



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.

Question number	Answer	Notes	Marks										
1 (a)	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th data-bbox="331 472 649 510">Start</th> <th data-bbox="649 472 965 510">End</th> </tr> </thead> <tbody> <tr> <td data-bbox="331 510 649 548">solid</td> <td data-bbox="649 510 965 548">liquid</td> </tr> <tr> <td data-bbox="331 548 649 622">solid</td> <td data-bbox="649 548 965 622">gas</td> </tr> <tr> <td data-bbox="331 622 649 660">gas</td> <td data-bbox="649 622 965 660">liquid</td> </tr> <tr> <td data-bbox="331 660 649 698">liquid</td> <td data-bbox="649 660 965 698">gas</td> </tr> </tbody> </table>	Start	End	solid	liquid	solid	gas	gas	liquid	liquid	gas	Award 1 mark for each correct row ALLOW gas to solid for sublimation	3
Start	End												
solid	liquid												
solid	gas												
gas	liquid												
liquid	gas												
(b)	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	ALLOW spread out IGNORE references to kinetic energy	3										
6 marks													

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)	3 / three		1
(ii)	2+ /+2	ALLOW Pb ²⁺	1
(d)	$\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{KI}(\text{aq}) \rightarrow \text{PbI}_2(\text{s}) + 2\text{KNO}_3(\text{aq})$	ALLOW multiples and fractions	1
			7 marks

Question number	Answer	Notes	Marks
4 (a)	<p>Example calculation</p> <p>M1 (volume of oxygen =) $100 - 25$ OR 75 (cm³)</p> <p>M2 $75 \div 365 \times 100$</p> <p>M3 20.5 (%)</p>	<p>Correct answer of 20.5 % with or without working scores 3</p> <p>ALLOW ecf from M1</p> <p>ALLOW ecf from M2</p> <p>ALLOW 2 or more significant figures</p> <p>REJECT incorrect rounding</p> <p>Use of 265 instead of 365 gives an answer of 28.3 and scores 2</p> <p>Alternative method</p> <p>M1 (volume of air left =) $265 + 25$ OR 290 (cm³)</p> <p>M2 $290 \div 365 \times 100$ OR 79.5 (%)</p> <p>M3 $(100 - 79.5 =)$ 20.5 (%)</p>	3
(b) (i)	<p>M1 paint provides a barrier</p> <p>M2 which prevents oxygen / water getting to /reacting with the iron</p>	<p>ALLOW paint forms a coating (on the iron) / paint is non-permeable</p> <p>ALLOW air</p>	2
(ii)	<p>M1 zinc is more reactive/higher in the reactivity series (than iron)</p> <p>M2 zinc will oxidise / react / corrode instead of /before iron</p>	<p>ALLOW zinc is a sacrificial metal</p> <p>IGNORE references to zinc rusting</p> <p>IGNORE references to galvanising</p>	2
			7 marks

Question number	Answer	Notes	Marks				
5 (a)	<p style="text-align: center;">Method</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">filtration</td> </tr> <tr> <td style="padding: 2px;">simple distillation or fractional distillation</td> </tr> <tr> <td style="padding: 2px;">fractional distillation</td> </tr> <tr> <td style="padding: 2px;">crystallisation</td> </tr> </table>	filtration	simple distillation or fractional distillation	fractional distillation	crystallisation	<p>ALLOW filtering</p> <p>ALLOW distillation</p> <p>REJECT simple distillation or distillation</p>	4
filtration							
simple distillation or fractional distillation							
fractional distillation							
crystallisation							
(b) (i)	<p>M1 A and B</p> <p>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</p>	<p>M2 dep on M1 correct or missing</p>	2				
(b) (ii)	<p>M1 D</p> <p>M2 because the spot is closest to the start line /travelled the least distance (from the start line) / has the lowest R_f value</p>			<p>M2 dep on M1 correct or missing</p>	2		
(c)	<p>Example calculation</p> <p>M1 120×0.72</p> <p>M2 $86 / 86.4(\text{mm})$</p>	<p>Correct answer of 86 or 86.4 (mm) with or without working scores</p> <p>2</p>	2				
10 marks							

Question number	Answer	Notes	Marks						
6 (a)	<table border="1" data-bbox="333 309 963 533"> <tr> <td data-bbox="333 309 651 383">precipitate of barium carbonate</td> <td data-bbox="651 309 963 383">precipitate of barium sulfate</td> </tr> <tr> <td data-bbox="333 383 651 456">no precipitate</td> <td data-bbox="651 383 963 456">no precipitate</td> </tr> <tr> <td data-bbox="333 456 651 533">precipitate of calcium carbonate</td> <td data-bbox="651 456 963 533">precipitate of calcium sulfate</td> </tr> </table>	precipitate of barium carbonate	precipitate of barium sulfate	no precipitate	no precipitate	precipitate of calcium carbonate	precipitate of calcium sulfate	<p>if barium sulfate and calcium carbonate correct but without including 'precipitate of' scores 1 out of 2</p> <p>ALLOW correct formulae</p>	3
precipitate of barium carbonate	precipitate of barium sulfate								
no precipitate	no precipitate								
precipitate of calcium carbonate	precipitate of calcium sulfate								
(b)	<p>A description that refers to any six of the following points</p> <p>M1 do a flame test</p> <p>M2 sodium chloride produces a yellow flame</p> <p>M3 add acid</p> <p>M4 potassium carbonate effervesces / bubbles</p> <p>M5 add dilute nitric acid</p> <p>M6 add silver nitrate (solution)</p> <p>M7 potassium chloride gives a white precipitate</p> <p>M8 potassium iodide gives a yellow precipitate</p>	<p>ACCEPT any description of a flame test</p> <p>ACCEPT yellow-orange or orange</p> <p>IGNORE any flame colour given for the potassium compounds</p> <p>ALLOW any named acid</p> <p>ACCEPT carbon dioxide/gas given off which turns limewater cloudy for M4</p> <p>M4 is dep on M3</p> <p>M7 and M8 are dep on M6</p> <p>ALLOW addition of chlorine/bromine solution as an alternative to M6</p> <p>M7 no colour change with potassium chloride</p>	6						

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

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

Question number	Answer	Notes	Marks
8 (a)	M1 solid M2 dark grey / black		2
(b) (i)	Example calculation M1 $(51 \times 79) + (49 \times 81)$ OR 7998 M2 $7998 \div 100$ 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

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

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 ₃ H ₇ Br M2 HBr	ALLOW polysubstituted product if correct balancing number in front of Br ₂ and HBr	2
(ii)	substitution		1

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
(iii)	M2 value correctly read from graph (expected value between 97 and 103°C)	ACCEPT value to $\pm 1^\circ\text{C}$	3
	An explanation that links the following three points		
	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 $82.8 \div 12$ or 6.9 $17.2 \div 1$ 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 $\text{CO}_2 = 7$ or $X = 7$ M2 moles of $\text{H}_2\text{O} = 8$ 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
(a) (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 $280 \div 120$ M2 2.33	ALLOW ecf from M1 ALLOW any number of significant figures except 1	2
(b) (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	3
(b) (iii)	M1 curve above original and starts at 0 M2 curve goes flat at same volume (410cm^3)	Max 1 if incorrect reference to energy	2

(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

