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Mark Scheme (Results)
November 2010

IGCSE

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

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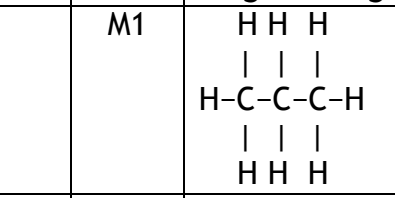
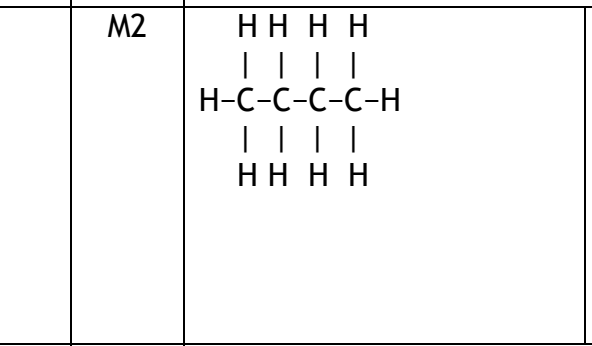
IGCSE CHEMISTRY 4437/5H – NOVEMBER 2010

SECTION A

Question			Mark	Acceptable answers	Notes	Total
1	**a**		M1	350 - 550 °C	Units required	**1**
			M2	100 - 300 (atm(ospheres))	Units not required	**1**
			M3	iron / Fe (catalyst)	Ignore iron oxide Ignore oxidation states	**1**
	b		M1	condensation / liquefaction / gas → liquid		**1**
	c	**i**	M1	$NH_3 + HNO_3 \rightarrow NH_4NO_3$	Reactants = 1 Products = 1 Award 1 if both reactant and product formulae correct but unbalanced	**2**
		ii	M1	fertiliser / explosives		**1**

Question			Mark	Acceptable answers	Notes	Total
2	**a**		M1	copper less reactive than iron / iron more reactive than copper	Do not accept iron(II) in place of iron or copper(II) in place of copper Accept negative (copper is not more reactive than…) Accept iron is a better oxidising agent than copper / copper ions are a better reducing agent that iron ions.	**1**
	b		M1	Copper((II)) / Cu^{2+} /$Cu(H_2O)_6^{2+}$ / hexa aqua copper(II)		**1**
	c		M1	copper / Cu		**1**
	d		M1	iron is formed/ iron displaced by zinc		**1**
	e		M1	zinc / Zn		**1**
	f		M1	green precipitate	Ignore qualifiers such as dark/light/sludge Reject all other colours Accept solid / suspension	**1**
			M2	iron(II) hydroxide / $Fe(OH)_2$	Accept ferrous hydroxide or formula of complex ion	**1**

Question			Mark	Acceptable answers	Notes	Total
3	a	i	M1	alkane		1
		ii	M1	C_nH_{2n+2}	Accept any other symbol in place of "n" n and 2n+2 must be clearly smaller than C and H.	1
		iii	M1	Similar/same chemical properties/ same functional group	Any two for 1 each	2
			M2	gradation in physical properties (or specified physical property – such as "increase in boiling point")		
			M3	neighbouring members (formulae) differ by CH_2		
	c		M1		All bonds/atoms must be shown.	1
	d	i	M1	(compounds with) same molecular formula	Reject atoms/elements/ions	1
			M2	(but) different structures/structural formulae/displayed formulae		1
		ii	M1	butane OR (2-)methylpropane		1
			M2			1
	e		M1 M2	methane + oxygen → carbon dioxide + water/steam	Reactants = 1 Products = 1	2
					If air given in place of oxygen, products mark can still be awarded Award M1 and M2 independently	

Question			Mark	Acceptable answers	Notes	Total
4	**a**	**i**	M1	electron transfer		**1**
			M2	from magnesium to fluorine		**1**
			M3	magnesium loses 2 electrons **and** (each) fluorine gains 1 electron		**1**
					Ignore covalent Electron sharing = 0	
		ii	M1	Mg^{2+}	Accept answers in either order	**1**
			M2	F^-		**1**

SECTION B

Question			Mark	Acceptable answers	Notes	Total
5	**a**		M1 M2	acid rain / kills fish/trees / damages buildings/statues / corrodes specified metal object / leaches minerals from soils	Any 2 for 1 mark each Ignore "kills animals"	**2**
	b	**i**	M1	pure copper / stainless steel		**1**
		ii	M1	copper(II) sulphate	Ignore references to acid	**1**
	c		M1	Electrical wiring Overhead power cables Water pipes Coins (bottom of) saucepans	Accept any other suitable	**1**
			M2	related property: Electrical wiring – electrical conductor/malleable/ductile Overhead power cables - electrical conductor / malleable /ductile Water pipes – unreactive/does not corrode / ductile /malleable coins – does not corrode (bottom of) saucepans – heat conductor/unreactive		**1**
	d	**i**	M1	to burn/react with coke/carbon/C		**1**
			M2	to produce heat / make it hot / increase the temperature		**1**
		ii	M1	limestone/calcium carbonate (thermally) decomposes/breaks down	Accept formula in place of name	**1**
			M2	forms calcium oxide	Accept formula in place of name	**1**
			M3	(calcium oxide) reacts with/neutralises silicon dioxide	Accept formula in place of name	**1**
			M4	forms calcium silicate/slag	Accept formula in place of name	**1**
					$CaCO_3 \rightarrow CaO + CO_2$ scores M1 and M2	
					$CaO + SiO_2 \rightarrow CaSiO_3$ scores M3 and M4	

