Mark Scheme (Results)

Summer 2025

Pearson Edexcel International GCSE In Chemistry (4CH1) Paper 1C

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General Marking Guidance

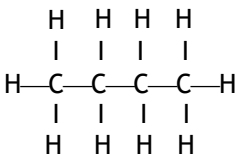
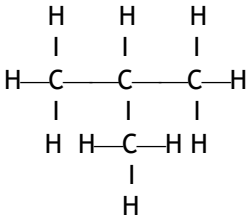
- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should 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.

Question number	Answer	Notes	Marks
1 (a)	**M1** •_____ proton **M2** o_____ neutron **M3** x_____ electron	must be in the right order if proton and neutron in wrong order allow one mark for M1 & M2.	3
(b)	<table><tr><td>mass number</td><td>11</td></tr><tr><td>group number</td><td>3</td></tr><tr><td>period number</td><td>2</td></tr><tr><td>electronic configuration</td><td>2,3</td></tr></table>		4
(c)	boron	**ALLOW** B	1
			Total 8

Question number	Answer	Notes	Marks
2 (a)	Any 2 from **M1** effervescence /fizzing /bubbles **M2** moves **M3** floats **M4** gets smaller / disappears	 **IGNORE** gas given off moves on the surface scores **M2** and **M3** **ALLOW** dissolves **IGNORE** heat produced **IGNORE** colour change	2
(b)	**A (lithium hydroxide and hydrogen)** B is incorrect as lithium hydroxide and oxygen are not the products C is incorrect as lithium oxide and hydrogen are not the products D is incorrect as lithium oxide and oxygen are not the products		1
(c) (i)	An explanation that links the following three points **M1** (colour of solution is) blue/purple **M2** (pH value or range between) 10 and 14 **M3** (as the solution is) alkaline /an alkali	 **ALLOW** indigo/violet **ACCEPT** (the solution is) basic	3
(ii)	OH^-	**ACCEPT** HO^-	1
(d)	**C (red)** A is incorrect as it is not lilac B is incorrect as it is not orange D is incorrect as it is not yellow		1 **Total 8**

Question number	Answer	Notes	Marks
3 (a)	An explanation that links the following two points **M1** ink would dissolve in the solvent/pencil would not dissolve in the solvent **M2** ink would travel/run/smudge/produce spots on the chromatogram which would interfere with the results/ pencil would not produce spots on the chromatogram so would not interfere with the results OWTTE	 **ALLOW** ink is soluble/pencil is insoluble **ALLOW** unable to calculate Rf value	2
(b)	An explanation that links the following two points **M1** X and Z **M2** as they both have a dye that travelled the furthest up the paper	 **M2** dep on **M1**	2
(c)	An explanation that links the following three points **M1** (W contains only one dye) produces only one spot **M2** V is insoluble/not soluble **M3** (V may contain more than one dye) as it has not moved (from the start line)/not separated		3
(d)	**M1** measurement to spot W = 2.2 cm/ 22 mm or 2.3cm/ 23mm **M2** measurement to solvent front = 6.9 cm/ 69 mm **M3** (R_f value =) $\frac{2.2}{6.9}$ OR $\frac{2.3}{6.9}$ more than 2 sig figs **M4** 0.32/0.33	**ALLOW** within range of 2.2-2.3 cm **ALLOW** ecf on incorrect measurements in **M1** and **M2** **ALLOW** ecf corrected to 2 sig figs	4 **Total 11**

Question number	Answer	Notes	Marks
4 (a) (i)	**C (13)** A is incorrect as there are not 8 atoms B is incorrect as there are not 11 atoms D is incorrect as there are not 19 atoms		1
(ii)	**B (Ca^{2+} and PO_4^{3-})** A the charges are incorrect C the charges are incorrect D the charges are incorrect		1
(b) (i)	**M1** Use of addition of Ca = 40 P = 31 O = 16 **M2** ($40 \times 3 + 31 \times 2 + 16 \times 8 =$) 310		2
(ii)	**M1** $\frac{40 \times 3 \times 100}{310}$ **M2** 39 (%)	**ALLOW** ecf for M_r incorrectly calculated **ALLOW** 1 mark for 13 (%) if working shown **ALLOW** any number of sig figs except 1 e.g. 38.7 for 2 marks or 12.9 for 1 mark	2
(c)	$3Ca(OH)_2 + 2H_3PO_4 \rightarrow (1)Ca_3(PO_4)_2 + 6H_2O$	**ALLOW** multiples and fractions	1
			Total 7

