Cambridge O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

CHEMISTRY **5070/22**

Paper 2 Theory **October/November 2019**

MARK SCHEME

Maximum Mark: 75

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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
1(a)	O / S / Se	**1**
1(b)	Cl	**1**
1(c)	I	**1**
1(d)	Al	**1**
1(e)	N	**1**

Question	Answer	Marks
2(a)	**Any two from:** conducts electricity / conducts heat (1) malleable (1) ductile (1) shiny / lustrous (1)	**2**
2(b)	electronic structure of 2.8.2	**1**
2(c)(i)	magnesium (atom) loses electron(s) (1) bromine (atom or molecule) gains electron (1) two electrons transferred from magnesium (1)	**3**
2(c)(ii)	high melting point / high boiling point (1) **OR** does not conduct electricity when solid / conducts when molten / conducts in aqueous solution (1)	**1**
2(d)	anode: bromine **AND** cathode: hydrogen (1)	**1**

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Question	Answer	Marks
2(e)(i)	$2Br^- + Cl_2 \rightarrow 2Cl^- + Br_2$	**1**
2(e)(ii)	chlorine is more reactive than bromine / bromine is less reactive than chlorine	**1**

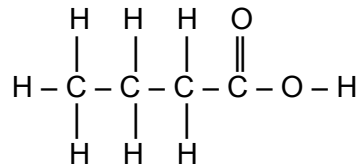
Question	Answer	Marks
3(a)	**Any three from:** • idea that petroleum vaporised / petroleum heated / petroleum at high temperature (1) • idea that petroleum enters near bottom of column (1) • idea that fractional distillation depends on boiling point (1) • larger hydrocarbons have higher boiling point ORA (1) • idea of (long) column (1) • temperatures high at bottom and low at the top / low boiling points at top / high boiling points at bottom (1) • fractions come off at different levels in the column (1)	**3**
3(b)	*kerosene:* (fuel) for aircraft engines / (fuel) for heating / (fuel) for cooking (1) *naphtha:* feedstock for chemical industry (1)	**2**
3(c)(i)	alkane(s)	**1**
3(c)(ii)	C_nH_{2n+2}	**1**
3(d)(i)	incomplete combustion of hydrocarbons / incomplete combustion of named carbon-containing substance / fuels burn in limited oxygen	**1**
3(d)(ii)	toxic / poisonous	**1**

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Question	Answer	Marks
4(a)	measuring the volume of gas (1) at known **time** intervals (1)	**2**
4(b)	rate faster (no mark by itself) greater number of particles exposed (1) increased collision frequency / more collisions per second (1)	**2**
4(c)	rate faster (no mark by itself) particles move faster / particles have more kinetic energy (1) greater number of particles have energy above (or equal to) the activation energy / more successful collisions (1) increased collision frequency / more collisions per second (1)	**3**
4(d)	mol $CO_2 = \frac{16.8}{24\,000}$ **OR** 7×10^{-4} **OR** 0.0007 (1) mass of $CaCO_3 = 7 \times 10^{-4} \times 100 = 0.0700$ (g) (1)	**2**
4(e)	lime water (1) turns milky / turns cloudy (1)	**2**
4(f)	calcium hydroxide alkaline / calcium hydroxide basic (1) neutralises acids / neutralises the soil / raises pH of soil / makes soil less acidic (1)	**2**

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Question	Answer	Marks
5(a)(i)	*melting point of sodium*: values between 70 °C and 170 °C (inclusive) (1) *atomic radius of rubidium:* values between 0.240 nm and 0.320 nm (inclusive) (1)	**2**
5(a)(ii)	there is no trend / the values go up and down	**1**
5(b)(i)	$4Na + O_2^- \rightarrow 2Na_2O$	**1**
5(b)(ii)	basic oxide **AND** because sodium is on the left of the Periodic Table / basic oxide **AND** because sodium is a metal	**1**
5(c)	copper does not form ions as easily as sodium / sodium forms ions more easily than copper	**1**
5(d)	$x = 5$ (2) if 2 marks not scored 1 mark for: molar mass of $NaIO_3 = 198$ (1)	**2**

Question	Answer	Marks
6(a)	correct structure of butanoic acid showing all atoms and all bonds 	**1**
6(b)	*movement*: sliding (over each other) (1) *arrangement:* random / no fixed positions (1)	**2**
6(c)	liquid **AND** 0 °C is above the melting point and below the boiling point / 0°C is between the melting and boiling points	**1**

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Question	Answer	Marks
6(d)	mol butanoic acid = $\frac{5.28}{88}$ **OR** 0.06 mol (1) mol sodium carbonate = $\frac{56}{1000}$ × 0.500 **OR** 0.028 (1) (butanoic acid in excess because sodium carbonate × 2) = 0.056 mol **OR** (butanoic acid in excess because butanoic acid ÷ 2) = 0.03 mol (1)	**3**
6(e)	$Mg + 2C_3H_7COOH \rightarrow (C_3H_7COO)_2Mg + H_2$	**1**
6(f)	use universal indicator / full range indicator (1) match the colour observed with a colour chart (1)	**2**

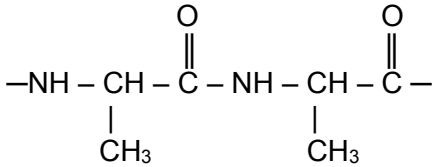
Question	Answer	Marks
7(a)	vanadium(V) oxide	**1**
7(b)(i)	equilibrium moves to the left (1) the (forward) reaction is exothermic / backward reaction endothermic / goes in the direction of the endothermic reaction (1)	**2**
7(b)(ii)	equilibrium moves to the right (1) fewer moles of gas on the right than on the left / more moles of gas on left than the right (1)	**2**
7(c)	product to right of reactants and reactant level above product level (1) enthalpy change shown as downward arrow and labelled (1) activation energy drawn as energy hump above product level and labelled with upward arrow (1)	**3**
7(d)	sulfur / water	**1**

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Question	Answer	Marks
7(e)	(making) detergents / fertilisers / battery acids	**1**

Question	Answer	Marks
8(a)(i)	*electrons*: 15 (1) *neutrons:* 16 (1) *protons:* 15 (1)	**3**
8(a)(ii)	<u>atoms</u> with the same number of protons and different numbers of neutrons / <u>atoms</u> of the same element with different numbers of neutrons	**1**
8(b)	**5**$KClO_3$ + **6**P → **5**KCl + **3**P_2O_5	**1**
8(c)	$H_5P_3O_{10}$	**1**
8(d)	one pair of bonding electrons between the P and each of the three C*l* atoms and 2 non-bonded electrons on P (1) 6 non-bonded electrons on each C*l* (1)	**2**
8(e)	Cu^{2+} / copper ions (1) it gains electrons (1)	**2**

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Question	Answer	Marks
9(a)	complex carbohydrates / starch / polysaccharides	**1**
9(b)	heat / reflux (1) with hydrochloric acid (1)	**2**
9(c)	minimum of two correct repeat units with amide link and extension bonds (2)  If 2 marks not scored 1 mark for continuation bonds and one amide link (1)	**2**
9(d)	ester (linkage) (1) OH and COOH / alcohol and carboxylic acid (1)	**2**
9(e)(i)	ink will run / ink will undergo chromatography / pencil will not run / pencil will not move during chromatography / ink will separate / pencil will not separate	**1**
9(e)(ii)	to make the spots visible / coloured	**1**
9(e)(iii)	0.71	**1**

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