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.

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>1 (a)</td><td>
<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>
</td><td>ALLOW Li

ALLOW Br/Br_2
REJECT Br^-

ALLOW C_2H_4

ALLOW Li</td><td>5</td></tr>
<tr><td>(b)</td><td>A description that refers to the following two points

M1 (use damp blue) litmus paper

M2 (litmus paper) bleached/turns white

Ignore gas/solution</td><td>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</td><td>2

Total 7</td></tr>
</table>

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

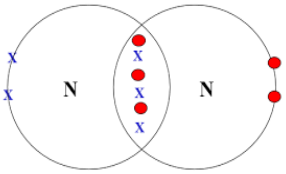
Question number	Answer	Notes	Marks
3 (a) (i)	2	ALLOW two	1
(ii)	3	ALLOW three	1
(iii)	ZF_2	ALLOW MgF_2 ALLOW F_2Mg ALLOW F_2Z REJECT $MgFl_2$ Penalise incorrect case or superscripts	1
(b)	M1 $12 \times 6.0 \times 10^{23}$ M2 7.2×10^{24}	ALLOW ecf if incorrect number of electrons x 6.0×10^{23} ALLOW ecf 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

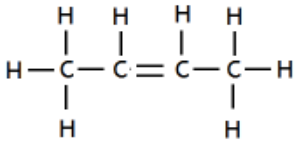
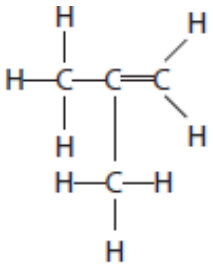
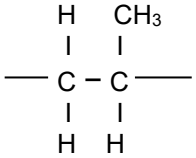
Question number	Answer	Notes	Marks
5 (a) (i)	An explanation that links the following two points M1 They will not dissolve/diffuse into the solvent (at the bottom of beaker) OWTTE M2 so that the dyes can travel up the paper	ALLOW dye in place of spot throughout question 5 ALLOW water	2
(ii)	An explanation 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 ^oC : 16.0 highest temperature reached in ^oC : 32.4 temperature rise in ^oC : 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 $Q \div n$ 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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