		Answer	Notes	Marks
5 (a)		**M1** butane contains hydrogen/H and carbon/C (atoms) **M2** only **M3** and contains only single bonds	**REJECT** hydrogen and carbon molecules for **M1** **M2** dep on hydrogen and carbon **ACCEPT** does not contain double bonds/multiple bonds	3
(b)	(i)	$2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$ **M1** all formulae correct **M2** balancing of correct formulae	 **ALLOW** multiples and fractions	2
	(ii)	carbon	**ALLOW** soot / C **ALLOW** water / water vapour / steam	1 1
	(iii)	carbon monoxide reduces the capacity of blood to transport oxygen OWTTE	**ACCEPT** correct references to haemoglobin **ALLOW** produces carboxyhaemoglobin	
(c)	(i)	**M1** isomers have the same molecular formula **M2** but different structural/displayed formulae	**ALLOW** same number of carbons and hydrogens **ALLOW** different arrangement of atoms	2 2
	(ii)	**M1**  **M2** 	Must show all bonds for both M1 and M2	

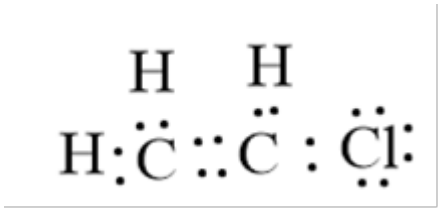
(d)	An explanation that links the following three points **M1** hexane is a larger molecule/longer chain ORA **M2** stronger intermolecular forces between the molecules ORA **M3** so more energy to overcome the forces ORA	 **ALLOW** contains more carbon (and hydrogen) atoms no **M2** or **M3** if any mention of breaking covalent bonds	3 **Total 14**

Question number	Answer	Notes	Marks
6 (a)	**M1** oxygen /O_2 **M2** water /H_2O	**ALLOW** air **ALLOW** moisture /water vapour /steam	2
(b)	**A (galvanisation)** B oxidation is not the name of the process C reduction is not the name of the process D sacrificial protection is not the name of the process		1
(c)	**C (aluminium zinc iron copper)** A this is not the correct order of reactivity B this is not the correct order of reactivity D this is not the correct order of reactivity		1
(d)	**M1** add sodium hydroxide (solution) **M2** a brown precipitate (forms)	 **ACCEPT** red-brown /orange-brown **M2** dependent on **M1**	2
(e) (i)	An explanation that links the following points **M1** iron(III) oxide /Fe_2O_3 loses oxygen so is reduced **M2** carbon monoxide gains oxygen so is oxidised **OR** **M1** iron(III) oxide /Fe_2O_3 is reduced and carbon monoxide /CO is oxidised **M2** iron(III) oxide /Fe_2O_3 loses oxygen and carbon monoxide /CO gains oxygen	 **ACCEPT** Fe^{3+} gains electrons and is reduced	2

(ii)	**M1** (amount of Fe =) 28 ÷ 56 OR 0.5(0) (mol) **M2** (amount of Fe_2O_3 =) 0.5 ÷ 2 OR 0.25 (mol) **M3** (mass of Fe_2O_3 = 0.25 × 160 =) 40 (g)	**ALLOW** ecf throughout correct answer without working scores 3	3
(iii)	**M1** $\frac{21}{28}$ x 100 **M2** 75 (%)	correct answer without working scores 2 **ALLOW** ecf for any correct calculation involving 21 as the numerator 0.75 scores 1	2 **Total 13**

Question number			Answer	Notes	Marks
7	(a)		$2NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$ **M1** equation correct and balanced **M2** state symbols correct	 If H_2 is shown as a product in the equation allow (g) for **M2**	2
	(b)		An explanation that links the following points **M1** use a polystyrene cup instead of a beaker / or use a lid on the beaker **M2** as less heat is lost	**ALLOW** any other acceptable answer REJECT prevent heat loss	2
	(c)	(i)	all points plotted correctly to the nearest small square		1
		(ii)	circle the correct anomalous point at 15 cm^3		1
		(iii)	**M1** first best fit line **M2** second best fit line		2
	(d)		**M1** volume of acid (approximately 27.5) **M2** maximum temperature (approximately 28.6)	values from the candidates graph to the nearest small square	2
	(e)		An explanation that links the following points **M1** took the temperature too early **M2** so highest temperature was not reached **OR** **M1** did not stir the mixture **M2** so highest temperature was not reached	do not allow use too little of the acid as this would affect the rest of the graph	2
I					**Total 12**

