Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CHEMISTRY **5070/21**

Paper 2 Theory **May/June 2017**

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.

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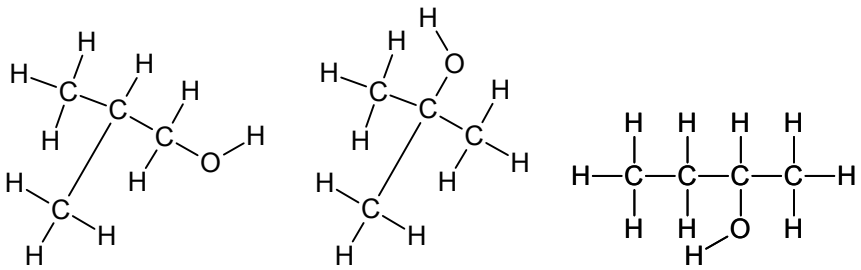
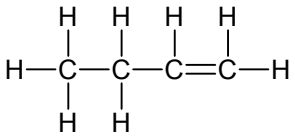
Question	Answer	Total
A1(a)	Silicon dioxide	**1**
A1(b)	Zinc oxide	**1**
A1(c)	Sulfur trioxide	**1**
A1(d)	Sodium oxide	**1**

Question	Answer	Total
A2(a)	<table><tr><th>sub-atomic particle</th><th>relative electric charge</th><th>relative mass</th></tr><tr><td>electron</td><td>–1</td><td>0 / 0.0005</td></tr><tr><td>neutron</td><td>0</td><td>1</td></tr><tr><td>proton</td><td>+1</td><td>1</td></tr></table> All four correct (3) Three correct (2) Two correct (1) One correct (0)	**3**
A2(b)(i)	85	**1**
A2(b)(ii)	Has more electrons than protons	**1**
A2(b)(iii)	**C** and **E** (1) Same number of protons but different number of neutrons (1)	**2**

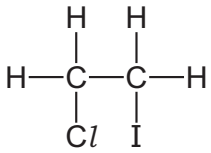
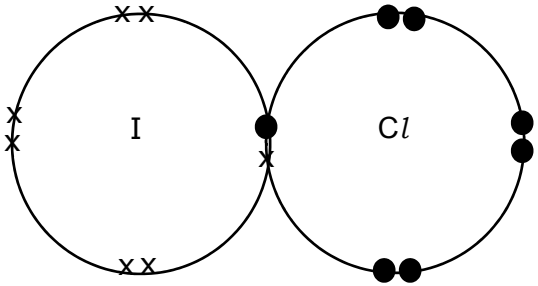
Question	Answer	Total
A3(a)	$H^+ + OH^- \rightarrow H_2O$ (1)	**1**
A3(b)(i)	Sulfuric acid **AND** sodium hydroxide	**1**
A3(b)(ii)	Place alkali in flask and acid in burette (1) Add acid to alkali until indicator shows it is neutralised (1) Repeat using same volumes but no indicator (1)	**3**
A3(b)(iii)	Evaporate solution and allow to crystallise / (concentrate) by heating the solution until the first signs of crystallisation / heat to crystallisation point (1) (Filter) wash with organic solvent / dry with filter paper / leave or dry in an oven (1)	**2**
A3(c)(i)	Moles = 0.020×0.550 **OR** 0.011 (1) Mass = 2.563 (1)	**2**
A3(c)(ii)	Percentage yield = 74.91	**1**

Question	Answer	Total
A4(a)	Calcium ion is 2.8.8 (1) Chloride ion is 2.8.8 (1)	**2**
A4(b)	Negative electrode: $Ca^{2+} + 2e^- \rightarrow Ca$ (1) Positive electrode: $2Cl^- \rightarrow Cl_2 + 2e^-$ (1)	**2**
A4(c)	Hydrogen / H_2 **AND** chlorine / Cl_2	**1**
A4(d)	Ionic bonds / attraction between positive ions and negative ions (1) Idea of having many (strong) bonds – this mark is dependent on the correct bonding (1)	**2**

Question	Answer	Total
A5(a)	Reaction with steam (1) In presence of a catalyst (1)	**2**
A5(b)(i)	Solvent / making vinegar	**1**
A5(b)(ii)	$C_2H_5OH + O_2 \rightarrow 2C + 3H_2O$ **OR** $C_2H_5OH + 2O_2 \rightarrow 2CO + 3H_2O$ Correct products (1) Balancing (1)	**2**
A5(c)	(Acidified) potassium manganate(VII) / oxygen	**1**
A5(d)	**ANY ONE FROM** 	**1**
A5(e)		**1**
A5(f)(i)	Addition	**1**
A5(f)(ii)	Do not decay / do not decompose naturally / not attacked by bacteria or microbes	**1**

