Mark Scheme (Results)

January 2021

Pearson Edexcel International GCSE In Chemistry (4CH1) Paper 1C and Science (Double Award) (4SD0) 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>Start</th><th>End</th></tr><tr><td>solid</td><td>liquid</td></tr><tr><td>solid</td><td>gas</td></tr><tr><td>gas</td><td>liquid</td></tr><tr><td>liquid</td><td>gas</td></tr></table></td><td>Award 1 mark for each correct row

ALLOW gas to solid for sublimation</td><td>3</td></tr>
<tr><td>(b)</td><td>A description that refers to any three of the following points

M1 irregular /random arrangement (of particles)

M2 large gaps between them /far apart /widely spaced

M3 random movement / move freely

M4 move (very) quickly</td><td>

ALLOW spread out

IGNORE references to kinetic energy</td><td>3</td></tr>
<tr><td colspan="4">6 marks</td></tr>
</table>

Question number	Answer	Notes	Marks
2 (a) (i)	A A is the correct answer because 100°C is above the boiling point of W B is not the correct answer because X is a solid at 100°C C is not the correct answer because Y is a solid at 100°C D is not the correct answer because Z is a solid at 100°C		1
(ii)	B B is the correct answer because X is a liquid for 1840°C A is not the correct answer because W is a liquid for 67°C C is not the correct answer because Y is a liquid for 1150°C D is not the correct answer because Z is a liquid for 330°C		1
(iii)	C C is the correct answer because Y is a liquid at 1000°C and a gas at 2000°C A is not the correct answer because W is a gas at 1000°C and at 2000°C B is not the correct answer because X is a liquid at 1000°C and 2000°C D is not the correct answer because Z is a gas at 1000°C and at 2000°C		1
(b)	ionic	**ALLOW** electrovalent	1
(c)	the (impure) substance will melt over a range of temperatures	**ALLOW** the (impure) substance will have a lower melting point	1
			5 marks

Question number	Answer	Notes	Marks
3 (a) (i)	M1 dissolving M2 diffusion	Answers can be in either order	2
(b) (i)	An explanation that links any two of the following points M1 crystals dissolve faster M2 (potassium iodide/ lead nitrate/ water) particles move faster / (lead/ iodide) ions move faster / rate of diffusion increases M3 therefore (lead and iodide) ions/ particles meet / collide after a shorter period of time/ sooner	 **ALLOW** (potassium iodide /lead nitrate/ water) particles have more energy **ALLOW** molecules in place of particles if referring to water **IGNORE** references to more collisions or more energetic collisions	2
(c) (i) (ii)	3 / three 2+ /+2	 **ALLOW** Pb^{2+}	1 1
(d)	$Pb(NO_3)_2(aq) + 2KI(aq) \rightarrow PbI_2(s) + 2KNO_3(aq)$	**ALLOW** multiples and fractions	1
			7 marks

Question number	Answer	Notes	Marks
4 (a)	Example calculation M1 (volume of oxygen =) 100 – 25 **OR** 75 (cm^3) M2 75 ÷ 365 × 100 M3 20.5 (%)	Correct answer of 20.5 % with or without working scores 3 **ALLOW** ecf from M1 **ALLOW** ecf from M2 **ALLOW** 2 or more significant figures **REJECT** incorrect rounding Use of 265 instead of 365 gives an answer of 28.3 and scores 2 Alternative method M1 (volume of air left =) 265 + 25 **OR** 290 (cm^3) M2 290 ÷ 365 × 100 **OR** 79.5 (%) M3 (100 – 79.5 =) 20.5 (%)	3
(b) (i)	M1 paint provides a barrier M2 which prevents oxygen / water getting to /reacting with the iron	**ALLOW** paint forms a coating (on the iron) / paint is non-permeable **ALLOW** air	2
(ii)	M1 zinc is more reactive/higher in the reactivity series (than iron) M2 zinc will oxidise / react / corrode instead of /before iron	**ALLOW** zinc is a sacrificial metal **IGNORE** references to zinc rusting **IGNORE** references to galvanising	2
			7 marks

Question number	Answer	Notes	Marks
5 (a)	**Method** filtration simple distillation **or** fractional distillation fractional distillation crystallisation	**ALLOW** filtering **ALLOW** distillation **REJECT** simple distillation or distillation	4
(b) (i)	M1 A and B M2 because they are the same height /moved the same distance up the paper / have the same R_f values as the spots in the purple ink	M2 dep on M1 correct or missing	2
(ii)	M1 D M2 because the spot is closest to the start line /travelled the least distance (from the start line) / has the lowest R_f value	M2 dep on M1 correct or missing	2
(c)	Example calculation M1 120 × 0.72 M2 86 / 86.4 (mm)	Correct answer of 86 or 86.4 (mm) with or without working scores 2	2
			10 marks

