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Pearson Edexcel

Mark Scheme (Results)

November 2021

Pearson Edexcel International GCSE

In Chemistry (4CH1) Paper 2C

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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.

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Question number		Answer	Notes	Marks
1	(a)	nitrogen	ALLOW N/N_2	1
	(b)	silicon/Si or phosphorus/P or sulfur/S		1
	(c)	bromine		1
	(d)	73		1
	(e)	The only correct answer is D as francium is the most reactive element in Group 1 and fluorine is the most reactive element in Group 7 A is not correct because lithium is not the most reactive element in Group 1 B is not correct because astatine is not the most reactive element in Group 7 C is not correct because lithium is not the most reactive element in Group 1 and astatine is not the most reactive element in Group 7		1

Total marks for Question 1 = 5

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Question number	Answer	Notes	Marks
2 (a)	Explanation containing following ideas (A saturated solution is one which contains) M1 as much solute as possible in (a certain volume of) the solvent OWTTE M2 at a particular / given / constant temperature OWTTE		2
2 (b) (i)	(volumetric) pipette/burette		1
(ii)	(water / solution) would be heated too quickly OR (water / solution) might spit out or be lost OWTTE	ALLOW (water / solution) might boil or evaporate	1
(iii)	repeat (and find the mean temperature)		1
(iv)	M1 4.5 (g solid in 10 g water) M2 (so solubility = 4.5 x 10) = 45 (g per 100 g of water)	ALLOW M1×10 45 with no working scores 2	2
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Question number	Answer	Notes	Marks
2 (c) (i)	71 (°C)	ALLOW 70-72(°C)	1
(ii)	M1 (from curve) 124 g of solid B dissolves in 100 g water M2 (so 124 x 2.5) = 310 (g dissolves in 250 g water)	ALLOW 123-125 g ALLOW ecf from M1 307.5-312.5 with no working scores 2 marks ALLOW M1×2.5 If solid A used 1 mark for correct answer of 262-268g	2
(iii)	some water may have been lost/evaporated OWTTE		1

Total marks for Question 2 = 11

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Question number	Answer	Notes	Marks
3 (a) (i)	$2H_2S$ (**g**) + SO_2 (**g**) → **3** S (s) + **2** H_2O (l) M1 all state symbols correct M2 balancing correct	 ALLOW upper case ALLOW multiples/fractions	2
(ii)	(sulfur dioxide is reduced because it) loses oxygen	IGNORE references to electrons	1
3 (b) (i)	Explanation linking following points M1 sulfur/(pale yellow) solid forms nearer to sulfur dioxide side/closer to left OWTTE ORA M2 so hydrogen sulfide particles moved / diffused further (in same time) OWTTE ORA		2
(ii)	M1 M_r of H_2S = (1 + 1 + 32) = 34 M2 M_r of SO_2 = (32 +16 + 16) = 64 M3 statement of relationship eg the higher the Mr the slower the gas diffuses	 ACCEPT reverse argument	3

Total marks for Question 3 = 8

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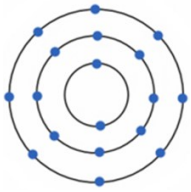
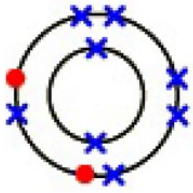
Question number	Answer	Notes	Marks
4 (a)	M1 (cation) Mg^{2+} M2 (anion) SO_4^{2-}	ALLOW 1 mark if formulae correct but in wrong order	2
(b)	M1 potassium ion  M2 oxide ion  M3 $(K)^+$ and $(O)^{2-}$	ALLOW any combination of dots and crosses If only outer shells shows – max 2	3

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Question number	Answer	Notes	Marks
4 (c) (i)	hydroxide/OH^-	ALLOW HO^-	1
(ii)	$K_2O + H_2O \rightarrow 2KOH$	ALLOW multiples	1
(d)	M1 (when molten or in aqueous solution) ions can move M2 (in solid) ions cannot move		2
(e)	M1 X is chlorine / Cl_2 M2 Y is hydrogen / H_2 M3 $2Cl^- \rightarrow Cl_2 + 2e^{(-)}$ M4 $2H^+ + 2e^{(-)} \rightarrow H_2$	ALLOW oxygen / O_2 If both given but wrong way round or unclear which is which allow 1 mark from M1 and M2 $2H_2O \rightarrow O_2 + 4H^+ + 4e^{(-)}$ or $4OH^- \rightarrow O_2 + 2H_2O + 4e^{(-)}$	4