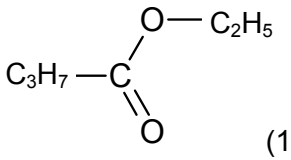
Question	Answer	Total
A6(a)	Axes – energy / enthalpy on vertical axis **AND** progress of reaction / course of reaction on horizontal axis (1) Reactant and product including the relative position of lines – reactant level below products **AND** reactant and product labelled (1) Enthalpy change – shown by upward arrow **AND** labelled enthalpy change or ΔH (1)	**3**
A6(b)(i)	Biological catalyst	**1**
A6(b)(ii)	Speeds up a reaction / lowers activation energy	**1**
A6(c)	Particles have more kinetic energy / particles moving faster (1) More successful collisions / more fruitful collisions / more energetic collisions / more particles with energy equal to or above activation energy(1)	**2**

Question	Answer	Total
B7(a)	Blue solution / brown gas / gas bubbles / metal disappears	**1**
B7(b)(i)	Copper(II) nitrate	**1**
B7(b)(ii)	Copper loses electron(s)	**1**
B7(c)	Moles of acid = 0.025 × 16 **OR** 0.4 (1) Moles of NO_2 = 0.2 (1) Volume of NO_2 = 4.8 dm^3 / 4800 cm^3 (1)	**3**
B7(d)	$2Cu(NO_3)_2 \rightarrow 2CuO + 4NO_2 + O_2$	**1**
B7(e)(i)	Blue precipitate / blue solid (1) In excess becomes a dark blue solution (1)	**2**
B7(e)(ii)	Blue precipitate / blue solid (which does not redissolve)	**1**

Question	Answer	Total
B8(a)	$2Na + IC\mathit{l} \rightarrow NaC\mathit{l} + NaI$	**1**
B8(b)		**1**
B8(c)	substitution (1) $C_2H_6 + IC\mathit{l} \rightarrow C_2H_5C\mathit{l} + HI$ **OR** $C_2H_6 + IC\mathit{l} \rightarrow C_2H_5I + HC\mathit{l}$ (1)	**2**
B8(d)	Correct 'dot-and-cross' diagram 	**1**

Question	Answer	Total
B8(e)(i)	Reversible reaction (1) Rate of forward reaction is the same as rate of backward reaction (1) So that the concentrations of reactants and products do not change (1)	**3**
B8(e)(ii)	The colour becomes less brown / colour becomes more yellow (1) Fewer moles on right hand side so position of equilibrium moves to the right / fewer moles on product side so position of equilibrium moves to the right (1)	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Total</th></tr>
<tr><td>B9(a)</td><td>Light bulb / steel manufacture</td><td>1</td></tr>
<tr><td>B9(b)</td><td>Exists as atoms (and not molecules)</td><td>1</td></tr>
<tr><td>B9(c)</td><td>Atoms do not need to gain or lose electrons / has a stable electronic arrangement</td><td>1</td></tr>
<tr><td>B9(d)(i)</td><td>
<table>
<tr><td>element</td><td>xenon</td><td>oxygen</td><td>fluorine</td></tr>
<tr><td>mass</td><td>0.549 g</td><td>0.134 g</td><td>0.317 g</td></tr>
<tr><td>moles</td><td>0.00419</td><td>0.008375</td><td>0.0167</td></tr>
<tr><td>Mole ratio</td><td>1</td><td>2</td><td>4</td></tr>
</table>
Correct moles (1)
XeO_2F_4 (1)
</td><td>2</td></tr>
<tr><td>B9(d)(ii)</td><td>Relative molecular mass / relative formula mass / molar mass</td><td>1</td></tr>
<tr><td>B9(e)</td><td>Use liquid mixture / liquefy the mixture (1)
Heat or boil the mixture (and collect fractions) (1)
Idea that each fraction or gas has a different boiling point (1)</td><td>3</td></tr>
<tr><td>B9(f)</td><td>Each gas has a different relative atomic mass / atoms or molecules have different masses</td><td>1</td></tr>
</table>

Question	Answer	Total
B10(a)(i)	$C_nH_{2n+1}COOH$ / $C_nH_{2n}O_2$	**1**
B10(a)(ii)	**ANY TWO FROM:** Same functional group (1) Idea that each member varies by a CH_2 group (1) Same or similar chemical properties (1) Physical properties change with a trend (1)	**2**
B10(b)(i)	An acid that partially ionises / partially dissociates	**1**
B10(b)(ii)	$MgCO_3 + 2CH_3CH_2CO_2H \rightarrow Mg(CH_3CH_2CO_2)_2 + CO_2 + H_2O$	**1**
B10(c)	Ethyl butanoate (1)  (1)	**2**
B10(d)	(Molecules) move faster / have more kinetic energy (as temperature increases) (1) (Molecules) are further apart (as temperature increases) (1) (Molecules) are arranged more randomly / more irregularity (as temperature increases) (1)	**3**