Question number	Answer	Notes	Marks
6 (a)	<table><tr><td>precipitate of barium carbonate</td><td>precipitate of barium sulfate</td></tr><tr><td>no precipitate</td><td>no precipitate</td></tr><tr><td>precipitate of calcium carbonate</td><td>precipitate of calcium sulfate</td></tr></table>	if barium sulfate and calcium carbonate correct but without including 'precipitate of' scores 1 out of 2 **ALLOW** correct formulae	3
(b)	A description that refers to any six of the following points M1 do a flame test M2 sodium chloride produces a yellow flame M3 add acid M4 potassium carbonate effervesces / bubbles M5 add dilute nitric acid M6 add silver nitrate (solution) M7 potassium chloride gives a white precipitate M8 potassium iodide gives a yellow precipitate	**ACCEPT** any description of a flame test **ACCEPT** yellow-orange or orange **IGNORE** any flame colour given for the potassium compounds **ALLOW** any named acid **ACCEPT** carbon dioxide/gas given off which turns limewater cloudy for M4 M4 is dep on M3 M7 and M8 are dep on M6 **ALLOW** addition of chlorine/bromine solution as an alternative to M6 M7 no colour change with potassium chloride	6

		M8 solution turns brown with potassium iodide If this alternative given no M5	
			9 marks

Question number	Answer	Notes	Marks
7 (a)	M1 two lithium atoms each lose one electron /give one electron to oxygen M2 oxygen gains two electrons M3 lithium (ion) has an electron configuration of 2 and oxide (ion) is 2,8	**ALLOW** lithium loses one electron /gives one electron to oxygen **ALLOW** oxygen becomes 2,8 All 3 marks can be scored from diagrams showing the electron configurations of the ions 0 marks if reference to sharing electrons	3
(b) (i)	M1 (temperature after) = 27.7°C M2 temperature rise = 10.4 °C	 **ALLOW** ecf from M1	2
(ii)	Example calculation M1 Use of 100 in Q = m x c (x ΔT) M2 Use of 10.4 in Q = (m x) c x ΔT M3 4368J M4 4400J	Correct answer of 4400J with or without working scores 4 **ALLOW** ecf from (b)(i) 100 x 4.2 x 10.4 scores M1 and M2 **ALLOW** ecf from M1 and M2 **ALLOW** ecf from M3 **IGNORE** + or – sign in front of answer	4
(iii)	Example calculation M1 5210 ÷ 1000 or 5.21 M2 5.21 ÷ 0.0580 M3 -89.8(kJ/mol)	Correct answer of -89.8 (kJ/mol) scores 3 **ALLOW** -90 (kJ/mol) or any number of sig figs as long as correctly rounded.	3
(iv)	polystyrene is a good insulator /poor conductor (of heat) OR to minimise/reduce heat loss	**ALLOW** prevent heat loss	1
			13 marks

Question number	Answer	Notes	Marks
8 (a)	M1 solid M2 dark grey / black		2
(b) (i)	Example calculation M1 (51 × 79) + (49 × 81) **OR** 7998 M2 7998 ÷ 100 M3 80.0	80.0 with no working scores 3 79.9 with no working scores 1 79.98 or 80 with no working scores 2	3
(ii)	same electron configuration	**ALLOW** same (total) number of electrons **IGNORE** same number of electrons in the outer shell **IGNORE** references to same number of protons	1
(c) (i)	An explanation that links the following three points M1 the order of reactivity is chlorine (most), bromine and iodine (least) M2 chlorine (is most reactive because it) displaces bromine and iodine/ oxidises bromide and iodide (ions) / reacts with sodium bromide and sodium iodide M3 bromine (is less reactive than chlorine since it) only displaces iodine / only oxidises iodide (ions) / only reacts with sodium iodide	**ACCEPT** bromine is only displaced by chlorine and iodine is displaced by chlorine and bromine scores M2 and M3 **ALLOW** chlorine has two reactions, bromine has one reaction and iodine no reactions for 1 mark out of M2 and M3 Deduct 1 mark for incorrect use of ine	3

		and ide e.g. bromine displaces iodide	
(ii)			1
	bromine cannot displace itself / bromine does not react with sodium bromide OWTTE	**ALLOW** there would be no reaction	2
(iii)			
	M1 bromine is reduced and iodide (ions)/I^- is oxidised		
	M2 bromine gains electrons and iodide (ions)/I^- loses electrons	Deduct 1 mark for mention of iodine (ions) being oxidised or losing electrons	
	OR		
	M1 bromine gains electrons so is reduced		
	M2 iodide (ions) /I^- loses electrons so is oxidised	**REJECT** iodine (ions) loses electrons so is oxidised	

