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Cambridge O Level

Chemistry

5070/21

(May/June 2018)

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Cambridge O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

CHEMISTRY **5070/21**

Paper 2 Theory **May/June 2018**

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 2018 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

PUBLISHED

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:

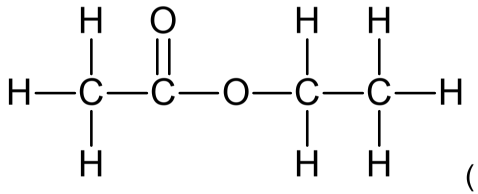
Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

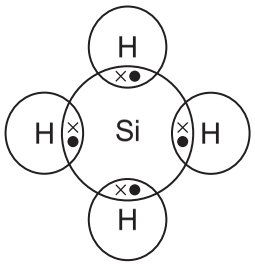
GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely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

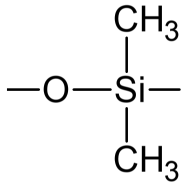
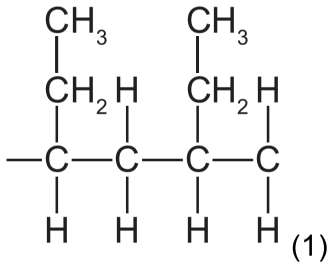
Question	Answer	Marks
1(a)	hydrogen (1)	**1**
1(b)	sulfur dioxide (1)	**1**
1(c)	ethane (1)	**1**
1(d)	methane (1)	**1**
1(e)	ozone (1)	**1**
1(f)	carbon monoxide (1)	**1**

Question	Answer	Marks
2(a)	all have 7 electrons in their outer shell (1)	**1**
2(b)(i)	(colourless) to brown (solution) (1)	**1**
2(b)(ii)	iodide (ion) loses electrons (1)	**1**
2(b)(iii)	chlorine (molecule) gains electrons (1)	**1**
2(c)	test – (moist red or blue) litmus paper (1) observation – bleached / goes white (1)	**2**
2(d)(i)	rate increases particles are more crowded / more particles in the same volume / increased number of particles per unit volume (1) more collisions per second / increased collision frequency (1)	**2**
2(d)(ii)	alternative reaction pathway (1) has lower activation energy (1)	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(a)(i)</td><td>mix (solutions) together AND then filter (1)
wash the residue (with distilled water or solvent) (1)
place residue in warm place (to dry) / place in oven (to dry) / use of filter paper (to dry) / leave (to dry) on the windowsill (1)</td><td>3</td></tr>
<tr><td>3(a)(ii)</td><td>$Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$
formulae and balancing correct (1)
correct state symbols – dependent on correct formulae (1)</td><td>2</td></tr>
<tr><td>3(b)</td><td>moles of hydrochloric acid = 6×10^{-2} / 0.06 (1)
(moles of barium chloride = moles of $HCl \div 2$) = 3×10^{-2} / 0.03 (1)
(mass of barium chloride = moles $\times$ 208 $\times$ 0.75) = 4.68 (1)</td><td>3</td></tr>
<tr><td>3(c)</td><td>
<table>
<tr><th>subatomic particles</th><th>number of subatomic particles</th><th></th></tr>
<tr><td>electrons</td><td>54</td><td>(1)</td></tr>
<tr><td>neutrons</td><td>82</td><td>(1)</td></tr>
<tr><td>protons</td><td>56</td><td>(1)</td></tr>
</table>
</td><td>3</td></tr>
</table>

Question	Answer	Marks
4(a)	use of glucose **AND** yeast (1) any **TWO** correct conditions from – aqueous conditions / temperature between 10 and 45 °C / absence of oxygen / any pH between 6 to 8 (1) (fractionally) distil reaction mixture (to get ethanol) (1)	**3**
4(b)	$CH_3CH_2OH + O_2 \rightarrow CH_3COOH + H_2O$ (1)	**1**
4(c)	 (1)	**1**
4(d)	(moles of CO_2 = 0.01 so) moles of C_2H_5OH = 0.005 (1) energy released = (moles of $C_2H_5OH \times 1350$) = 6.75 (1)	**2**