Total marks for Question 4 = 13

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Question number	Answer	Notes	Marks
5 (a) (i)	ore(s)	IGNORE minerals	1
(ii)	gold/platinum	ALLOW silver/copper ALLOW symbols	1
5 (b) (i)	(calcium from calcium chloride) M1 electrolysis M2 (because) calcium is more reactive than carbon **OR** carbon cannot displace calcium	 ALLOW reverse argument M2 dep on M1	2
(ii)	(lead from lead oxide) M1 carbon extraction M2 (because) carbon is more reactive than lead **OR** carbon can displace lead	 ALLOW reverse argument M2 dep on M1	2

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Question number	Answer	Notes	Marks
5 (c)	M1 2-D diagram showing at least two layers of particles M2 particles labelled atoms or (positive) ions (malleable because) M3 layers can slide over each other		3
(d)	M1 calculation of M_r of Al_2O_3 M2 moles of Al_2O_3 M3 calculation of mass of aluminium exemplar M1 102 M2 1275÷102 OR 12.5(moles) M3 (12.5×2×27) = 675g	 ALLOW M1×2 ALLOW ecf from M1 ALLOW ecf from M2 675g without working scores 3 0.675 without working scores 2 337.5 without working scores 2 1350 without working scores 2	3

Total marks for Question 5 = 12

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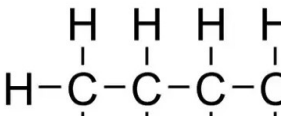
Question number	Answer	Notes	Marks
6 (a)	C is the only correct answer as temperature used is 300°C and pressure is 65 atm (60-70 atm) A is incorrect because 35°C and 300 atm are not the correct conditions B is incorrect because 65°C and 300 atm are not the correct conditions D is incorrect because 300°C and 35 atm are not the correct conditions		1
(b)		formula must be fully displayed ALLOW fully displayed formula for butan-2-ol	1
(c)(i)	M1 mol(KOH) = $\frac{45.00 \times 0.40}{1000}$ = 0.018		2
	M2 conc(CH_3COOH) = $\frac{0.018 \times 1000}{25}$ = 0.72 (mol/dm^3)	ALLOW ecf from M1 0.72 (mol/dm^3) without working scores 2	
(ii)	M1 mol(CO_2) = (0.0030÷2) = 0.0015		
	M2 vol(CO_2) = 0.0015 x 24000 = 36 (cm^3)	ALLOW ecf from M1 36 (cm^3) without working scores 2 72 (cm^3) without working scores 1	2
(d)	**B** C_2H_5OH is the only correct answer A is not correct because CH_3OH could not form the ester ethyl propanoate C is not correct because C_3H_7OH could not form the ester ethyl propanoate D is not correct because C_4H_9OH could not form the ester ethyl propanoate		1

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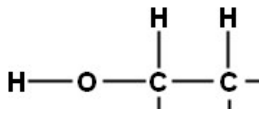
(e)	(i)	(in condensation polymerisation) two different monomers used / water is produced	ALLOW small molecule is produced	1
	(ii)	M1 	ALLOW -OH	2
		M2 	ACCEPT in either order ALLOW -OH	
	(iii)	biodegradable	ACCEPT description	1

Total marks for Question 6 = 11

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Question number	Answer	Notes	Marks
7 (a) (i)	M1 no effect on yield	IGNORE comments about rate	2
	M2 because same number of moles (of gas) on both sides of equation	M2 dep on M1	
(ii)	M1 no effect on yield		2
	M2 because catalyst increases rate of both forward and backward reactions by same amount	M2 dep on M1	
(b)	M1 bonds broken = (436 + 158) OR 594 (ignore sign)		3
	M2 bonds made = (2 x 562) OR 1124 (ignore sign)		
	M3 ΔH = -530 (kJ/mol)	-530 with no working scores 3 +530 or 530 with no working scores 2 +32 or 32 with no working scores 2	
(c)	M1 right hand line below left hand line		3
	M2 correct names/formulae of reactants and products	ALLOW reactants and products	
	M3 enthalpy change, ΔH correctly shown and labelled with arrow pointing down	ACCEPT line with no arrow head / double arrow head if -ΔH or -530 is labelled REJECT arrow pointing upwards	
	If the answer to (b) is positive		
	M1 right hand line above left hand line		
	M2 correct names/formulae of reactants and products	ALLOW reactants and products	
	M3 enthalpy change, ΔH correctly shown and labelled with arrow pointing up	ACCEPT line with no arrow head / double arrow head if (+)ΔH or +530 is labelled REJECT arrow pointing downwards	

Total marks for Question 7 = 10

Total for Paper = 70

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