Pearson Edexcel

Mark Scheme (Results)

November 2021

Pearson Edexcel International GCSE

In Chemistry (4CH1) Paper 2C

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

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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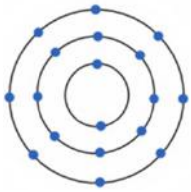
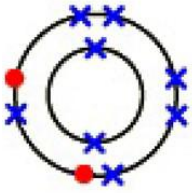
Question number	Answer	Notes	Marks
2 (c) (i)	71 (°C)	ALLOW 70-72(°C)	1
(ii)	M1 (from curve) 124 g of solid B dissolves in 100 g water M2 (so 124 x 2.5) = 310 (g dissolves in 250 g water)	ALLOW 123-125 g ALLOW ecf from M1 307.5-312.5 with no working scores 2 marks ALLOW M1×2.5 If solid A used 1 mark for correct answer of 262-268g	2
(iii)	some water may have been lost/evaporated OWTTE		1

Total marks for Question 2 = 11

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

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

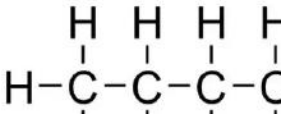
Question number	Answer	Notes	Marks
4 (c) (i)	hydroxide/OH^-	ALLOW HO^-	1
(ii)	$K_2O + H_2O \rightarrow 2KOH$	ALLOW multiples	1
(d)	M1 (when molten or in aqueous solution) ions can move M2 (in solid) ions cannot move		2
(e)	M1 X is chlorine / Cl_2 M2 Y is hydrogen / H_2 M3 $2Cl^- \rightarrow Cl_2 + 2e^{(-)}$ 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

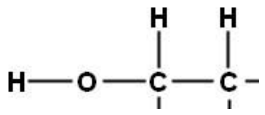
Total marks for Question 4 = 13

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

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

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

(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

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) 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	3
(c)	M1 right hand line below left hand line M2 correct names/formulae of reactants and products M3 enthalpy change, ΔH correctly shown and labelled with arrow pointing down	ALLOW reactants and products ACCEPT line with no arrow head / double arrow head if $-\Delta H$ or -530 is labelled REJECT arrow pointing upwards	3
	If the answer to (b) is positive M1 right hand line above left hand line M2 correct names/formulae of reactants and products M3 enthalpy change, ΔH correctly shown and labelled with arrow pointing up	ALLOW reactants and products ACCEPT line with no arrow head / double arrow head if $(+)\Delta H$ or +530 is labelled REJECT arrow pointing downwards	

Total marks for Question 7 = 10

Total for Paper = 70