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CHEMISTRY **0620/31**

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 Br^- = 36	**1**
	number of neutrons in Cl = 18	**1**
	number of protons in Cl = 17 **AND** number of protons in 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**

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Question	Answer	Marks
2(d)	negative electrode: calcium / Ca	**1**
	positive electrode: chlorine / Cl_2	**1**

Question	Answer	Marks
3(a)	any 5 of: **X** has covalent bonding **X** particles are randomly arranged / irregularly arranged **X** particles are moving rapidly / freely / randomly / irregularly **Y** has ionic bonding / ionic **Y** particles are regularly arranged / lattice / in rows / uniformly arranged **Y** particles (only) vibrate / do not move from place to place **Z** has covalent bonding **Z** particles are regularly arranged / lattice / in a tetrahedral shape **Z** particles (only) vibrate / do not move from place to place	**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**

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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: 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**

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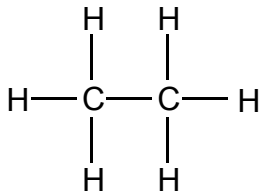
Question	Answer	Marks
5(a)	circle drawn around the OH group	**1**
5(b)	20	**1**
5(c)	C=C double bond	**1**
5(d)(i)	increases with an increasing number of carbon atoms **ORA**	**1**
5(d)(ii)	any value between –88 and 0 (°C) (exclusive of these values)	**1**
5(d)(iii)	there is no (clear) trend / the numbers 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)		**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 weak**er**	**1**
6(a)(iii)	tungsten because it has a (very) high melting point	**1**
6(b)	any 2 properties: 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**

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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: 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: 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**

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