Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/31**

Paper 3 Core Theory **October/November 2017**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Question	Answer	Marks
1(a)(i)	**A**	**1**
1(a)(ii)	**B**	**1**
1(a)(iii)	**D**	**1**
1(a)(iv)	**B**	**1**
1(a)(v)	**C**	**1**
1(b)	substance containing only one type of atom / substance containing atoms (each) with the same number of protons / substance which cannot be broken down further by chemical means	**1**
1(c)	solid	**1**
	–15 °C is below the melting point	**1**

Question	Answer	Marks
2(a)	1.5 (%)	**1**
2(b)	any 3 from: • greater percentage of helium (on Neptune) / more helium on Neptune / less helium on Earth • greater percentage of hydrogen (on Neptune) / more hydrogen on Neptune / no hydrogen on Earth / (very) little hydrogen on Earth • no oxygen on Neptune / little oxygen on Neptune (but Earth has 21% oxygen) • greater percentage of methane (on Neptune) / more methane on Neptune / less methane on Earth / more methane on Neptune • more argon on Earth / less argon on Neptune • no nitrogen on Neptune / little nitrogen on Neptune	**3**
2(c)	labels ‘C’ and ‘H’ in the correct circles and no non-bonding electrons or extra bonding electrons	**1**
	one pair of electrons in each overlap area	**1**

Question	Answer	Marks
2(d)(i)	atoms of the same element with the same number of protons but a different number of neutrons	**1**
2(d)(ii)	number of protons: 1	**1**
	number of neutrons: 2	**1**
2(e)(i)	30 IF full credit is not awarded, allow 1 mark for (C =) 12 and (H =) 1	**2**
2(e)(ii)	anhydrous / white copper(II) sulfate **OR** anhydrous / blue cobalt(II) chloride	**1**
	(anhydrous copper(II) sulfate) turns blue **OR** (anhydrous cobalt(II) chloride) turns pink	**1**

Question	Answer	Marks
3(a)(i)	2 (CO_2)	**1**
	3 (H_2O)	**1**
3(a)(ii)	correct structure showing all of the atoms and all of the bonds including O–H IF full credit is not awarded, allow 1 mark for structure with OH	**2**
3(b)(i)	pH 10	**1**
3(b)(ii)	red / pink	**1**
	to yellow	**1**
3(b)(iii)	sodium carbonate + sulfuric acid → sodium sulfate + carbon dioxide + water IF full credit is not awarded, allow 1 mark for either sodium sulfate **OR** carbon dioxide + water	**2**

Question	Answer	Marks
3(c)	sulfur dioxide	**1**
3(d)(i)	**P**: chromatography paper / filter paper	**1**
	Q: solvent	**1**
3(d)(ii)	chromatography	**1**
3(d)(iii)	**X** drawn on the baseline	**1**

Question	Answer	Marks
4(a)	graphite: conducts	**1**
	potassium: conducts	**1**
4(b)	low boiling point	**1**
4(c)	does not conduct when solid but conducts when molten IF full credit is not awarded, allow 1 mark for conducts when molten	**2**
4(d)	positive electrode (anode): chlorine / Cl_2	**1**
	negative electrode (cathode): zinc / Zn	**1**
4(e)	chlorine is more reactive than iodine	**1**

Question	Answer	Marks
5(a)(i)	2 (C)	**1**
	2 (Cl_2)	**1**
5(a)(ii)	carbon gains oxygen / oxidation number of carbon increases / carbon loses electrons	**1**

Question	Answer	Marks
5(b)	any 2 from: • titanium has a high melting / boiling point **ORA** • titanium has a high density **ORA** • titanium is hard / strong **ORA**	**2**
5(c)(i)	relative reactivity with water: forms bubbles slowly / slower than sodium	**1**
	melting point of potassium: any value between 45–90 (°C) inclusive	**1**
5(c)(ii)	increases down the group / decreases up the group	**1**
5(d)	basic because it is a metal (oxide)	**1**

Question	Answer	Marks
6(a)	any 4 from: • petroleum vaporised / heated • petroleum enters the fractionating column at the bottom • vapours move up the fractionating column • column is hotter at the bottom / cooler at the top • idea of vapours condensing in different parts of the fractionating column • idea of different fractions having different boiling ranges • fractions (condensing) higher up have lower boiling points **ORA**	**4**
6(b)(i)	breaking down / decomposing / splitting hydrocarbons	**1**
	into smaller hydrocarbons / into alkanes and alkenes / by heating / using a high temperature	**1**
6(b)(ii)	hydrogen	**1**
6(c)	covalent	**1**
6(d)	polymer	**1**

Question	Answer	Marks
7(a)	any 3 from: • diffusion • molecules move (from place to place) • (molecules move) randomly • molecules collide • molecules spread out / mix up • (bulk) movement of molecules from areas of where they are at higher concentration to where they are at lower concentration	**3**
7(b)(i)	$C_4H_6O_2Br_2$	**1**
7(b)(ii)	carboxylic acid	**1**
7(c)	average	**1**
	an element	**1**
	an atom	**1**
	12	**1**
7(d)(i)	increasing the concentration of the acid	**1**
	increasing the temperature	**1**
	using magnesium powder / using smaller pieces of magnesium	**1**
7(d)(ii)	4 (HBr)	**1**

Question	Answer	Marks
8(a)(i)	reversible reaction	**1**
8(a)(ii)	speed up the reaction / increase the rate of reaction / speed of reaction faster	**1**

Question	Answer	Marks
8(b)(i)	decreases as the temperature increases **ORA**	**1**
8(b)(ii)	28%	**1**
8(c)	112 (g)	**1**
8(d)	clothing / named clothing / fishing lines	**1**