Question	Answer	Marks
5(a)	moles of SiO_2 = 5 / percentage of Si in SiO_2 = 46.67 (1) mass of Si (= moles of $SiO_2 \times 28$) = 140 (1)	**2**
5(b)	**Any two from:** high melting point / high boiling point (1) poor conductor of electricity (1) does not dissolve (in water) (1) (very) hard (1)	**2**
5(c)(i)	correct 'dot-and-cross' diagram for silane (1) 	**1**
5(c)(ii)	has a simple (molecular or covalent) structure (1) weak intermolecular forces / van der Waals' forces between molecules / easy to overcome the forces between molecules / weak forces between molecules / easy to break attraction between molecules (1)	**2**
5(d)(i)	monomers react together / monomers combine / monomers join / monomers link (1) form a polymer and another molecule (1)	**2**

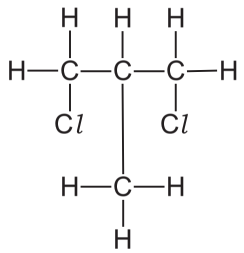
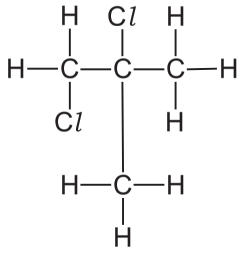
Question	Answer	Marks
5(d)(ii)	 (1)	**1**
5(e)	 (1)	**1**

Question	Answer	Marks
6(a)	M_r = 184 (1) (% copper = 34.8 so mass of copper = % × 20) = 6.96 (1)	**2**
6(b)	$2CuFeS_2 + 6½O_2 \rightarrow 2CuO + Fe_2O_3 + 4SO_2$ correct formulae (1) balancing – dependent on correct formulae (1)	**2**
6(c)	$2CuO + C \rightarrow 2Cu + CO_2$ **OR** $CuO + C \rightarrow Cu + CO$ (1)	**1**
6(d)(i)	(aqueous) copper(II) sulfate (1)	**1**

Question	Answer	Marks
6(d)(ii)	anode – impure copper (1) cathode – (pure) copper (1)	2
6(d)(iii)	anode: $Cu \rightarrow Cu^{2+} + 2e^{-}$ (1) cathode: $Cu^{2+} + 2e^{-} \rightarrow Cu$ (1)	2

Question	Answer	Marks
7(a)	rate of forward reaction = rate of backward reaction (1)	1
7(b)	(composition) does not change (1) same number of moles of gas on left hand side and right hand side (1)	2
7(c)(i)	exothermic / enthalpy change is negative (1)	1
7(c)(ii)	rate increases because particles have more energy / particles moving faster / more successful collisions / more energetic collisions (1)	1
7(d)(i)	water (1)	1
7(d)(ii)	$Fe_3O_4 + 4H_2SO_4 \rightarrow Fe_2(SO_4)_3 + FeSO_4 + 4H_2O$ correct formulae (1) balanced equation – dependent on correct formulae (1)	2
7(d)(iii)	test – add (aqueous) sodium hydroxide / (aqueous) ammonia (1) observation – brown ppt / brown solid (1)	2

Question	Answer	Marks
8(a)	CH_4SO_3 (1)	**1**
8(b)	methanesulfonic acid is more dissociated (1)	**1**
8(c)	acids contain H^+ (1) alkalis contain OH^- (1)	**2**
8(d)	moles of acid = 0.0225 / 0.15 × 0.150 (1) M_r of acid = 96 (1) mass of acid (= moles of acid × M_r) = 2.16 (1)	**3**
8(e)	8.57 (cm^3) (1)	**1**
8(f)(i)	hydrogen (1)	**1**
8(f)(ii)	$Mg(CH_3SO_3)_2$ (1)	**1**

Question	Answer	Marks
9(a)(i)	$C_4H_8Cl_2$ (1) Structure showing all atoms and all of the bonds of a compound having two chlorine atoms substituted and based on methylpropane skeleton e.g.   (1)	**2**

Question	Answer	Marks
9(a)(ii)	molecular formula is $C_4H_7Cl_3$ (2) If two marks not scored: 1 mark for mole ratio C : H : Cl is 2.475 : 4.30 : 1.856 **OR** 1 mark for C = 29.7 / 12, H = 4.3 / 1 and Cl = 65.9 / 35.5	**2**
9(a)(iii)	$C_4H_5Cl_5$ (1)	**1**
9(b)(i)	same molecular formula but different structures / same molecular formula but different arrangement of atoms (1)	**1**
9(b)(ii)	(compounds) containing only hydrogen and carbon (1)	**1**
9(b)(iii)	unsaturated contains a carbon-carbon double bond / saturated does not contain carbon-carbon double bond (1)	**1**
9(b)(iv)	add (aqueous) bromine (1) unsaturated goes colourless and saturated stays orange (1)	**2**