Mark Scheme (Results)

Summer 2024

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)	<table><tr><th>Description</th><th>Substance</th></tr><tr><td>a good conductor of electricity</td><td>lithium</td></tr><tr><td>an element that is a liquid at room temperature</td><td>bromine</td></tr><tr><td>a substance that can be used to form a polymer</td><td>ethene</td></tr><tr><td>an element that forms a basic oxide</td><td>lithium</td></tr><tr><td>a substance that has a giant covalent structure</td><td>diamond</td></tr></table>	**ALLOW** Li **ALLOW** Br/Br_2 **REJECT** Br^- **ALLOW** C_2H_4 **ALLOW** Li	5
(b)	A description that refers to the following two points **M1** (use damp blue) litmus paper **M2** (litmus paper) bleached/turns white Ignore gas/solution	**ALLOW** universal indicator paper **ACCEPT** blue litmus paper turns red and then bleached **IGNORE** gas/solution **ALLOW** **M1** bromide solution **M2** turns brown **REJECT** iodide solution **M2** dep on **M1** Red litmus paper turns blue then bleaches/turns white scores **M1 only**	2 **Total 7**

Question number			Answer	Notes	Marks
2	(a)	(i)	most reactive Q S R least reactive P		1
		(ii)	R		1
		(iii)	aluminium + hydrochloric acid → aluminium chloride + hydrogen	**ALLOW** $2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$ or multiples or fractions	1
		(iv)	copper/silver/gold	**ALLOW** platinum or any other metal that does not react with hydrochloric acid **ALLOW** correct symbol	1
		(v)	explosive/dangerous/violent/unsafe	**IGNORE** volatile/vigorous	1
	(b)	(i)	heat/thermal energy is given out/released (to the surroundings)	**IGNORE** energy on its own	1
		(ii)	aluminium is more reactive/ higher in the reactivity series (than iron) **ORA**	**ACCEPT** aluminium is a better/stronger reducing agent **ALLOW** Al	1
		(iii)	An explanation that links the following two points **M1** aluminium/Al gains oxygen and iron(III) oxide /Fe_2O_3 loses oxygen **M2** (so) aluminium/Al is oxidised and **iron(III) oxide /Fe_2O_3** is reduced OR **M1** Aluminium/Al gains oxygen so is oxidised **M2 Iron(III) oxide/Fe_2O_3** loses oxygen so is reduced	 **ACCEPT** aluminium/Al loses electrons and iron ions/Fe^{3+} gain electrons for **M1** **ACCEPT** correct changes in oxidation numbers **ACCEPT** aluminium/Al loses electrons so is oxidised scores for **M1** and iron ions/Fe^{3+} gain electrons so is reduced for **M2** **REJECT** iron loses oxygen for M2	2
					Total 9

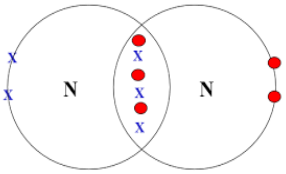
Question number	Answer	Notes	Marks
3 (a) (i)	2	**ALLOW** two	1
(ii)	3	**ALLOW** three	1
(iii)	ZF_2	**ALLOW** MgF_2 ALLOW F_2Mg ALLOW F_2Z REJECT $MgFl_2$ Penalise incorrect case or superscripts	1
(b)	**M1** $12 \times 6.0 \times 10^{23}$ **M2** 7.2×10^{24}	**ALLOW** ecf if incorrect number of electrons x 6.0×10^{23} **ALLOW** ecf if /12 ONLY rather than x12 giving $5(.0) \times 10^{22}$	2 4
(c)	**M1** (isotopic masses) 24, 25 and 26 **M2** $79.0 \times 24 + 10.0 \times 25 + 11.0 \times 26$ **OR** 2432 **M3** $\frac{79.0 \times 24 + 10.0 \times 25 + 11.0 \times 26}{100}$ **OR** $\frac{2432}{100}$ **OR** 24.32 **M4** 24.3	**M2** subsumes **M1** **ALLOW** ecf if incorrect mass numbers used 12.3 scores 3 with working 24.3 without working scores 4 24.32 without working scores 3 M4 scores only if numbers from the table are used.	
(d)	magnesium	**ALLOW** Mg	1
			Total 10