Question number	Answer	Notes	Marks
8 (a)	An explanation that links the following three points		3
	M1 covalent bonds are strong	**ACCEPT** strong (electrostatic) forces between the shared pair of electrons and nuclei	
	M2 many (covalent) bonds (need to be broken)		
	M3 a large amount of (heat/thermal) energy is needed to break the bonds	**IGNORE** more energy NOT just heat Any mention of intermolecular forces/forces between molecules or ions/ionic bonding/metallic bonding scores 0 out of 3	
(b)	An explanation that links six of the following points but must include **M3** and **M7** for full marks		6
	M1 carbon atoms are joined together by covalent bonds		
	M2 (structure is) in layers /in a 2D structure	ACCEPT sheets	
	M3 (layers) can slide over each other (therefore it is soft)		
	M4 (because there are) weak forces between layers	If reference to weak intermolecular forces or layers of molecules then no **M4**	
	M5 each carbon atom is bonded to three others (carbons)		
	M6 there are delocalised electrons (between the layers)	**IGNORE** free/spare electron/unbonded	
	M7 electrons are free to move (therefore they can conduct electricity)	**IGNORE** reference to can carrying a charge/current	
			Total 9

Question number			Answer	Notes	Marks
9	(a)	(i)	**M1** two shared pairs between carbon atoms **M2** rest of molecule fully correct 	**ALLOW** any combination of dots and crosses **M2** dep on **M1**	2
		(ii)	a description that refers to the following points **M1** attraction between a shared pair of electrons **M2** and two nuclei **OR** **M1** attraction between nuclei **M2** and a shared pair of electrons	 Do not allow nucleus Do not allow nucleus	2
		(iii)	H H | | — C — C— | | H Cl	**ALLOW** with or without extension bonds **IGNORE** brackets and n	1
		(iv)	A description that refers to the following two pairs of points **M1** disposal of poly(chloroethene) in landfill **M2** takes up space / takes a very long time to decompose/ they are inert OWTTE **M3** burning poly(chloroethene) **M4** hydrogen chloride / toxic gases produced	 **IGNORE** non-biodegradable M2 dependent on M1 M4 dependent on M3 ALLOW produces greenhouse gases	4
	(b)		**M1** $\frac{22.0}{12}$ $\frac{4.6}{1}$ $\frac{73.4}{80}$ **M2** $\frac{1.83}{0.92}$ $\frac{4.6}{0.92}$ $\frac{0.92}{0.92}$	0 marks if division by atomic numbers or upside down calculation correct answer without	3

	OR 2 5 1 **M3** C_2H_5Br	working scores 3 **ALLOW** symbols in any order	
(c)	A description that refers to any five of the following points with a <u>maximum of three marks from each section/reactant:</u> **ethane** **M1** a substitution reaction **M2** does not decolourise/stays orange/decolourises very slowly **M3** ultraviolet radiation/light needed **M4** produces bromoethane/C_2H_5Br **M5** produces hydrogen bromide/HBr **ethene** **M6** an addition reaction **M7** decolourises (immediately) / turns colourless **M8** produces dibromoethane/$C_2H_4Br_2$	**ALLOW** UV	5 **Total 17**

Question number	Answer	Notes	Marks
10 (a)	An explanation that links any two pairs **Pair 1** **M1** same volume of water **M2** so the same amount of fuel/heat is required **Pair 2** **M1** stir the water **M2** so the temperature is uniform throughout the water **Pair 3** **M1** to make sure the spirit burner is the same distance to the copper can **M2** so the same amount of heat loss occurs	 **ALLOW** same mass of water **IGNORE** references to time **ALLOW** the wick is the same height **ALLOW** any other acceptable answer	4
(b) (i)	**M1** $\Delta T = (30\text{-}18) = 12$ **M2** $Q = 100 \times 4.2 \times 12$ (= 5040 / 5000 (J))	 correct answer without working scores 2 marks **ALLOW** ecf if incorrect temperature change e.g. 7560 /7600 or 12600 /13000 scores 1	2
(ii)	**M1** (mass of ethanol =) 38.52 − 38.29 **OR** 0.23 (g) **M2** (amount =) 0.23 ÷ 46 **OR** 0.005(0) (mol) **M3** 5040 ÷ 0.005(0) **OR** 1 008 000 (J/mol) **M4** 1 008 000 ÷ 1000 **OR** 1008 (kJ/mol) **M5** − 1008 (kJ/mol)	correct answer without working scores 5 marks **ALLOW** ecf throughout **ACCEPT** 1 000 000 **ACCEPT** 1000 **ACCEPT** − 1000	5 **Total 11**

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