



CHEMISTRY

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Paper 3 Theory (Core)

May/June 2017

MARK SCHEME

Maximum Mark: 80

Published

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Question	Answer	Marks
1(a)(i)	A	1
1(a)(ii)	E	1
1(a)(iii)	C	1
1(a)(iv)	B	1
1(a)(v)	C	1
1(b)	number of electrons in $\text{Br}^- = 36$	1
	number of neutrons in $\text{Cl} = 18$	1
	number of protons in $\text{Cl} = 17$ AND number of protons in $\text{Br}^- = 35$	1

Question	Answer	Marks
2(a)(i)	Na^+ / sodium	1
2(a)(ii)	sulfite / sulfate(IV)	1
2(a)(iii)	3 (mg)	1
2(a)(iv)	36.3 (mg)	1
2(a)(v)	calcium hydrogencarbonate	1
2(b)	flame test	1
	yellow	1
2(c)	MgCl_2	1

Question	Answer	Marks
2(d)	negative electrode: calcium / Ca	1
	positive electrode: chlorine / Cl ₂	1

Question	Answer	Marks
3(a)	<p>any 5 of:</p> <p>X has covalent bonding</p> <p>X particles are randomly arranged / irregularly arranged</p> <p>X particles are moving rapidly / freely / randomly / irregularly</p> <p>Y has ionic bonding / ionic</p> <p>Y particles are regularly arranged / lattice / in rows / uniformly arranged</p> <p>Y particles (only) vibrate / do not move from place to place</p> <p>Z has covalent bonding</p> <p>Z particles are regularly arranged / lattice / in a tetrahedral shape</p> <p>Z particles (only) vibrate / do not move from place to place</p>	5
3(b)	volume gets smaller	1
	particles get closer together	1
3(c)	drill tips / drills / cutting (tools)	1
3(d)	A / substance Y dissolves easily in water	1
	C / substance Y melts (at 8015 °C)	1
	the change can be reversed by altering the conditions	1

Question	Answer	Marks
4(a)	has two atoms in a molecule/two atoms combined	1
4(b)(i)	the chlorine has displaced/replaced the bromine (in KBr)	1
4(b)(ii)	(from green / colourless) to orange	1
4(b)(iii)	I ₂	1
	KBr	1
4(c)	add (nitric acid then aqueous) silver nitrate	1
	yellow precipitate	1
4(d)(i)	water purification / water treatment / killing bacteria / in (swimming) pools / disinfectant	1
4(d)(ii)	breaking down of a compound / breaking down of a substance	1
	(using) heat	1
4(d)(iii)	any 2 distinct pollution problems: <ul style="list-style-type: none"> • litter OR eyesore • sticks in gullets OR throats of birds / animals • blocking of drains OR watercourses • animals gets trapped OR tangled (in plastic) • poisonous vapours when burned • fills landfill sites 	2

Question	Answer	Marks
5(a)	circle drawn around the OH group	1
5(b)	20	1
5(c)	C=C double bond	1
5(d)(i)	increases with an increasing number of carbon atoms ORA	1
5(d)(ii)	any value between -88 and 0 ($^{\circ}\text{C}$) (exclusive of these values)	1
5(d)(iii)	there is no (clear) trend / the numbers go down and up	1
5(d)(iv)	liquid	1
	30°C is between melting and boiling point / 30°C is above the melting point and below the boiling point	1
5(d)(v)	substance containing carbon and hydrogen	1
	only / and no other element	1
5(d)(vi)	$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $	1
5(d)(vii)	3 (CO_2)	1
	5 (O_2)	1

Question	Answer	Marks
6(a)(i)	aluminium	
	low density	1
	good electrical conductivity	1
6(a)(ii)	iron is cheap(er)/tungsten is (too) expensive OR iron is strong(er)/tungsten is weaker	1
6(a)(iii)	tungsten because it has a (very) high melting point	1
6(b)	any 2 properties: <ul style="list-style-type: none"> • high melting point / high boiling point • high density • hard / strong • sonorous / rings (when hit) • ions are coloured / compounds are coloured 	2
6(c)	2 (W)	1
	3 (O ₂)	1
6(d)	tungsten < cobalt < iron < magnesium IF full credit is not awarded, allow 1 mark for either a correct sequence apart from a consecutive pair reversed OR for the whole sequence reversed	2
6(e)(i)	the more concentrated the acid, the greater the rate ORA	1
6(e)(ii)	nitric (acid)	1
6(e)(iii)	any value between 19 and 39 hours (exclusive of these values)	1
6(e)(iv)	pH 4	1

Question	Answer	Marks
7(a)	the energy of the reactants is greater than the energy of the products / the product has less energy than the reactants / the arrow is going down (from reactants to product)	1
7(b)	any 2 sources: <ul style="list-style-type: none"> • carbon monoxide from incomplete combustion of fossil fuels / named fossil fuel / named carbon-containing fuel • carbon dioxide from combustion of fossil fuels / respiration • methane from animal flatulence / rice paddy fields / bacteria / decomposition of vegetation / decomposition of animals any 3 effects: <ul style="list-style-type: none"> • carbon dioxide: global warming / greenhouse effect / acidification of oceans • methane: global warming / greenhouse effect • carbon monoxide: poisonous / toxic 	5
7(c)(i)	making mortar / whitewash / neutralising (acidic) soils / neutralising acidic lakes / flue gas desulfurisation / steelmaking / glassmaking / making plaster	1
7(c)(ii)	100 IF full credit is not awarded, allow 1 mark for (Ca =) 40, (C =) 12 and (O =) 16	2
7(d)	add hydrochloric acid to the mixture	1
	filter off the carbon	1
	wash carbon (with water or other solvent) AND dry in an oven / air dry / leave in air / leave to dry	1