Question number	Answer	Notes	Marks
4 (a) (i)	24		1
(ii)	**M1** $12 \times 8 + 1 \times 10 + 14 \times 4 + 16 \times 2$ **M2** 194	correct answer of 194 scores 2 No ECF	2
(iii)	$C_4H_5N_2O$	**ALLOW** atoms in any order	1
(b) (i)	(simple) distillation	**REJECT** fractional distillation	1
(ii)	A description that refers to two of the following points **M1** (the condenser/X) **cools** the (ethanol) vapour **M2** so it **condenses OR** forms **liquid** (ethanol)		2
(c)	**M1** calcium bromide is a giant (ionic) lattice/structure **M2** with many/strong electrostatic attractions between (oppositely charged) ions **M3** caffeine has a simple molecular structure **M4** caffeine has weak intermolecular forces /weak forces between molecules **M5** more energy is needed to break the electrostatic attractions (in calcium bromide) than to overcome the intermolecular forces (in caffeine) OWTTE	 **ALLOW** many/strong ionic bonds No **M2** if covalent bonds or IMF given here **ALLOW** simple covalent structure **REJECT** weak forces between bonds No **M5** if reference to breaking covalent bonds No **M5** if reference to incorrect bonds	5
			Total 12

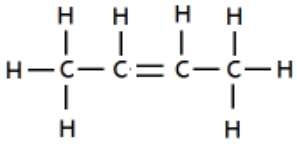
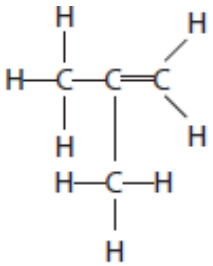
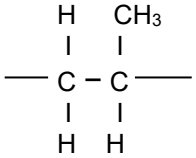
Question number	Answer	Notes	Marks
5 (a) (i)	An explanation that links the following two points **M1** They will not dissolve/diffuse into the solvent (at the bottom of beaker) OWTTE **M2** so that the dyes can travel up the paper	**ALLOW** dye in place of spot throughout question 5 **ALLOW** water	2
(ii)	An explanation that links the following two points **M1** E and H **M2** as the dye is/both have a spot at the same level/travelled the same distance/same Rf value	**M2** dep on **M1**	2
(iii)	An explanation that links the following two points **M1** The student can only be certain about G containing one dye as only one spot **M2** As F is insoluble/not moved (so you cannot tell how many dyes it has) OWTTE		2
(b)	**M1** distance from baseline to solvent level in mm = 65 **M2** distance from baseline to spot/dye in mm = 39 **M3** (R_f value = 39 ÷ 65 =) 0.6	**ACCEPT** any value between 38 and 41 inclusive **ACCEPT** any value between 0.57 and 0.64 **M3** not awarded if value is incorrectly rounded	3
			Total 9

Question number	Answer	Notes	Marks
6 (a) (i)	Any 2 from **M1** effervescence/bubbles/fizzing **M2** moves **M3** floats **M4** disappears/ gets smaller **M5** melts/forms a ball/forms a sphere **M6** white trail	 moves on surface scores **M2** and **M3** **ALLOW** dissolves **IGNORE** heat produced **IGNORE** flame	2
(ii)	An explanation that links the following two points **M1 (**the phenolphthalein) turns pink **M2** (because) OH^- ions/hydroxide ions are present	Mark independently **ALLOW** an alkaline solution /an alkali is produced **REJECT** red or purple **IGNORE** metal oxide forms	2
(b) (i)	An explanation that links the following two points **M1 (**to remove) any other ions/chemicals/ impurities/substances/elements (that may be on the wire) **M2** (so that) they do not interfere with/mask the colour of the flame/change the flame colour		2
(ii)	**C** (red) A is incorrect as lithium ions do not give a lilac flame B is incorrect as lithium ions do not give an orange flame D is incorrect as lithium ions do not give a yellow flame		1
(c) (i)	**M1** potassium ion K^+ **M2** aluminium ion Al^{3+} **M3** sulfate ion SO_4^{2-} All three correct 2 marks Any two correct 1 mark	 **ALLOW** Al^{+3} **ALLOW** SO_4^{-2}	2

