

# Mark Scheme (Results) Summer 2010

IGCSE

## IGCSE Chemistry (4335) Paper 2H

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## SECTION A

Question			Mark	Acceptable answers	Notes	Total	
1	a	i	M1	bubbles / fizzing / effervescence / metal gets smaller / white trail	Ignore metal dissolves / gas produced Reject all answers in a(ii)	1	
		ii	M1	melts / forms a ball / darts / moves (on surface) / floats	Ignore reference to flames Reject all answers in a(i)	1	
	b	i	M1	calcium hydroxide		1	
		ii	M1	NaOH		1	
	c		M1	hydrogen / H <sub>2</sub>	Ignore H	1	
				M2	(squeaky) pop with burning splint / burns with a (squeaky) pop	Accept other words such as explosion / lighted spill or taper Reject glowing splint Ignore references to air/splint extinguished No CONSEQ from wrong gas	1
	d	i	M1	blue / purple	Ignore qualifiers such as light / dark / bright	1	
				M2	OH <sup>-</sup> / hydroxide	Ignore hydroxyl	1
			ii	M1	yellow / orange	Ignore qualifiers such as light / dark / golden / bright Reject all other colours	1

Question		Mark	Acceptable answers	Notes	Total	
2	a	M1	hydrogen peroxide		1	
		M2	manganese(IV) oxide / manganese dioxide		1	
	b	M1	(gas) syringe		1	
		M1	catalyst / to speed up the reaction / lower activation energy		1	
	d	i	M1	(s) for both PbS and PbSO <sub>4</sub>		1
			M2	(aq) for H <sub>2</sub> O <sub>2</sub> and (l) for H <sub>2</sub> O		1
		ii	M1	PbS / lead sulphide / sulphide ion / S <sup>2-</sup> / sulphur in lead sulphide	Ignore oxidation numbers if given	1
			M2	gains oxygen/O/O <sub>2</sub> increase in oxidation state	only award if M1 correct or sulphur ignore loss of electrons	1
	e	i	M1	S + O <sub>2</sub> → SO <sub>2</sub>	Ignore state symbols Accept S <sub>2</sub> or S <sub>8</sub>	1
			M1	acidic / (forms) H <sup>+</sup> (ions) / sulphurous acid / sulphuric(IV) acid	Reject sulphuric acid / sulphuric(VI) acid	1
			iii	M1	orange	
	M2	green		Accept blue-green	1	

Question		Mark	Acceptable answers	Notes	Total
3	a	M1	electron transfer	All marks can be scored from suitably annotated diagrams Award 0/3 if any reference to sharing electrons Ignore covalent M3 dependent on M2	1
		M2	from magnesium/Mg to chlorine/Cl		1
		M3	Mg loses two electrons and (each) Cl gains one electron		1
	b	M1	magnesium / Mg		1
		M2	loss of electrons / increase in oxidation state	Ignore number of electrons M2 independent of M1	1
	c	M1	+ and - ions / oppositely charged ions / $Mg^{2+}$ and $Cl^{-}$	Need idea of + and - charge	1
		M2	strong (electrostatic) attractions (within lattice)	accept strong (ionic) bonds reject covalent bonds / molecular attraction	1
		M3	<u>lot of</u> energy needed to overcome attractions / break bonds / separate ions	Do not accept “loosening bonds” Ignore “hard to break”	1
				any mention of “intermolecular” or “intramolecular” loses M1 and M2  So “strong intermolecular forces need lots of energy to overcome” scores M3	

