Cambridge O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

CHEMISTRY **5070/21**

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.

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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)	P	**1**
1(b)	Fe	**1**
1(c)	Fe	**1**
1(d)	Mg	**1**
1(e)	C	**1**

Question	Answer	Marks
2(a)	**Any two from** • low melting point / low boiling point (1) • low density (1) • soft (1)	**2**
2(b)	drawing of electronic structure of 2.8.1	**1**
2(c)	$\text{mol}\,H_2 = \frac{300}{24\,000}$ **OR** 0.0125 (1) moles sodium 2×0.0125 **OR** 0.025 (1) mass of sodium = 0.575 g (1)	**3**
2(d)	sodium (atom) loses electron(s) (1) oxygen (atom or molecule) gains electron(s) (1) two electrons gained by oxygen (atom) (1)	**3**
2(e)(i)	high melting point / high boiling point / does not conduct electricity when solid / does conduct electricity when molten / does conduct electricity when in aqueous solution	**1**

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Question	Answer	Marks
2(e)(ii)	*anode:* chlorine **AND** *cathode:* hydrogen	**1**
2(e)(iii)	(add nitric acid) then (aqueous) silver nitrate (1) white precipitate (1)	**2**

Question	Answer	Marks
3(a)	**Any three from:** • (property on which distillation) depends is the boiling point / copper(II) sulfate has higher boiling point than water / ORA (1) • idea of distillation apparatus, e.g. flask connected to condenser (1) • flask or solution heated (1) • idea that only water vaporised (when flask heated) (1) • water vapour converted to (liquid) water (in condenser) (1)	**3**
3(b)	filtration	**1**
3(c)	$\begin{array}{ccc} \text{Cu} & \text{Cs} & \text{Cl} \\ \underline{21.09} & \underline{43.82} & \underline{35.09} \\ 64 & 133 & 35.5 \end{array}$ **OR** Cu = 0.33 Cs = 0.33 Cl = 0.99 (1) $CuCsCl_3$ (1)	**2**

Question	Answer	Marks
4(a)	**Any three from:** Use a titration method (1) with suitable named alkali, e.g. (aqueous) sodium hydroxide (1) use a known concentration of the alkali (1) add indicator to the acid / add indicator to the titration flask (1) use a known volume of acid (1) record volume of alkali added when indicator changes colour (1)	**3**
4(b)(i)	1.38 mol / dm^3	**1**
4(b)(ii)	**A** (1) gradient of graph is greatest / slope of graph is greatest (1)	**2**
4(c)	rate decreased (no mark by itself) particles move slower / particles have less kinetic energy (1) fewer particles have energy above (or equal to) the activation energy / fewer successful collisions (1) decreased collision frequency / fewer collisions per second (1)	**3**
4(d)	turns it red	**1**
4(e)	lead chloride / silver chloride	**1**
4(f)	CFCs destroy ozone / deplete ozone (1) more (harmful) uv will get to the Earth's surface / more skin cancer / more eye cataracts	**2**

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Question	Answer	Marks
5(a)(i)	*boiling point of bromine:* values between –10 and 150 °C (inclusive) (1) *density of liquid chlorine:* values between 1 and 3 (inclusive) (1)	**2**
5(a)(ii)	black / grey-black / purple-grey / purple-black	**1**
5(b)	kills bacteria / disinfects the water	**1**
5(c)(i)	$Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$	**1**
5(c)(ii)	chlorine is more reactive than iodine / chlorine is a stronger oxidising agent than iodine / ORA	**1**
5(d)	molar mass of $NiCl_2$ = 130 (1) x = 6 (1)	**2**

Question	Answer	Marks
6(a)	acid does not ionise completely / acid only partially dissociated / acid not fully dissociated	**1**
6(b)	*arrangement:* regular / lattice (1) *movement:* (only) vibrating / not moving from place to place (1)	**2**
6(c)	gas because 130 °C is above the boiling point	**1**

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Question	Answer	Marks
6(d)	mol sodium carbonate $= \frac{3.18}{106}$ **OR** 0.03 mol (1) mol ethanoic acid $= \frac{224}{1000} \times 0.250$ **OR** 0.056 (1) sodium carbonate in excess because $0.03 \times 2 = 0.06$ **OR** sodium carbonate in excess because $0.056 \div 2 = 0.028$ (1)	**3**
6(e)	$Ca + 2CH_3COOH \rightarrow (CH_3COO)_2Ca + H_2$	**1**
6(f)(i)	butyl ethanoate	**1**
6(f)(ii)	$CH_3COOC_4H_9$	**1**

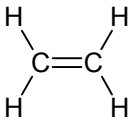
Question	Answer	Marks
7(a)(i)	equilibrium moves to the right (1) (forward) reaction is exothermic (1)	**2**
7(a)(ii)	equal number of moles of gas on each side of equation	**1**
7(b)(i)	products to right of reactants and reactant level below product level (1) enthalpy change shown as upward arrow and labelled (1) activation energy drawn as energy hump above product level and labelled with upward arrow (1)	**3**
7(b)(ii)	**2** $Fe(OH)_3$ + **3** $H_2S \rightarrow Fe_2S_3$ + **6** H_2O	**1**
7(c)(i)	sulfur (in fuel) burns to form sulfur dioxide (1) sulfur dioxide reacts with rainwater / water in atmosphere to form (sulfurous) acid (1)	**2**

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Question	Answer	Marks
7(c)(ii)	corrodes buildings (made of carbonate rocks) / reacts with buildings (made of carbonate rocks) / corrodes mortar / reacts with mortar	**1**

Question	Answer	Marks
8(a)	*electrons*: 14 (1) *neutrons:* 16 (1) *protons:* 14 (1)	**3**
8(b)	$3Si + 2N_2 \rightarrow Si_3N_4$	**1**
8(c)(i)	**Any two from:** both have covalent bonds / covalent (lattice) (1) both have giant structures (1) tetrahedral arrangement of structure (1)	**2**
8(c)(ii)	many strong bonds / strong bonding throughout the structure (1) needs a high temperature to break (all) the bonds / needs a lot of energy to break (all) the bonds (1)	**2**
8(d)	$SiO_2C_4H_{12}$	**1**
8(e)	pair of shared electrons between each of the 4 C*l* atoms and central Si **AND** 6 non-bonding electrons around each chlorine	**1**

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Question	Answer	Marks
9(a)	reaction in which molecules combine and small molecule is formed	**1**
9(b)(i)	circle drawn around one of the COO linkage	**1**
9(b)(ii)	HOOC-□-COOH (1) HO-■-OH (1)	**2**
9(b)(iii)	clothing / fabrics	**1**
9(c)	amide link can form between NH_2 and COOH (1) ester link can form between OH and COOH (1)	**2**
9(d)(i)		**1**
9(d)(ii)	cannot be broken down (by organisms) / cannot be broken by biological means / cannot be decomposed (by bacteria) / cannot be decayed (by fungi)	**1**
9(d)(iii)	gets stuck in gullets of birds / gets stuck in gills of fish / blocks drains / litter / burning causes toxic gases to be emitted / burning causes greenhouse gas emissions	**1**

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