					$CaCO_3 + SiO_2 \rightarrow CaSiO_3 + CO_2$ scores 1 for slag formula	
		iii	M1	carbon/C oxidised/gains oxygen/increases oxidation number		**1**
			M2	Iron((III)) oxide/Fe_2O_3/ iron in iron oxide / iron(III) reduced/loses oxygen iron in iron oxide / iron(III) decreases oxidation number / gains electrons		**1**
					If neither M1 nor M2 scored, award 1 mark for idea of both oxidation and reduction occurring	

Question			Mark	Acceptable answers	Notes	Total
6	**a**	**i**	M1	same number of electrons in outer energy level/shell	Accept all/both have one electron in outer energy level/shell	**1**
		ii	M1 M2	$2Rb + 2H_2O \rightarrow 2RbOH + H_2$	Formulae = 1 Balancing = 1	**2**
		iii	M1	Flame/ explosion / moves/fizzes faster	Ignore references to colour of flame	**1**
	b		M1	23		**1**
			M2	11		**1**
			M3	48		**1**
	c	**i**	M1	atoms with same atomic number/same number of protons OR atoms of same element	Ignore "same number of electrons" Reject "different numbers of electrons"	**1**
			M2	different mass number / different number of neutrons	If no mention of atoms, then max 1	**1**
		ii	M1	^{87}Rb percentage = 27.8		**1**
			M2	$(0.278 \times 87) + (0.722 \times 85)$	CQ on M1	**1**
			M3	85.6	CQ on M2 Answer must be to 1 dp Correct answer scores 3.	**1**
	d	**i**	M1	Regular arrangement / lattice		**1**
			M2	Positive and negative/oppositely charged ions	Reject atoms or any other particle for M1 and M2	**1**
		ii	M1	**Ions** mobile/(able to) move		**1**

Question			Mark	Acceptable answers	Notes	Total
7	a	i	M1 M2	$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$	Formulae = 1 Balancing = 1 Ignore state symbols	**2**
		ii	M1	carbonic (acid)		**1**
	b		M1	bright/white/dazzling light/flame		**1**
			M2	white solid/smoke/ash	Ignore vapour/gas	**1**
	c	i	M1	$\frac{20 \times 5}{100}$ / answer in range = 1		**1**
			M2	$\frac{M1}{24}$ = 0.04167	Cq Accept 1 sig fig up to calculator value	**1**
					Correct final answer scores 2 marks	
		iii	M1	(i) × 2 = 0.08333	Accept 1 sig fig up to calculator value	**1**
		iv	M1	(iii) × 24		**1**
			M2	2g		**1**

Question			Mark	Acceptable answers	Notes	Total
8	**a**		M1	(crude oil) heated / vaporized	Reject if heated in fractionating tower	
			M2	cooler at top / hotter at bottom / idea of temperature gradient	Accept gases cool as they rise	
			M3	fractions **condense** at different heights/levels		**3**
			M4	fractions have different boiling points/ranges/(molecular) size/mass		
					Any three for 1 each If lab process described, scores M1 only	
	b	**i**	M1	product with alkene formula (≤20 C atoms)		**1**
			M2	second product shown and balances	M2 dep on M1	**1**
		ii	M1	distillation/crude oil produces more long-chain / fewer short-chain hydrocarbons/fractions (than there is demand for)		
			M2	short chains more useful/in greater demand/used as fuels / or converse	accept produces fuels	**2** **1**
	c	**i**	M1	correct repeat unit		
			M2	continuation bonds	DEP on M1	**1**
		ii	M1	chloroethene / vinyl chloride		**1**

			M2	H–C=C–H
				  | |
				  H Cl
						1

Question			Mark	Acceptable answers	Notes	Total
9	a		M1	weak forces / van der Waals' forces / hydrogen bonds	Accept London / dispersion forces	1
			M2	intermolecular / between molecules		1
			M3	need little energy to overcome / break	Accept easily broken	1
					Any reference to ions / breaking covalent bonds / bonds within molecules = 0	
	b		M1	bubbles / fizzing / effervescence		1
	c	i	M1	three shared pairs of electrons	Accept any recognisable symbol for electrons	1
			M2	other electrons correct	DEP on M1	1
					Ignore inner shells	
		ii	M1	covalent		1
	d		M1	Division by A_r N H P O $\frac{28.2}{14} = 2.01$ $\frac{8.1}{1} = 8.1$ $\frac{20.8}{31} = 0.67$ $\frac{42.9}{16} = 2.68$		1
			M2	Simplification of ratio $\frac{2.01}{0.67} = 3$ $\frac{8.1}{0.67} = 12$ $\frac{0.67}{0.67} = 1$ $\frac{2.68}{0.67} = 4$	CQ on (i)	1
			M3	$N_3H_{12}PO_4$	Accept $(NH_4)_3PO_4$ if obtained with some working CQ on M2 – but only if attempt has been made to simplify ratio, can not just use moles from (i)	1

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