

Mark Scheme (Results) November 2010

IGCSE

IGCSE Chemistry (4335) Paper 2H

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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 $\text{NH}_3 + \text{HNO}_3 \rightarrow \text{NH}_4\text{NO}_3$	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 iron) Accept iron is a better oxidising agent than copper / copper ions are a better reducing agent than iron ions.	1
	b	M1	Copper(II) / Cu^{2+} / $\text{Cu}(\text{H}_2\text{O})_6^{2+}$ / 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 / $\text{Fe}(\text{OH})_2$	Accept ferrous hydroxide or formula of complex ion	1

Question			Mark	Acceptable answers	Notes	Total
3	a	i	M1	contain hydrogen and carbon only	Reject hydrogen or carbon molecules/ions	1
		ii	M1	no double bond(s) / only single bonds (between carbon atoms)	Accept no multiple bonds / no C=C	1
	b	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	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	<pre> H H H H-C-C-C-H H H H </pre>	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	<pre> H H H H H-C-C-C-C-H H H H H </pre> OR <pre> H H H H-C-C-C-H H H H-C-H H </pre>		1
	e		M1	methane + oxygen → carbon dioxide + water/steam	Reactants = 1	2

			M2		Products = 1	
					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	M1	(1)	H ₂	Ignore state symbols	1
		M2	(1)	hydrogen		1
		M3	(3)	H ₂ O + CO ₂	Ignore state symbols Accept answers in either order	1
		M4	(3)	water		1
		M5	(3)	carbon dioxide	1	
	b	M1	effervescence / fizzing / bubbles		Ignore "gas formed"	1
	c	M1	white precipitate/solid/suspension			1
		M2	barium sulphate			1

Question		Mark	Acceptable answers		Notes	Total
5	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		
	b	i	M1	carbon / graphite / C		1
			M1	Melt / fused	Ignore dissolved in water	1
		iii	M1	(silvery liquid) lead	if M1 and M2 wrong way round then give 1 mark, but do not award M3	1
			M2	(brown gas) bromine		1
			M3	(silvery liquid) - or cathode AND (brown gas) + or anode		1

SECTION B

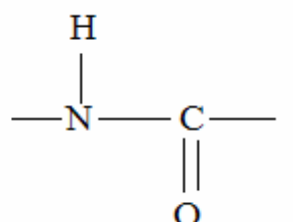
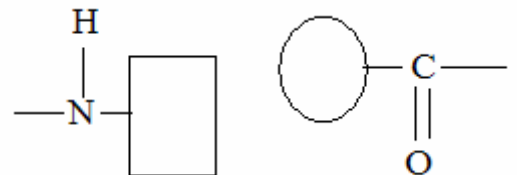
Question		Mark	Acceptable answers	Notes	Total	
6	a		M1	acid rain / kills fish/trees / damages buildings/statues / corrodes specified metal object / leaches minerals from soils	Not corrodes/erodes for buildings/statues Ignore "kills animals" Accepts harms for kills	1
	b	i	M1	(pure) copper / stainless 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 property	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 (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	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
					$\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ scores M1 and M2	
					$\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$ scores M2, M3 and M4	
					$\text{CaCO}_3 + \text{SiO}_2 \rightarrow \text{CaSiO}_3 + \text{CO}_2$	

					scores 1 for slag formula	
		iii	M1	carbon/C oxidised/gains oxygen/increases oxidation number		1
			M2	Iron(III) oxide/Fe ₂ O 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	
7	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	$2\text{Rb} + 2\text{H}_2\text{O} \rightarrow 2\text{RbOH} + \text{H}_2$	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	electrons (can) move/are mobile (throughout structure)	Ignore sea of/delocalised/free electrons Reject ions moving	1		
		ii	M1	atoms/ions in layers/rows		1	
		M2	layers/rows slide/move over each other		1		
				Marks can be awarded for explanation based on non-directional bonding meaning atoms/ions can move without the need to break bonds			

