Cambridge Assessment International Education

Cambridge O Level

CHEMISTRY **5070/21**

Paper 2 Theory **May/June 2020**

MARK SCHEME

Maximum Mark: 75

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

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

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level 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.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.

5 ‘List rule’ guidance

For questions that require ***n*** responses (e.g. State **two** reasons …):

- The response should be read as continuous prose, even when numbered answer spaces are provided
- Any response marked *ignore* in the mark scheme should not count towards ***n***
- Incorrect responses should not be awarded credit but will still count towards ***n***
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response
- Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states ‘show your working’.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form, (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Question	Answer	Marks
1(a)	sulfur dioxide (1)	**1**
1(b)	zinc oxide (1)	**1**
1(c)	nitrogen monoxide (1)	**1**
1(d)	silicon dioxide (1)	**1**
1(e)	copper(II) oxide (1)	**1**

Question	Answer	Marks
2(a)	reacts to give hydrogen and manganese chloride (1)	**1**
2(b)	$MnCO_3 \rightarrow MnO + CO_2$ (1)	**1**
2(c)	$Mn(s) + Zn^{2+}(aq) \rightarrow Mn^{2+}(aq) + Zn(s)$ balanced (1) state symbols – dependent on correct formulae (1)	**2**
2(d)	purple to colourless (1)	**1**
2(e)(i)	$Al^{3+} + 3e^- \rightarrow Al$ (1)	**1**
2(e)(ii)	$2O^{2-} \rightarrow O_2 + 4e^-$ / $2O^{2-} - 4e^- \rightarrow O_2$(1)	**1**
2(f)	saves natural resources / less environmental damage due to mining / saves energy (1)	**1**

Question	Answer	Marks
3(a)	(moles of H_2O_2) = $\frac{680}{34}$ **OR** 20 (1) (energy = 20×98) = 1960 (kJ) (1)	**2**
3(b)	bond breaking is endothermic and bond making is exothermic / bond breaking absorbs energy and bond making releases energy(1) more energy released (in bond making) than absorbed (in bond breaking) (1)	**2**
3(c)	**A** is enthalpy change / ΔH (1) **B** is activation energy / E_a (1)	**2**
3(d)	particles have more energy / particles moving faster (1) more successful collisions / more particles with energy equal or above activation energy (1)	**2**

Question	Answer	Marks
4(a)	**Any two from:** general formula (1) same or similar chemical properties (1) same functional group (1) physical properties show a trend (1) each member varies by a CH_2 group / each member varies by 14 amu (1)	**2**
4(b)	melting point increases and then decreases but boiling point just increases / melting point goes up then down, but boiling point has a trend (1)	**1**

Question	Answer	Marks
4(c)	melting point below 25°C **and** boiling point above 25°C / 25 °C is between melting point and boiling point (1)	**1**
4(d)	perfume / solvent / flavouring (1)	**1**
4(e)(i)	mole ethanoic acid = $\frac{7.20}{60}$ **OR** 0.12 (1) (mass = 102×0.12) = 12.2 (g) (1)	**2**
4(e)(ii)	rate increases (1) particles more crowded together / particles are closer together / more particles per unit volume (1) more collisions per second / greater collision frequency (1)	**3**
4(e)(iii)	moves to the right / moves to the side of the product / moves to side of the ester (1) to replace water that has been removed (1)	**2**

Question	Answer	Marks
5(a)	**Any two from:** initially beaker has hydroxide ions so alkali or high pH (1) acid contains hydrogen ions which react with hydroxide ions (1) at end beaker contains hydrogen ions which is acidic or pH is low (1)	**2**
5(b)	20.0 (cm^3) (1)	**1**

Question	Answer	Marks
5(c)	moles of $Ba(OH)_2 = 0.025 \times 0.0500$ **OR** 0.00125 (1) mole of $HCl = 2 \times$ moles of $Ba(OH)_2$ **OR** 0.00125×2 **OR** 0.00250 (1) conc of $HCl = 0.125$ (mol / dm^3) (1)	**3**

Question	Answer	Marks
6(a)(i)	butanoic (acid) (1)	**1**
6(a)(ii)	same molecular formula but different structures (1)	**1**
6(b)	aerial oxidation (of ethanol) / (ethanol) reacts with oxygen (1) in presence of bacteria (1)	**2**
6(c)(i)	$Ca(CH_3CO_2)_2$ / $Ca(CH_3COO)_2$ (1)	**1**
6(c)(ii)	water **and** carbon dioxide (1)	**1**

