Cambridge Assessment International Education
Cambridge Ordinary Level

CHEMISTRY **5070/21**

Paper 2 Theory **May/June 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 May/June 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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.

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.

Question	Answer	Marks
1(a)	$^{39}_{20}$**Ca** (1)	**1**
1(b)	$^{35}_{17}$**Cl** (1)	**1**
1(c)	$^{37}_{17}$**Cl**$^{-}$ (1)	**1**
1(d)	$^{20}_{10}$**Ne** (1)	**1**
1(e)	$^{64}_{29}$**Cu** (1)	**1**

Question	Answer	Marks
2(a)	all have 2 electrons in their outer shell (1)	**1**
2(b)	atomic radius is always increasing / the melting point goes up and down (1)	**1**
2(c)(i)	2.8 (1)	**1**
2(c)(ii)	negative electrode: $Mg^{2+} + 2e^{-} \rightarrow Mg$ (1) positive electrode: $2Cl^{-} \rightarrow Cl_2 + 2e^{-}$ (1)	**2**
2(d)	Cu^{2+} because it gains electrons (1)	**1**
2(e)	magnesium oxide and hydrogen (1)	**1**
2(f)	$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$ (1)	**1**

Question	Answer	Marks
2(g)	use hydrochloric acid (1) use **excess** magnesium (1) filter (off magnesium) (1) leave filtrate in warm place / evaporate solution to point of crystallisation then leave (1)	**4**

Question	Answer	Marks
3(a)	high melting point / high boiling point / high density / (good) conductor of electricity / (good) conductor of heat / malleable / ductile / hard / strong / sonorous (1)	**1**
3(b)	coloured / variable oxidation state / catalyst (1)	**1**
3(c)	idea that there are atoms or ions of different size in steel (1) in steel the layers (of atoms, ions or particles) cannot move as easily (1)	**2**
3(d)	process 1 – correct use of 20% in calculation e.g. need to make 200 g of molybdenum (1) process 2 – moles of molybdenum needed = 200 / 96 **OR** 2.083 process 3 – mass of MoO_3 = (moles of Mo $\times$ 144) = 300 (g)	**3**

Question	Answer	Marks
4(a)	78%	**1**
4(b)	**Any three from:** fractional distillation (1) (liquid) air heated / (liquid) air vapourised (1) idea that different components have different boiling points (1) (gases with) lowest boiling point come off at the top / highest boiling point at the bottom / gases come off at different levels (in the column) (1)	**3**
4(c)	used to **make** fertilisers / used to **make** ammonia (1)	**1**
4(d)(i)	sulfur dioxide / nitrogen dioxide (1)	**1**
4(d)(ii)	global warming / ice-caps melting / sea-level rising (1)	**1**
4(d)(iii)	incomplete combustion of carbon (-containing compounds) / incomplete combustion of hydrocarbons (1)	**1**

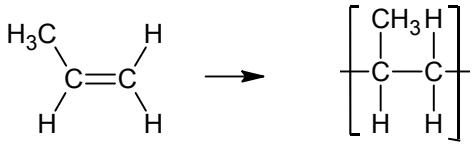
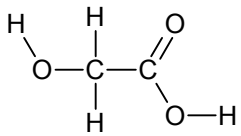
Question	Answer	Marks
5(a)	<table><tr><td>element</td><td>C</td><td>H</td><td>O</td></tr><tr><td>mass in g</td><td>1.68</td><td>0.14</td><td>**4.48**</td></tr><tr><td>moles</td><td>**0.14**</td><td>**0.14**</td><td>**0.28**</td></tr><tr><td>simplest mole ratio</td><td>**1**</td><td>**1**</td><td>**2**</td></tr></table> mass of oxygen / 4.48 (1) moles / mole ratio (1) empirical formula CHO_2 (1)	**3**
5(b)	moles of KOH = 0.0127 x 0.150 **OR** 0.001905 (1) mole of **U** = 0.5 × moles of KOH **OR** 0.001905 × 0.5 **OR** 0.0009525 (1) M_r = (0.086 / 0.0009525) =90.3 / 90 (1)	**3**
5(c)	$C_2H_2O_4$ (1)	**1**