Question			Mark	Acceptable answers	Notes	Total
4	a	i	M1	fractional distillation / fractionation		1
		ii	M1	crude oil heated	M1 given even if describe laboratory process. Only M1 possible if describe lab process or mention cracking/breaking bonds	1
			M2	(vapour) passed into column/tower	If crude oil heated in fractionating column, then give only 1 mark for M1 and M2	1
			M3	fractions collected at different heights		1
			M4	correct reference to boiling point / molecular size / temperature gradient/hot at bottom cooler at top	Do not award if specified temperature gradient is wrong way round	1
					All marks can be gained from a suitable diagram	
	b	i	M1	bitumen		1
		ii	M1	gasoline		1
		iii	M1	bitumen		1
		iv	M1	refinery gases	Accept answers in either order	1
			M2	fuel oil	Accept naphtha in place of either	1
	c		M1	oxygen	Ignore air	1
			M2	carbon dioxide	Accept answers in either order	1
			M3	water	Accept steam in place of water	1
					All marks in c are independent	
					Ignore heat	

	d	i	M1	$C_nH_{2n+2}$	Accept other letters/symbols such as x accept $C_nH_{2(n+1)}$	1
		ii	M1	same/similar chemical properties / same functional group	reject trend in chemical properties  reject same/similar physical properties Accept any two for 1 mark each Ignore references to general formula and references to saturation/unsaturation/specific functional group	
		M2	gradation in physical properties / gradation in specified physical property (eg boiling point)			
		M3	neighbouring members differ by $CH_2$	2		

SECTION A TOTAL: 45 MARKS

## SECTION B

Question		Mark	Acceptable answers	Notes	Total
5	a		M1 number of protons in an atom	Do not award mark if no mention of atom/nucleus Ignore reference to electrons unless clearly added to number of protons	1
	b	i	M1 isotope(s)		1
		ii	M1 38		1
			M2 18		1
			M3 18		1
			M4 22		1
		iii	M1 full outer energy level/shell / complete octet / no need to gain or lose electrons / eight electrons in outer energy level/shell / 2.8.8	Ignore reference to stability/ionisation energy	1
	c	i	M1 (atoms of isotope 65 are) 30.9 %		1
			M2 $(63 \times 0.691) + (65 \times 0.309)$	CONSEQ on incorrect percentage in M1	1
			M3 63.6	Correct final answer scores 3 marks Award 2 marks for 63.62 / 63.618 CONSEQ on incorrect percentage in M1 ignore units	1
		ii	M1 same electronic configuration/number of (outer) electrons	ignore references to same number of protons	1



Question		Mark	Acceptable answers	Notes	Total	
6	a		M1 M2	$\text{MgCO}_3 \rightarrow \text{MgO} + \text{CO}_2$	reagent = 1	1
					both products = 1	1
				Award 1 mark for all formulae correct in an unbalanced equation ignore state symbols		
	b	i	M1	magnesium chloride/nitrate/sulphate/other soluble magnesium salt		1
			M2	sodium/potassium/ammonium carbonate / other soluble carbonate		1
		ii	M1	correct balanced equation such as	CONSEQ on b(i) even if either reagent incorrect. Must give required product Award 2 marks for any correctly balanced equation that uses formulae from the names in bi Award 1 mark for any incorrectly balanced equation that uses formulae from the names in bi Award 1 mark for any correctly balanced equation that uses formulae different from the names in bi equation with any incorrect formulae scores 0	2
	M2		$\text{MgCl}_2 + \text{Na}_2\text{CO}_3 \rightarrow \text{MgCO}_3 + 2\text{NaCl}$			
		iii	M1	filter / centrifuge and decant		1
			M2	Wash (residue/solid) with water	M2 and M3 dependent on an attempt at M1(eg “sieving”, “decant”)	1
			M3	dry by warming gently / leave (in warm place) to dry / uses filter/absorbent paper / dry in (warm) oven / place in dessicator		1
				Points must be in correct order to score all marks		

