number of electrons for each atom <p>marks could be gained by suitable additions to printed diagram</p>	Indication of 2 Na and 1 O	Any reference to sharing /covalent gives 0	(3)
5 (b)(ii)	<ul style="list-style-type: none"> •strong attractive forces / bonds (regardless of what these are between) •between <u>ions</u> •require a lot of energy to overcome / difficult to break (regardless of what these are between) 		second mark not given if atoms / molecules / intermolecular	1 1 1 (3)
				12

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (a)	any five from: <ul style="list-style-type: none"> •add magnesium carbonate to acid •stir/mix •excess magnesium carbonate • filter / centrifuge and decant •heat or evaporate filtrate and stop evaporation at a suitable point / heat filtrate and leave to cool / leave filtrate to evaporate or to crystallise or for suitable time / place in oven below 100 °C •dry crystals with (filter) paper / desiccator 	Ignore indicators <ul style="list-style-type: none"> •If use sodium carbonate (or other soluble carbonate)only points 2,5,6 •If use other insoluble carbonate, all bar first point. •Wrong method of prep. Then get 5 and 6 only. 	Heat to dryness, can not get 5 or 6	(5)
6 (b)	<ul style="list-style-type: none"> •colourless •to pink 	if just state "pink" with no start colour, then score 1	purple / red	1 1 (2)
				7
7 (a)(i)	<ul style="list-style-type: none"> •add (named) acid •bubbles/effervescence/fizzing OR gas produced turns limewater milky 	2 nd mark possible only if acid added		1 1 (2)
7 (a)(ii)	2NaOH + CO ₂ → Na ₂ CO ₃ + H ₂ O formulae = 1 balancing = 1 (only if formulae correct)	Accept any multiple		(2)
7 (b)(i)	<ul style="list-style-type: none"> •Mr NaHCO₃ = 84 •moles = 4.2 ÷ 84 •= 0.05(0) ignore any units Correct answer scores 3 If M _r incorrect, max 2 (107 gives 0.039; 168 gives 0.025)			1 1 1 (3)
7 (b)(ii)	(i) ÷ 2 = 0.025 ignore any units	cq		(1)
7 (b)(iii)	(ii) x 24 (dm ³) = 0.6 unit not required but penalise incorrect units.	cq	answer in cm ³	(1)
				9
8 (a)	any in range 40 to 100			(1)
8 (b)(i)	H ₂ + Cl ₂ → 2HCl formulae = 1 balancing = 1 (only if formulae correct) accept any multiples		CL	(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (b)(ii)	water: <ul style="list-style-type: none"> • paper becomes red (NOT orange) • acidic / H⁺ ions produced methylbenzene: <ul style="list-style-type: none"> • no change / orange • no H⁺ ions formed / not acidic / does not ionise (indep. of colour) 	red/orange ignore refs to being neutral	Orange Ionizes alone Green References to acidity of methyl benzene	1 1 1 1 (4)
				7
9 (a)(i)	galvanising / sacrificial protection			(1)
9 (a)(ii)	railings / cars / bridges / buckets / watering cans / lamp posts etc.	accept ships/boats even though zinc blocks and not a continuous layer used	bikes	(1)
9 (a)(iii)	<ul style="list-style-type: none"> • zinc more reactive (than iron) • zinc reacts/corrodes/oxidises in preference to /before /instead of iron 	It is more reactive than iron	It is more reactive zinc rusts protective coating of zinc oxide	1 1 (2)
9 (b)	<ul style="list-style-type: none"> • zinc • loses electron(s) / oxidation number increases 		If not zinc = zero	1 1 (2)
9 (c)	<ul style="list-style-type: none"> • make solution of nickel nitrate • add metal • if reaction occurs then metal is more reactive than nickel OR <ul style="list-style-type: none"> • work down from top of list until no reaction occurs / work up from bottom of list until reaction does occur. 	Displacement reaction without making a solution is max 2	Reaction with anything else (such as HCl(aq)) is zero react with metal (for 2 nd mark)	1 1 1 (3)
				9
10 (a)	<ul style="list-style-type: none"> • Increased • endothermic (left to right) or description of endothermic / ΔH is positive 	ignore references to rate	If decreased or stays the same = zero	1 1 (2)
10 (b)	<ul style="list-style-type: none"> • correct structure with minimum 4 	Ignore "n"	any structure	1

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	<p>carbons</p> <ul style="list-style-type: none"> • continuation bonds shown (not just dots) (brackets not required) 	subscripts	with C=C or based on wrong repeat unit = 0	1 (2)																												
10 (c)	<p>If calculate empirical first:</p> <ul style="list-style-type: none"> • Correct empirical formula with some correct working = 3 <table border="1"> <tr> <td>division by A_r</td> <td>$38.7/12 = 3.23$</td> <td>$9.70/1 = 9.70$</td> <td>$51.6/16 = 3.23$</td> </tr> <tr> <td>division by smallest</td> <td>$3.23 / 3.23 = 1$</td> <td>$9.70 / 3.23 = 3$</td> <td>$3.23 / 3.23 = 1$</td> </tr> <tr> <td>empirical</td> <td colspan="3">CH₃O</td> </tr> </table> <ul style="list-style-type: none"> • Correct molecular formula (with any correct working) = 2 <table border="1"> <tr> <td>mass of empirical</td> <td>31</td> </tr> <tr> <td>molecular</td> <td>C₂H₆O₂</td> </tr> </table> <p>If calculate molecular first</p> <table border="1"> <tr> <td>mass of each element</td> <td>$38.7 \times .62 = 24$</td> <td>$9.70 \times .62 = 6$</td> <td>$51.6 \times .62 = 32$</td> </tr> <tr> <td>division by A_r</td> <td>$24 / 12 = 2$</td> <td>$6 / 1 = 6$</td> <td>$32 / 16 = 2$</td> </tr> <tr> <td></td> <td colspan="3">C₂H₆O₂</td> </tr> </table> <p>correct molecular with some working = 3</p> <p>Correct empirical = 2</p>	division by A_r	$38.7/12 = 3.23$	$9.70/1 = 9.70$	$51.6/16 = 3.23$	division by smallest	$3.23 / 3.23 = 1$	$9.70 / 3.23 = 3$	$3.23 / 3.23 = 1$	empirical	CH ₃ O			mass of empirical	31	molecular	C ₂ H ₆ O ₂	mass of each element	$38.7 \times .62 = 24$	$9.70 \times .62 = 6$	$51.6 \times .62 = 32$	division by A_r	$24 / 12 = 2$	$6 / 1 = 6$	$32 / 16 = 2$		C ₂ H ₆ O ₂			<p>If A_r incorrect/ use Z in place of A_r then lose first mark</p> <p>If NO working shown, then max 1 each for the two answers regardless of order of answers</p>	<p>If first step totally wrong, zero.</p>	<p>1 1 1 2 1 1 1 2 (5)</p>
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PAPER TOTAL 90 MARKS