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Mark Scheme (Results)
Summer 2010

IGCSE

IGCSE Science (Double Award) (4437) Paper 5H

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IGCSE SCIENCE DOUBLE AWARD 4437/5H – SUMMER 2010

SECTION A

Question			Mark	Acceptable answers	Notes	Total
1	**a**	**i**	M1	bubbles / fizzing / effervescence / metal disappears floats / moves	Ignore metal dissolves / gas produced	**1**
		ii	M1	flame / explosion		**1**
	b	**i**	M1	lithium hydroxide		**1**
		ii	M1	KOH		**1**
	c		M1	hydrogen / H_2	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^- / hydroxide	Ignore hydroxyl	**1**
		ii	M1	lilac / purple	Ignore qualifiers such as light / dark Reject all other colours	**1**

Question			Mark	Acceptable answers	Notes	Total
2	**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**
	b	**i**	M1	bitumen		**1**
		ii	M1	any one from: refinery gas(es) petroleum gas(es) fuel oil naphtha	ignore liquified	**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**

Question			Mark	Acceptable answers	Notes	Total
3	**a**		M1	2.8.2	Accept other punctuation marks (or none) in place of full stops	**1**
			M2	2.8.7		**1**
	b		M1	electron transfer	All marks can be scored from suitably annotated diagrams	**1**
			M2	from magnesium/Mg to chlorine/Cl		**1**
			M3	Mg loses two electrons and (each) Cl gains one electron	Award 0/3 if any reference to sharing electrons Ignore covalent	**1**
	c				M3 dependent on M2	**1**
			M1	magnesium / Mg		**1**
	d		M2	loss of electrons / increase in oxidation state	Ignore number of electrons M2 independent of M1	**1**
			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	lot of energy needed to overcome attractions / break bonds / separate ions	Do not accept "loosening bonds" Ignore "hard to break"	
					any mention of "intermolecular" or "intramolecular" loses M1 and M2 So "strong intermolecular forces need lots of energy to overcome" scores M3	

SECTION A TOTAL: 30 MARKS

SECTION B

Question			Mark	Acceptable answers	Notes	Total
4	**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 × 0.691) + (65 × 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**

Question			Mark	Acceptable answers	Notes	Total
5	**a**		M1	$MgCO_3 \rightarrow MgO + CO_2$	reagent = 1	**1**
			M2		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	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
6	**a**		M1	bromine (water)	Reject bromide, but mark M2 and M3 as if bromine accept $KMnO_4$	**1**
			M2	(stays) yellow / orange / brown /no change/ no reaction	Reject red Purple if $KMnO_4$	**1**
			M3	(becomes) colourless / decolourised	Ignore clear ignore discoloured Decolourised if acidified $KMnO_4$ brown if neutral $KMnO_4$ green if alkaline $KMnO_4$ if only $KMnO_4$ allow any of above three accept 1,2-dibromopropane (if bromine) or propan(e)-1,2-diol (if $KMnO_4$)	**1**
	b		M1	H CH_3 | | --C--C-- | | H H	M1 for correct structure (ignore continuation bonds)	**1**
			M2		M2 for continuation bonds	**1**
					M2 dependent on M1 Ignore brackets and subscript letters Award 0 marks if double bond shown	
	c		M1	poly(propene) / polypropene / polypropylene		**1**

Question			Mark	Acceptable answers	Notes	Total
7	**a**	**i**	M1	$Zn + CuSO_4 \rightarrow Cu + ZnSO_4$ / $Zn + Cu^{2+} \rightarrow Cu + Zn^{2+}$	M1 for reagents	**1**
			M2		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 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
8	**a**		M1	$PCl_5 + 4H_2O \rightarrow H_3PO_4 + 5HCl$	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 / H^+ (ions) (formed)	Accept 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**
	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**

Question			Mark	Acceptable answers	Notes	Total
9	**a**		M1	$Mg + 2HCl \rightarrow MgCl_2 + H_2$	M1 for all formulae	**1**
			M2		M2 for correct balancing	**1**
	b		M1	rate increased		**1**
			M2	particles have more energy	Accept atoms for Mg, ions for HCl Reject ions for Mg, atoms for HCl, molecules for either	**1**
			M3	particles move faster	M3 alt - more particles have energy greater than activation energy	**1**
			M4	more frequent collisions more collisions per unit time	Must be some indication of frequency or time M4 alt - greater proportion of/more collisions successful	**1**
					If no particles then can not score M2 or M3 If incorrect particle penalise only once in M2 or M3	
	c	**i**	M1	decreases / slows down		**1**
		ii	M1	surface area get less	Any two for 1 mark each	
			M2	acid gets less concentrated / fewer acid particles/H^+ (in given volume)		**2**
			M3	less frequent collisions		
					If neither M1 nor M2 scored, then award 1 mark for either/both reagent being used up/reacted	
		iii	M1	line goes to same final level	Not awarded if gap between horizontal sections of lines	**1**
			M2	line steeper than original		**1**

Question			Mark	Acceptable answers	Notes	Total
10	**a**	**i**	M1	0.1(00)		**1**
		ii	M1	*(M_r* of $CuCO_3$ =) 123.5 / 124		**1**
			M2	0.1(00) × 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) × 24 / 0.1(00) × 24000	CONSEQ on answer to ai	**1**
			M2	= 2.4 (dm^3) / = 2400 cm^3	Correct final answer with units scores 2 marks If no units stated assume 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	$[Cu(NH_3)_4(H_2O)_2]^{2+}$	Square brackets not needed NH_3 and H_2O can be in reverse order	**1**

SECTION B TOTAL: 60 MARKS

PAPER TOTAL: 90 MARKS

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