Question		Mark	Acceptable answers	Notes	Total
7	a	M1	bromine (water)	Reject bromide, but mark M2 and M3 as if bromine accept $\text{KMnO}_4$	1
		M2	(stays) yellow / orange / brown / no change/ no reaction	Reject red Purple if $\text{KMnO}_4$	1
		M3	(becomes) colourless / decolourised	Ignore clear ignore discoloured Decolourised if acidified $\text{KMnO}_4$ brown if neutral $\text{KMnO}_4$ green if alkaline $\text{KMnO}_4$ if only $\text{KMnO}_4$ allow any of above three  accept 1,2-dibromopropane (if bromine) or propan(e)-1,2-diol (if $\text{KMnO}_4$ )	1
	b	M1	alkene(s)	Accept olefins	1
	c	M1	$\begin{array}{cc} \text{H} & \text{CH}_3 \\   &   \\ \text{---C---} & \text{C---} \end{array}$	M1 for correct structure (ignore continuation bonds)	1
		M2	$\begin{array}{cc} \text{---C---} & \text{C---} \\   &   \\ \text{H} & \text{H} \end{array}$	M2 for continuation bonds	1
				M2 dependent on M1 Ignore brackets and subscript letters Award 0 marks if double bond shown	
	d	M1	poly(propene) / polypropene / polypropylene		1

Question			Mark	Acceptable answers	Notes	Total
8	a	i	M1	$\text{Zn} + \text{CuSO}_4 \rightarrow \text{Cu} + \text{ZnSO}_4$	M1 for reagents	1
			M2	$/ \text{Zn} + \text{Cu}^{2+} \rightarrow \text{Cu} + \text{Zn}^{2+}$	M2 for products	1
					Ignore state symbols Award 1 for all formulae correct in unbalanced equation	
		ii	M1	(copper is) less reactive (than zinc)/lower (in reactivity series than zinc) /	Accept "copper forms ions less easily" Accept reverse argument for zinc Reject answers that compare reactivity of ions.	1
		iii	M1	(red-)brown/pink solid/ppt/coating( on zinc)	Accept copper in place of colour	1
			M2	solution becomes colourless/ paler		1
	b	i	M1	sacrificial (protection/anode)	Ignore galvanising	1
		ii	M1	zinc is more reactive than iron/steel/hull / higher in reactivity series than iron/steel/hull	Accept reverse argument for iron/steel Accept "they" for zinc blocks	1
			M2	zinc reacts (with air/water) instead of/ before/ in preference to iron/steel/hull /prevents iron from losing electrons/zinc makes $\text{Fe}^{2+}$ gain electrons	reject zinc rusts reject references to a protective coating of zinc or zinc oxide If have zinc sacrificing itself here, can award mark for (i) if not contradictory to (i)	1
		iii	M1	copper less reactive than iron/steel/hull / lower in reactivity series than iron/steel/hull / copper does not react with air/water / copper makes iron corrode more / copper makes iron lose electrons	They = copper blocks Accept converse argument	1

Question		Mark	Acceptable answers	Notes	Total	
9	a	M1	$\text{PCl}_5 + 4\text{H}_2\text{O} \rightarrow \text{H}_3\text{PO}_4 + 5\text{HCl}$	M1 for all four formulae correct	1	
		M2		M2 for balancing	1	
				M2 dependent on M1 Allow multiples and fractions		
	b	M1	(starts) green		1	
		M2	(turns) red/pink	accept orange if only 1 colour given and not clear whether start or end, then do not award mark.	1	
		M3	(becomes) acidic / acid / $\text{H}^+$ (ions) (formed)	Accept $\text{pH} < 7$	1	
	c	i	M1	two atoms linked by shared pair of electrons	Atoms do not have to be labelled H and Cl,	1
			M2	six more electrons in Cl and no more electrons in H	Ignore inner electrons in Cl M2 dependent on M1 do not award M2 if atoms are wrongly identified Accept any suitable symbol(s) for electrons	1
		ii	M1	Shared electrons/ electron pair		1
			M2	attracts/pulls nucleus/nuclei / protons (in nuclei)	ignore neutrons	1
	d		M1	weak forces of attraction		1
			M2	between molecules/intermolecular	Idea of covalent bonds breaking = 0 Intramolecular bonds are covalent therefore breaking them scores 0 Weak intermolecular bonds = 2	1
	e	i	M1	$0.150 \times 12.3/1000$	Ignore units	1
			M2	$0.001845 / 0.00185$	Award max 1 mark wrong conversion or no conversion of volume to $\text{dm}^3$ correct answer alone scores 2	1
		ii	M1	$(0.001845 \times 3 =) 0.005535$	CONSEQ on e(i)/M2	1
		iii	M1	$\frac{0.005535}{0.025}$	CONSEQ on e(ii) Award 1 mark for 0.0002214 (not divided vol by 1000)	1
			M2	0.2214	Final answer must be to 2 or more sig fig Ignore units	1