(c) (ii)	**M1** (mass of water =) 23.7 − 12.9 **OR** 10.8 **M2** (moles of $KAl(SO_4)_2$ =) 12.9 ÷ 258 **OR** 0.05(00) **M3** (moles of water =) 10.8 ÷ 18 **OR** 0.6(00) **M4** (x = 0.6 ÷ 0.05 =) 12	correct answer of 12 without working scores 4 **ALLOW** ecf on incorrect mass of water answer to **M4** must be a whole number **ACCEPT** alternative methods	4 **Total 13**

Question number	Answer	Notes	Marks
7 (a)	**D** (80 %) A is incorrect as there is not approximately 1 % of nitrogen in the atmosphere B is incorrect as there is not approximately 20 % of nitrogen in the atmosphere C is incorrect as there is not approximately 70 % of nitrogen in the atmosphere		1
(b)	**M1** 3 pairs of electrons between the two nitrogen atoms **M2** rest of molecule fully correct 	**ALLOW** any combination of dots and crosses **M2** dep on **M1**	2
(c) (i)	$4NO_2 + 2H_2O + O_2 \rightarrow 4HNO_3$ **M1** all formulae correct **M2** balancing of correct formulae	**ALLOW** multiples and fractions **IGNORE** state symbols even if incorrect **M2** dep on **M1**	2
(ii)	any one environmental effect of acid rain e.g. acidifies lakes /kills fish /deforestation /damages plants /corrodes marble statues /corrodes buildings	**ACCEPT** any other environmental effect **REJECT** ozone layer **IGNORE** climate change	1
(d) (i)	**D** $(NH_4)_2CO_3$ A is incorrect as NH_3CO_3 is not the formula of ammonium carbonate B is incorrect as $(NH_3)_2CO_3$ is not the formula of ammonium carbonate C is incorrect as NH_4CO_3 is not the formula of ammonium carbonate		1

(ii)	A description that refers to the following six points Test for ammonium ions **M1** add sodium hydroxide solution (and heat) **M2** test the **gas/ammonia** with (damp) red litmus paper **M3** (red litmus) turns blue Test for carbonate ions **M4** add (hydrochloric) acid ONLY **M5** test the **gas/carbon dioxide** with limewater **M6** (limewater) turns cloudy/milky/white precipitate	**ACCEPT** universal indicator paper which turns blue/purple for **M2** and **M3** **M2** is dependent on **M1** **OR** can be awarded for heating the solution and producing a gas to test **M3** can be awarded independently if ammonia gas is correctly tested with correct colour change No **M2** and **M3** if litmus paper added directly to the solution **ACCEPT** other acids **M5** dependent on gaining **M4** by adding acid **ONLY** to the solution **M6** can be awarded independently if a correct limewater test on carbon dioxide gas is carried out No **M5** and **M6** if limewater added directly to the solution.	6 **Total 13**

Question number	Answer	Notes	Marks
8 (a) (i)	An explanation that links the following two points **M1** (compounds with) the same molecular formula	 **ALLOW** same number of carbons and hydrogens/atoms of each element **REJECT** elements with the same molecular formula **REJECT** chemical formula for M1	2
	M2 but different structural/displayed formulae	**ALLOW** different structures/arrangements of atoms **M2** independent of **M1**	
(ii)	**M1** 	Must show all bonds **ALLOW** cis and trans isomers for both marks	2
	M2 	**REJECT** cycloalkanes	
(b)	**A** (addition) B is incorrect as this is not a combustion reaction C is incorrect as this is not a decomposition reaction D is incorrect as this is not a substitution reaction		1
(c) (i)		**IGNORE** brackets and n	1

