Cambridge Assessment International Education

Cambridge O Level

CHEMISTRY **5070/22**

Paper 2 **October/November 2021**

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 October/November 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

© UCLES 2021

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.

© UCLES 2021

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.

© UCLES 2021

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.

© UCLES 2021

Question	Answer	Marks
1(a)	cobalt(II) chloride	**1**
1(b)	iron(III) chloride	**1**
1(c)	silver chloride	**1**
1(d)	ammonium chloride	**1**
1(e)	hydrogen chloride	**1**

Question	Answer	Marks
2(a)	carbon monoxide (1) octane (1)	**2**
2(b)	limewater (1) turns milky / turns cloudy / white precipitate (1)	**2**
2(c)	decomposition of vegetation / decomposition of plants	**1**
2(d)	greenhouse (1) global warming (1)	**2**
2(e)	mention of nitrogen oxides and carbon monoxide (as the pollutants / reactants) (1) nitrogen / N_2 (in exhaust gases) (1) carbon dioxide / CO_2 (in exhaust gases) (1)	**3**

© UCLES 2021

Question	Answer	Marks
3(a)	initial gradient less steep **AND** starting from origin (1) line levels off at lower than 45 cm^3 gas (1)	**2**
3(b)(i)	rate of reaction increases **AND** one or both of: more particles exposed on surface / more (magnesium) particles per unit area / more particles per cm^2 (1) collision frequency increases / collision rate increases / more collisions per second (1)	**2**
3(b)(ii)	rate of reaction decreases **AND** one or both of: particles move more slowly / particles have less kinetic energy (1) fewer particles have activation energy (or above) / collisions are less successful (1)	**2**
3(c)	mol magnesium = $\frac{1.68}{24}$ **OR** 0.070 mol (1) volume of oxygen = 1.68 (dm^3) (1)	**2**
3(d)	add (aqueous acidified) potassium manganate(VII) (1) turns from purple to colourless (1)	**2**

© UCLES 2021

Question	Answer	Marks
4(a)(i)	viscosity	**1**
	Any two from: similar chemical properties (1) same functional group (1) (have a) general formula (1) (successive) members differ by CH_2 (1)	**2**
4(b)	type of reaction: substitution (1) reactant: chlorine (1)	**2**
4(c)(i)	high temperature (1) catalyst (1)	**2**
4(c)(ii)	$C_{13}H_{28} \rightarrow C_4H_8 + C_9H_{20}$ **OR** $C_{13}H_{28} \rightarrow 2C_4H_8 + C_5H_{12}$ **OR** $C_{13}H_{28} \rightarrow 3C_4H_8 + CH_4$	**1**

© UCLES 2021

Question	Answer	Marks
4(d)	C_2H_3 (2) if 2 marks not scored 1 mark for: C H $\frac{88.9}{12}$ $\frac{11.1}{1}$ **OR** 7.4 11.1 (1)	**2**

Question	Answer	Marks
5(a)	lithium oxidised because it loses electrons (1) zinc **ions** reduced because they gain electrons (1)	**2**
5(b)	yellow precipitate / yellow solid	**1**
5(c)(i)	iodine **AND** zinc bromide	**1**
5(c)(ii)	chlorine is more reactive than bromine / bromine is less reactive than chlorine	**1**

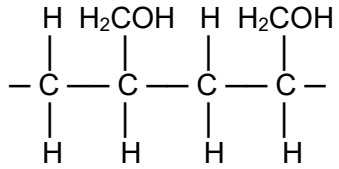
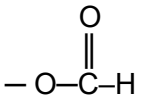
Question	Answer	Marks
6(a)	reactants on the left and products on the right and reactant line below product line (1) arrow upwards between reactants and products with ΔH label (1)	**2**
6(b)	bond breaking endothermic and bond making exothermic / (thermal) energy absorbed to break bonds and (thermal) energy released on making bonds (1) more energy absorbed than released (1)	**2**
6(c)	$4PH_3 + 8O_2 \rightarrow P_4O_{10} + 6H_2O$	**1**

© UCLES 2021

Question	Answer	Marks
7(a)	**Any two from:** sodium conducts electricity / diamond does not conduct electricity (1) sodium malleable / diamond brittle (1) brittle (1) sodium ductile / diamond not ductile (1) sodium soft / diamond hard (1)	**2**
7(b)	protons: 11 (1) neutrons: 12 (1) electrons: 10 (1)	**3**
7(c)	$6Na + N_2 \rightarrow 2Na_3N$	**1**
7(d)(i)	equilibrium moves to the right / more product formed (1) (increasing the temperature) pushes the reaction in the direction of absorbing energy / (increasing the temperature) pushes the reaction in the direction of the endothermic reaction (1)	**2**
7(d)(ii)	equilibrium moves to the right / more product formed (1) more gas molecules on right than on left / more moles of gas on right than on left / when pressure decreased reaction moves in direction of more gas molecules (1)	**2**

Question	Answer	Marks
8(a)	C_3H_6O	**1**
8(b)	orange to colourless	**1**

© UCLES 2021

Question	Answer	Marks
8(c)	potassium manganate(VII)	**1**
8(d)	 (2 marks) if two marks not scored 1 mark for – C — C — C — C –	**2**
8(e)	completed with 	**1**
8(f)(i)	H^+	**1**
8(f)(ii)	methanoic acid has a lower concentration of H^+ ions / hydrochloric acid has a higher concentration of H^+ ions	**1**
8(g)	$2HCOOH + Mg \rightarrow (HCOO)_2Mg + H_2$ (2) if two marks not scored 1 mark for $(HCOO)_2Mg$	**2**

Question	Answer	Marks
9(a)(i)	air **AND** water	**1**
9(a)(ii)	vanadium(V) oxide	**1**
9(b)(i)	decomposition of an ionic compound / decomposition of an electrolyte (1) using electricity (1)	**2**

© UCLES 2021

Question	Answer	Marks
9(b)(ii)	$2H^+ + 2e^- \rightarrow H_2$	**1**
9(c)	mol $H_2SO_4 = \frac{45}{1000} \times 0.20$ **OR** 0.009 (1) mol sodium hydroxide = $\frac{0.76}{40}$ **OR** 0.019 mol (1) (sodium hydroxide because 0.019 is greater than) 2×0.009 **OR** (sodium hydroxide because 0.009 is less than) 0.019 / 2 (1)	**3**
9(c)	ammonia **AND** sodium sulfate **AND** water (2) if 2 marks not scored 1 mark for any two of ammonia, sodium sulfate or water	**2**

Question	Answer	Marks
10(a)(i)	values between 6.00 and 9.50 (inclusive of these values)	**1**
10(a)(ii)	there is no trend (down the group)	**1**
10(b)(i)	R is an ionic structure / R has an ionic lattice / R is giant ionic (1) R bonds (throughout lattice) are strong (1) (dependent on the mention of ions / ionic for R) S is a simple molecular structure / small molecule / simple molecule (1) S weak forces between molecules (1)	**4**

© UCLES 2021

Question	Answer	Marks
10(b)(ii)	ions can move / has mobile ions	**1**
10(b)(iii)	3 pairs of bonding electrons between each H and P **AND** 2 non-bonding electrons on P	**1**
10(c)	43.7 (%) (2) If 2 marks not scored 1 mark for molar mass of P_4O_{10} = 284	**2**

© UCLES 2021