Question	Answer	Marks
7(a)	(increased) greenhouse effect / global warming (1)	**1**
7(b)	$C_8H_{18} + 12\frac{1}{2}O_2 \rightarrow 8CO_2 + 9H_2O$ correct formulae for reactants and products (1) balanced – dependent on correct formulae for reactants and products (1)	**2**
7(c)(i)	$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$ (1)	**1**

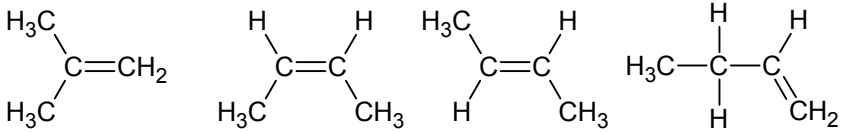
Question	Answer	Marks
7(c)(ii)	**Any two from:** aqueous / presence of water (1) absence of oxygen / anaerobic (1) yeast (1) temperature between 10 and 40°C (1)	**2**
7(d)	particles change from vibrational to translational motion / change from vibrations to moving very fast (1) change from a set pattern to a random arrangement (1) particles change from touching each other to large distance between particles (1)	**3**
7(e)	electrons cannot move / no mobile electrons	**1**

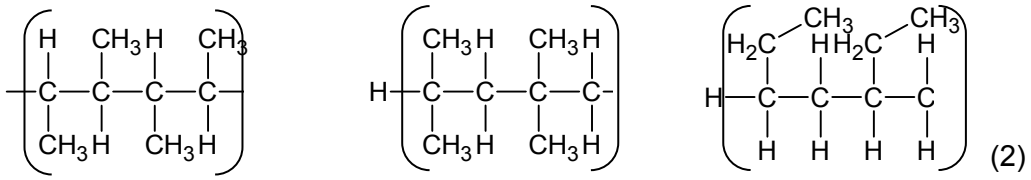
Question	Answer	Marks
8(a)	2.8	**1**
8(b)(i)	magnesium oxide or magnesium hydroxide **AND** hydrochloric (acid) (1)	**1**
8(b)(ii)	excess base (added to warm acid) (1) mixture filtered (and the filtrate collected) (1) filtrate partially evaporated and then left to crystallise / filtrate left to crystallise / filtrate heated until saturated then left to form crystals (1)	**3**
8(c)(i)	mole ratio Al to Cl is $\frac{20.2}{27}$ to $\frac{79.8}{35.5}$ **OR** 0.748 to 2.25 (1) divide by smallest $\frac{0.748}{0.748}$ to $\frac{2.25}{0.748}$ (1)	**2**

Question	Answer	Marks
8(c)(ii)	267 (1) Al_2Cl_6 (1)	**2**
8(d)	low melting point / low boiling point / does not conduct electricity (1)	**1**

Question	Answer	Marks
9(a)	**Any two from:** high boiling point / high melting point (1) high density (1) good electrical conductor / good thermal conductor (1) lustrous (1) sonorous (1)	**2**
9(b)	Haber (process) (1)	**1**
9(c)(i)	iron(II) ions lose electrons (1)	**1**
9(c)(ii)	moles of $FeSO_4 = \frac{6.08}{152}$ **OR** 0.04 (1) moles of SO_2 ($= 0.5 \times 0.04$) = 0.02 (1) volume of SO_2 ($= 24 \times 0.02$) = 0.48 (dm^3) (1)	**3**
9(d)	$Fe_2O_3 + 3H_2SO_4 \rightarrow Fe_2(SO_4)_3 + 3H_2O$ (1)	**1**

Question	Answer	Marks
9(e)	(aqueous) ammonia / (aqueous) sodium hydroxide (1) iron(II) sulfate – green ppt **AND** iron(III) sulfate – rusty / red-brown / orange / orange-brown ppt (1)	**2**

Question	Answer	Marks
10(a)	a mixture (1)	**1**
10(b)	aviation fuel / heating (in the home) / cooking (stoves) (1)	**1**
10(c)(i)	alkane is C_nH_{2n+2} which fits C_3H_8 if n = 3 (1) alkene is C_nH_{2n} which fits C_3H_6 if n = 3 (1)	**2**
10(c)(ii)	substitution (1) $C_3H_6Cl_2$ / $C_3H_5Cl_3$, etc. (1)	**2**
10(c)(iii)	orange to colourless / decolourises (1)	**1**
10(d)(i)	**Any one from:** 	**1**

Question	Answer	Marks
10(d)(ii)	**Any one from:**  (2) extension bonds at end and no double bonds between carbon atoms (1) rest of structure (1)	**2**