Cambridge Assessment International Education

Cambridge O Level

CHEMISTRY **5070/02**

Paper 2 Theory **For examination from 2020**

MARK SCHEME

Maximum Mark: 80

Specimen

This document has **14** pages. Any blank pages are indicated.

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	<u>'List rule' guidance</u> 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.

Abbreviations used in the Mark Scheme

- **;** separates marking points
- **/** separates alternatives within a marking point
- **R** reject
- **I** ignore (mark as if this material was not present)
- **A** accept (a less than ideal answer which should be marked correct)
- **COND** indicates mark is conditional on previous marking point
- **OWTTE** or words to that effect (accept other ways of expressing the same idea)
- **AW** alternate wording (where responses vary more than usual)
- **underline** actual word given must be used by candidate (grammatical variants accepted)
- **max** indicates the maximum number of marks that can be awarded
- **ECF** credit a correct statement that follows a previous wrong response
- **( )** the word / phrase in brackets is not required, but sets the context
- **ORA** or reverse argument

Question	Answer	Marks
1(a)	silicon(IV) oxide	**1**
1(b)	zinc oxide	**1**
1(c)	calcium oxide	**1**
1(d)	sodium oxide	**1**

Question	Answer	Marks
2(a)	<table><tr><th></th><th>relative charge</th><th>relative mass</th></tr><tr><td>proton</td><td>+1</td><td>1</td></tr><tr><td>neutron</td><td>0</td><td>1</td></tr><tr><td>electron</td><td>−1</td><td>0 / 0.0005</td></tr></table> **All four** correct = 3 marks **Three** correct = 2 marks **Two** correct = 1 mark **One** correct = 0 marks **A** any fraction between 1/1700 and 1/2000 for relative mass of electron **A** negligible for mass of electron	**3**
2(b)(i)	85	**1**
2(b)(ii)	has more electrons than protons **A** has 54 electrons but **only** 53 protons	**1**
2(b)(iii)	**C** and **E**	**1**
	same number of protons but different number of neutrons **A** same proton number but different mass or nucleon number	**1**

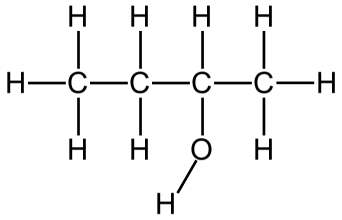
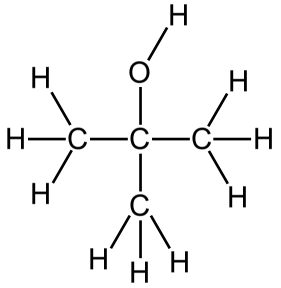
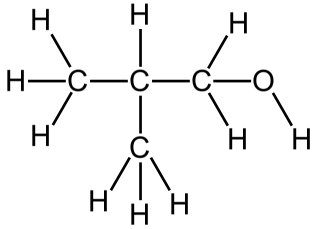
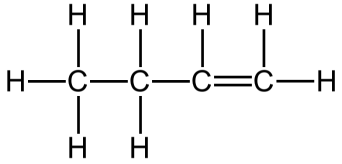
Question	Answer	Marks
3(a)	$H^+ + OH^- \rightarrow H_2O$	**1**
3(b)	acid – sulfuric acid / H_2SO_4 **AND** alkali – sodium hydroxide / NaOH	**1**

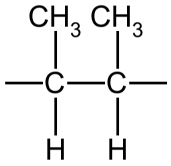
Question	Answer	Marks
3(c)(i)	white	**1**
3(c)(ii)	moles = 0.020 × 0.550 **OR** 0.011	**1**
	mass = 2.563 / 2.56 / 2.6 **ECF** as moles × 233	**1**
3(c)(iii)	74.9 **OR** 75 **ECF** from **3(c)(ii)** even if above 100%	**1**

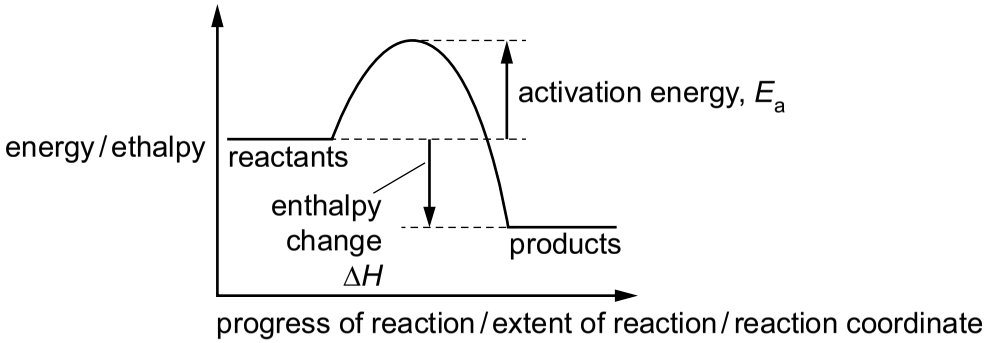
Question	Answer	Marks
4(a)	calcium ion is 2.8.8	**1**
	chloride ion is 2.8.8	**1**
4(b)	negative electrode: $Ca^{2+} + 2e^- \rightarrow Ca$ **A** e for e^-	**1**
	positive electrode: $2Cl^- \rightarrow Cl_2 + 2e^-$ **A** e for e^-	**1**
4(c)	hydrogen / H_2 **AND** chlorine / Cl_2	**1**
4(d)	structure: giant lattice	**1**
	bonding: strong ionic / strong attraction between positive ions and negative ions	**1**