Question			Mark	Acceptable answers	Notes	Total
8	a	i	M1 M2	$\text{MgO} + \text{H}_2\text{O} \rightarrow \text{Mg(OH)}_2$	Mg(OH)_2 formula = 1 Rest correct = 1	2
		ii	M1 M2	$7 < \text{value} \leq 11$ (weakly) alkaline / hydroxide / OH^-	Ignore base	1 1
	b	i	M1 M2	$\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$	Formulae = 1 Balancing = 1 Ignore state symbols	2
		ii	M1	carbonic (acid)		1
		iii	M1	magnesium carbonate / MgCO_3	Accept $\text{Mg(HCO}_3)_2$ or magnesium hydrogencarbonate	1
	c		M1	bright/white/dazzling light/flame		1
			M2	white solid/smoke/ash		1
	d	i	M1	answer in range 20 - 21		1
			M1	$\frac{(\text{i}) \times 5}{100}$ / answer in range 1 - 1.05	CQ on (i)	1
		M2	$\frac{\text{M1}}{24}$ / answer in range 0.04 - 0.044	Cq Accept 1 or more sig fig answer cq on (i)	1	
					Correct final answer scores 2 marks	
		iii	M1	$(\text{ii}) \times 2$ / answer in range 0.08 - 0.088	Accept answer to 1 or more sig figs	1
		iv	M1	$(\text{iii}) \times 24$		1
			M2	answer in range 1.92 - 2.112		1

Question		Mark	Acceptable answers	Notes	Total
9	a	M1	(crude oil) heated / vaporized	Reject if heated in fractionating tower	3
		M2	cooler at top / hotter at bottom / idea of temperature gradient	Accept gases cool as they rise	
		M3	fractions condense at different heights/levels		
		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)		2
M2		short chains more useful/in greater demand/used as fuels / converse			
c	i	M1	correct repeat unit		1
		M2	continuation bonds	DEP on M1	1
	ii	M1	chloroethene / vinyl chloride		1
M2		$\begin{array}{c} \text{H}-\text{C}=\text{C}-\text{H} \\ \quad \\ \text{H} \quad \text{Cl} \end{array}$		1	

	d	i	M1	condensation / polyamide		1
		ii	M1	alternating square and circle with continuation bonds (continuation may be incorrect)	At least one square and one circle needed	1
			M2	correct link between square and circle 	Accept -NHCO- / -HNOC- Ignore continuation section	1
			M3	correct continuation 	Needs to be correct at both ends	1
		iii	M1	hydrogen chloride / HCl	Reject hydrochloric acid	1

Question		Mark	Acceptable answers	Notes	Total											
10	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	6×169		1										
			M2	1014	CQ on M1 only if 169 transcription error or multiplication by 3 instead of 6 Correct answer scores 2 marks, -1014 scores 1	1										
		ii	M1	$944 + (3 \times 151)$		1										
			M2	1397	Ignore sign	1										
					Correct answer scores 2 Max 1 if one error (such as failing to x 3 or incorrect transcription of bond energy) – if miss out one of the bonds, then zero.											
		iii	M1	$(i) - (ii) / -383$	CQ	1										
	d	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	(electrons) attracted to both nuclei	Attraction to both nuclei must be implied	1										
	e		M1	Division by A_r <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">N</td> <td style="text-align: center;">H</td> <td style="text-align: center;">P</td> <td style="text-align: center;">O</td> <td style="text-align: center;">=</td> </tr> <tr> <td style="text-align: center;">$\frac{28.2}{2.68} = 2.01$</td> <td style="text-align: center;">$\frac{8.1}{1} = 8.1$</td> <td style="text-align: center;">$\frac{20.8}{31} = 0.67$</td> <td style="text-align: center;">$\frac{42.9}{16}$</td> <td></td> </tr> </table>	N	H	P	O	=	$\frac{28.2}{2.68} = 2.01$	$\frac{8.1}{1} = 8.1$	$\frac{20.8}{31} = 0.67$	$\frac{42.9}{16}$			1
N				H	P	O	=									
$\frac{28.2}{2.68} = 2.01$	$\frac{8.1}{1} = 8.1$	$\frac{20.8}{31} = 0.67$	$\frac{42.9}{16}$													
		M2	Simplification of ratio <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">$\frac{2.01}{1} = 3$</td> <td style="text-align: center;">$\frac{8.1}{1} = 12$</td> <td style="text-align: center;">$\frac{0.67}{1} = 1$</td> <td style="text-align: center;">$\frac{2.68}{1} = 4$</td> </tr> </table>	$\frac{2.01}{1} = 3$	$\frac{8.1}{1} = 12$	$\frac{0.67}{1} = 1$	$\frac{2.68}{1} = 4$	CQ on (i)	1							
$\frac{2.01}{1} = 3$	$\frac{8.1}{1} = 12$	$\frac{0.67}{1} = 1$	$\frac{2.68}{1} = 4$													

			0.67	0.67	0.67	0.67		
		M3	$\text{N}_3\text{H}_{12}\text{PO}_4$				Accept $(\text{NH}_4)_3\text{PO}_4$ 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

PAPER TOTAL: 120 MARKS

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