12 marks

Question number	Answer	Notes	Marks
9 (a)	M1 (propane/it) contains hydrogen and carbon (atoms) M2 only	**REJECT** carbon and hydrogen molecules M2 is dependent on mention of just carbon and hydrogen in M1	2
(b) (i)	carbon monoxide	**ALLOW** CO	1
(ii)	it decreases the capacity of the blood to transport oxygen OWTTE	**ALLOW** carbon monoxide binds to haemoglobin	1
(c)	M1 (strong electrostatic) attraction between (bonding) pair of electrons M2 (and) nuclei (of both atoms) **OR** M1 (bonding) pair of electrons M2 attracted to nuclei	 **REJECT** nucleus **REJECT** nucleus 0 marks if reference to intermolecular forces between atoms	2
(d)	An explanation that links the following three points M1 (crude oil) produces more long chain hydrocarbons than can be used directly OWTTE M2 shorter chain alkanes are more flammable /more useful as fuels M3 alkenes are used to make polymers / plastics	 **ALLOW** less demand for long chain hydrocarbons **ALLOW** shorter chain alkanes/hydrocarbons are more useful	3
(e) (i)	M1 C_3H_7Br M2 HBr	 **ALLOW** polysubstituted product if correct balancing number in front of Br_2 and HBr	2
(ii)	substitution		1

12 marks

Question number	Answer	Notes	Marks
10 (a) (i)	curve of best fit	**REJECT** dot to dot line	1
(ii)	M1 lines shown on graph	**ALLOW** extra point on curve at 7 carbon atoms	2
	M2 value correctly read from graph (expected value between 97 and 103°C)	**ACCEPT** value to $\pm$ 1°C	
(iii)	An explanation that links the following three points		3
	M1 the boiling point increases as the number of carbons / the chain length increases	**ALLOW** boiling point increases as the M_r increases	
	M2 because the intermolecular forces (of attraction) get stronger	**REJECT** directly proportional	
	M3 and therefore take more energy to overcome / break	M3 dep on M2	
		Any mention of breaking covalent bonds does not score M2 or M3	
(b)	M1 same **molecular** formula		2
	M2 different **displayed** / **structural** formulae	**ALLOW** different structures/ different arrangement of atoms	
(c) (i)	M1 82.8 ÷ 12 **or** 6.9 17.2 ÷ 1 **or** 17.2	0 marks if upside down calculation or use of atomic numbers	2
	M2 (divide by smallest to give) 1:2.5 which is 2:5	**ACCEPT** alternative methods	
(ii)	C_4H_{10}		1

(d)	M1 moles of CO_2 = 7 **or** X = 7 M2 moles of H_2O = 8 **or** Y = 8 M3 balancing number = 11 **or** Z = 11	 **ALLOW** ecf from incorrect values of X and Y	3
			14 marks

Question number			Answer	Notes	Marks
11	(a)	(i)	glowing splint relights	**REJECT** burning splint	1
		(ii)	A description that refers to the following three points M1 filter out manganese(IV) oxide / solid M2 leave to dry M3 same mass/ 1g of manganese(IV) oxide / solid		3
	(b)	(i)	M1 280 ÷ 120 M2 2.33	 **ALLOW** ecf from M1 **ALLOW** any number of significant figures except 1	2
		(ii)	An explanation that links the following three points M1 the concentration of hydrochloric acid is greatest M2 therefore there are more collisions M3 per unit time	 **ALLOW** the surface area of zinc is greatest **ALLOW** greatest number of/more particles (of hydrochloric acid/ zinc) More frequent collisions scores M2 and M3 Max 1 if incorrect reference to energy	3 2
		(iii)	M1 curve above original and starts at 0 M2 curve goes flat at same volume (410cm^3)		

(iv)	M1 greater surface area M2 more collisions per unit time / more frequent collisions		2
(c)	M1 8.46×10^{-3} mol of zinc M2 therefore 1.69×10^{-2} mol hydrochloric acid needed (which is less than 2.50×10^{-2} mol) **OR** M1 1.25×10^{-2} mol of zinc are needed M2 therefore 0.8(13) g of zinc is needed (and there is only 0.55g)	**ALLOW** any number of sig figs including one e.g. 0.008 moles of zinc, therefore 0.016 moles of acid needed scores M1 and M2	2
			15 marks

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