Question	Answer	Marks
6(a)	in aqueous solution contains hydrogen ions	**1**
6(b)	acid that does not dissocate completely / partial ionisation in water / little dissociation (1)	**1**
6(c)	match the colour obtained with a colour chart (1)	**1**
6(d)	reducing acidity of soil / removing acidic gases from power station chimneys / flue gas desulfurisation (1)	**1**
6(e)	bond breaking is endothermic **and** bond making is exothermic (1) more energy released than absorbed (1)	**2**

Question	Answer	Marks
7(a)	solid disappears / ammonium carbonate disappears / nothing left in tube (1)	**1**
7(b)	moles of ammonium carbonate = 4.80 / 96 **OR** 0.05(00) (1) moles of gas = 3 × 0.05 **OR** 0.15 (1) volume of gas = (0.15 × 24) = 3.6 dm^3 **OR** 3600 cm^3 (1)	**3**
7(c)	heat or warm with (aqueous) sodium hydroxide (1) gas that turns (moist red) litmus blue (1)	**2**
7(d)	$CO_3^{2-}(aq) + 2H^+(aq) \rightarrow CO_2(g) + H_2O(l)$ correct formulae (1) correct state symbols – dependent on correct formulae (1)	**2**
7(e)	in solid ions cannot move (1) in aqueous solution ions can move (1)	**2**

Question	Answer	Marks
8(a)	when a reversible reaction (in a closed system) (1) (reaches a point that the) rate of forward reaction equals the rate of the backward reaction (1)	**2**
8(b)	more PCl_5 / concentration of PCl_5 increases / less PCl_3 / less Cl_2 / concentration of Cl_2 decreases / concentration of PCl_3 decrease (1) there are fewer moles of gas on the left hand side of the reaction (1)	**2**
8(c)(i)	the reaction absorbs heat / the (forward) reaction is endothermic (1)	**1**

Question	Answer	Marks
8(c)(ii)	particles have more **kinetic** energy / particles moving faster (1) more successful collisions / more energetic collisions / more effective collisions / more particles with equal or above activation energy (1)	**2**
8(d)	outer shell of phosphorus is correct (3 bond pairs with chlorine and 2 non-bonding electrons) (1) rest of outer shells of all three chlorine atoms correct (1)	**2**
8(e)	$PCl_5 + 4H_2O \rightarrow H_3PO_4 + 5HCl$	**1**

Question	Answer	Marks
9(a)	 correct repeat unit (1) open bonds (1)	**2**
9(b)	$2CH_2 + 3O_2 \rightarrow 2CO_2 + 2H_2O$ correct formulae (1) balancing – dependent on correct formulae (1)	**2**
9(c)(i)	will rot away / will not leave litter / no need to use land-fill sites (1)	**1**
9(c)(ii)		**1**

Question	Answer	Marks
9(d)	idea of motion changing from vibration to (particles) sliding over each other (1) idea of (particles) changing from ordered to disordered / regularly arranged to irregularly arranged(1)	**2**
9(e)	sand is a giant molecule / giant covalent / macromolecule (1) has many strong bonds (that have to be broken or overcome) / needs lots of energy to break or overcome the many bonds / difficult to break the many bonds (1)	**2**

Question	Answer	Marks
10(a)	contains only hydrogen and carbon (1)	**1**
10(b)	same molecular formula but different structures (1)	**1**
10(c)	test: (aqueous) bromine (1) cyclobutane: stays orange / no change (1) butene: goes colourless (1)	**3**
10(d)	M_r = 56 (1) % = 85.7 / 86 (1)	**2**
10(e)(i)	ethanol / CH_3CH_2OH / C_2H_5OH (1)	**1**
10(e)(ii)	steam (1)	**1**
10(e)(iii)	(acidified) potassium manganate(VII) (1)	**1**