Question	Answer	Marks
5(a)	reaction with steam	**1**
	in presence of an acid catalyst **A** phosphoric acid / H^+	**1**
5(b)(i)	solvent / making vinegar	**1**

Question	Answer	Marks
5(b)(ii)	$C_2H_5OH + O_2 \rightarrow 2C + 3H_2O$ **OR** $C_2H_5OH + 2O_2 \rightarrow 2CO + 3H_2O$ correct products 1 mark balancing 1 mark **A** CH_3CH_2OH / C_2H_6O for ethanol **A** equations showing mix of C and CO	**2**
5(c)	(acidified aqueous) potassium manganate(VII) / oxygen	**1**

Question	Answer	Marks
5(d)	 **OR**  **OR** 	**1**
5(e)(i)	$CH_3CH_2CH=CH_2$ **A** 	**1**
5(e)(ii)	water / H_2O	**1**
5(f)(i)	addition	**1**

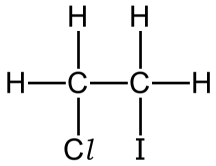
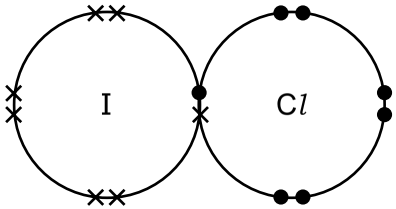
Question	Answer	Marks
5(f)(ii)	 correct repeat unit with no double bond **;** free bonds at either end **;** **A** more than one repeat unit **A** structure with brackets with or without *n* structures with double bond = 0 marks for the question	**2**

Question	Answer	Marks
6(a)	 *x*-axis **AND** *y*-axis labelled **;** reactants and products labelled **AND** drawn as shown with product level below reactant level **;** enthalpy change labelled **AND** shown by a downward arrow **;** activation energy labelled **AND** shown by an upward arrow to an energy 'hump' above the highest energy level of both products and reactants **;** **ECF** from endothermic reaction	**4**

Question	Answer	Marks
6(b)	bond breaking is endothermic **AND** bond making is exothermic **A** bond breaking absorbs energy **AND** bond making releases energy	**1**
	more energy released than absorbed **A** heat instead of energy throughout the question	**1**

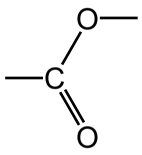
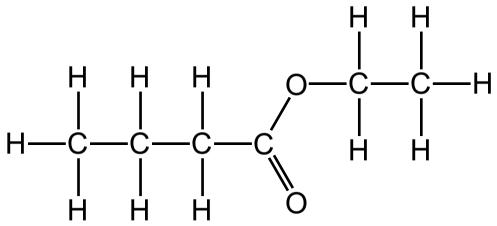
Question	Answer	Marks
7(a)	iodide ions lose electron(s) **R** iodine loses electrons	**1**
7(b)	peroxodisulfate: increases rate / doubling concentration doubles the rate	**1**
	iodide: increases rate / doubling concentration doubles the rate	**1**
7(c)	activation energy decreases	**1**
	so greater proportion of collisions are successful / more particles have energy above that of the activation energy	**1**

Question	Answer	Marks
8(a)	aqueous / solution in water	**1**
8(b)	moles of acid = 0.025×16 **OR** 0.4	**1**
	moles of NO_2 = 0.2 **ECF** from incorrect number of moles of acid	**1**
	volume of NO_2 = 4.8 dm^3 / 4800 cm^3 **ECF** from incorrect moles of NO_2	**1**
8(c)	$2Cu(NO_3)_2 \rightarrow 2CuO + 4NO_2 + O_2$	**1**
8(d)(i)	blue precipitate / blue solid	**1**
	in excess becomes a dark blue solution	**1**
8(d)(ii)	blue precipitate / blue solid (which does not redissolve)	**1**

Question	Answer	Marks
9(a)		**1**
9(b)(i)	substitution	**1**
9(b)(ii)	$C_2H_6 + ICl \rightarrow C_2H_5Cl + HI$ **OR** $C_2H_6 + ICl \rightarrow C_2H_5I + HCl$ **A** other equations with more hydrogen atoms substituted	**1**
9(c)	correct dot-and-cross diagram **A** all dots or all crosses **I** inner shells 	**1**
9(d)(i)	rate of forward reaction is the same as rate of backward reaction	**1**
	the concentrations of reactants and products do not change	**1**
9(d)(ii)	the colour becomes less brown / colour becomes more yellow **A** goes yellow / it is 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**

Question	Answer	Marks
10(a)	exists as atoms (and not molecules) / atoms unbonded	**1**
10(b)	atoms do not need to gain or lose electrons / has a stable electronic arrangement **A** complete valence shell / stable outer octet	**1**
10(c)	have different boiling points	**1**
10(d)	neon	**1**
	has the smallest (relative) atomic mass / atoms have the smallest masses	**1**
10(e)(i)	photochemical smog / acid rain **A** ozone depletion	**1**
10(e)(ii)	$N_2 + O_2 \rightarrow 2NO$ / nitrogen + oxygen → nitrogen oxide	**1**
	high temperature	**1**

Question	Answer	Marks
11(a)(i)	$C_nH_{2n+1}COOH$ / $C_nH_{2n}O_2$	**1**
11(a)(ii)	Any two from: • same functional group • idea that each member varies by a CH_2 group • same or similar chemical properties • physical properties change with a trend. **A** an example of a trend, e.g. boiling point increases down a series	**2**
11(b)	releases a hydrogen ion	**1**

Question	Answer	Marks
11(c)	ethyl butanoate	**1**
	 **A** full displayed structure 	**1**
11(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 irregularly (as temperature increases)	**1**

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