					Correct final answer scores 2 marks	
					If correct answer of 0.2214 obtained by failing to convert $\text{cm}^3$ to $\text{dm}^3$ correctly in both ei and eiii, then max 1 in both ei and eiii	

Question		Mark	Acceptable answers	Notes	Total
10	a		M1 phosphoric acid / H <sub>3</sub> PO <sub>4</sub>	Ignore dilute / concentrated	1
			M2 high temperature / 250-350 °C / high pressure / 50-100 atmospheres	Ignore heat If range of T or P given, must be fully within accepted range If give both a temperature and a pressure , then do not apply list principle	1
	b	i	M1 3186	Accept 1075	1
		ii	M1 3231	Accept 1120	1
				Ignore units and signs	
		iii	M1 -45	CONSEQ on bi - bii Sign must be shown if negative Note - if (i) correct and (ii) 2883, then conseq answer in (iii) is (+)303.	1
	c		M1 $\begin{array}{c} \text{H H H} \\       \\ \text{H-C-C=C} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$	Accept CH <sub>3</sub> CHCH <sub>2</sub> as minimum	1

Question			Mark	Acceptable answers	Notes	Total
11	a	i	M1	0.1(00)		1
		ii	M1	( $M_r$ of $\text{CuCO}_3$ =) 123.5 / 124		1
			M2	$0.1(00) \times 123.5$ or $124 = 12.35$ or $12.4$		1
					CONSEQ on ai Correct final answer scores 2 marks If final answer wrong, and M1 not awarded, award M2 for showing multiplication of any number by a(i)	
		iii	M1	$0.1(00) \times 24$ / $0.1(00) \times 24000$	CONSEQ on answer to ai	1
			M2	$= 2.4 \text{ (dm}^3\text{)} / = 2400 \text{ cm}^3$	Correct final answer with units scores 2 marks If no units stated assume $\text{dm}^3$	1
	b		M1	(light) blue precipitate	Accept ppt / solid in place of precipitate Reject dark/deep/royal	1
			M2	dark(er) blue solution	Accept deep / royal in place of dark	1
			M3	$[\text{Cu}(\text{NH}_3)_4(\text{H}_2\text{O})_2]^{2+}$	Square brackets not needed $\text{NH}_3$ and $\text{H}_2\text{O}$ can be in reverse order	1

Question		Mark	Acceptable answers	Notes	Total	
12	a	M1	lattice/regular arrangement/array of positive ions	If positive AND negative ions do not award M1	1	
		M2	sea of/delocalised/mobile electrons	Accept free electrons	1	
		M3	electrons move	If ions move then do not award M3	1	
	b	i	M1	steel/iron reacts with chlorine /forms iron chloride /oxidises	ignore references to corrodes /wears away	1
		ii	M1	titanium / Ti		1
	c	i	M1	$100\,000 \times 2 \times 60$		1
			M2	12 000 000	Correct answer alone scores 2 Award 1 mark for answer of 200 000 Ignore units	1
		ii	M1	$\frac{12\,000\,000}{96\,000} = 125$		1
			M2	$\frac{125}{2} = 62.5 / 63$	CONSEQ on answer from ci correct answer scores 2 if fail to convert coulombs to Faradays, can score M2 only (6 000 000)	1

SECTION B TOTAL: 75 MARKS

PAPER TOTAL: 120 MARKS





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