	(ii)	**M1** they are inert/unreactive/do not biodegrade/decomposes (very) slowly/running out space **M2** they produce toxic fumes/greenhouse gases (when burned)	**IGNORE** global warming	2
(d)		**M1** y (= 396 ÷ 44) = 9 **M2** z (= 180 ÷ 18) = 10 **M3** x = 14	**ALLOW** ecf for **M3** on incorrect values for **M1** and/or **M2**	3
(e)	(i)	$C_8H_{18}(l) + 7O_2(g) \rightarrow 5CO(g) + 3C(s) + 9H_2O(l)$ **M1** correct balancing **M2** correct state symbols	**ACCEPT** (g) for H_2O	2
	(ii)	**M1** carbon monoxide/CO **M2** is poisonous/toxic/limits the capacity to carry oxygen in the blood	**ALLOW** carbon/C **ALLOW** soot causes respiratory problems **ACCEPT** correct references to haemoglobin **M2** dep on **M1** **IGNORE** harmful	2
				Total 15

Question number	Answer	Notes	Marks
9 (a) (i)	carbon dioxide/a gas is given off	**IGNORE** marble dissolving **IGNORE** gas formed	1
(ii)	to prevent acid spray from leaving the flask OWTTE	**IGNORE** to stop solid from escaping	1
(b) (i)	Any two linked pairs from the following: **M1** the curve is steep(est) at the start/the loss in mass is fastest at the start **M2** because the acid concentration is highest/maximum number of reacting particles **OR** **M3** curves becomes less steep/the loss in mass slows down **M4** acid becomes more dilute/less concentrated **OR** **M5** curve levels off/becomes flat/plateaus/the loss in mass stops **M6** acid has been used up	**IGNORE** comments linked to rate of reaction Max 2 marks for M1, M3 and M5	4
(ii)	**M1** curve drawn starting at the origin and below the original curve **M2** curve levels off at 0.27 g + or − half a small square		2
(c)	An explanation that links the following three points **M1** the rate of reaction would increase/be faster **M2** (because) the smaller marble chips have a greater surface area **M3** (so) there will be more collisions per unit time	**IGNORE** less chance of collisions **ACCEPT** more frequent collisions MAX 1 mark if reference to particles having more energy or moving faster	3
			Total 11

Question number	Answer	Notes	Marks
10 (a)	$Mg + 2HNO_3 \rightarrow Mg(NO_3)_2 + H_2$	**IGNORE** state symbols even if incorrect	1
(b)	temperature of the acid at the start in °C: 16.0 highest temperature reached in °C: 32.4 temperature rise in °C: 16.4	Must be given to 1dp **ALLOW** ECF from incorrect highest temperature reached **ALLOW** ECF from an incorrect starting temperature	2
(c) (i)	**M1** $Q = 40 \times 4.2 \times 16.4$ **M2 2755** (J)	**ACCEPT** any number of sig figs except 1	2
(ii)	• find the amount of magnesium in moles • divide *Q* by *n* • convert answer in J/mol to kJ/mol • answer including sign to 2sf **M1** *n*(Mg) = 0.12 ÷ 24 **OR** 0.005 **M2** *Q* ÷ *n* **OR** 2755 ÷ 0.005 **OR** 551 000 (J/mol) **M3** 551 000 ÷ 1000 **OR** 551 (kJ/mol) **M4** − 550 (kJ/mol)	correct answer with minus sign and without working scores 4 **ACCEPT** use of 2760 or 2800 **ALLOW** ECF on incorrect answer to (i) and/or **M1** **ALLOW** ECF on incorrect answer to **M2** **ALLOW** ECF on incorrect answer to **M3** **M4** - to score must be to 2sf and have correct sign Use of 2800 gives an answer of − 560 (kJ/mol)	4

(d)	An explanation that links the following two points **M1** polystyrene is an insulator/poor conductor OWTTE **M2** (so) there is less heat loss/more heat retained (compared to the glass beaker)	**REJECT** no heat loss	2 **Total 11**

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