Cambridge Assessment International Education

Cambridge O Level

CHEMISTRY **5070/22**

Paper 2 Theory **October/November 2020**

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.

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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)	ammonia	**1**
1(b)	copper(II) sulfate	**1**
1(c)	aluminium sulfate	**1**
1(d)	calcium carbonate	**1**
1(e)	potassium nitrate	**1**

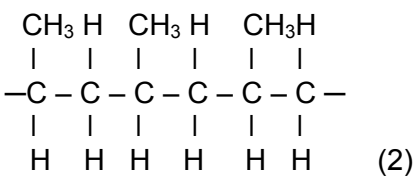
Question	Answer	Marks
2(a)	chlorine is a (simple) molecule **and** sodium chloride is ionic (1) for chlorine: weak (attractive) forces between molecules / weak intermolecular forces(1) for sodium chloride: strong (attractive) forces between ions (1)	**3**
2(b)	2,8,7	**1**
2(c)(i)	decomposition of the electrolyte by an electric current	**1**
2(c)(ii)	(positive ions move to the) negative electrode **AND** (negative ions move to the) positive electrode	**1**
2(c)(iii)	green gas formed / green fumes formed / solution goes green (near electrode) / bubbles formed / fizzes / effervescence	**1**
2(c)(iv)	Cl^- **AND** OH^-	**1**
2(d)	hydrogen ions (from water) gain electrons more easily than sodium ions / sodium ions gain electrons less easily than hydrogen ions	**1**

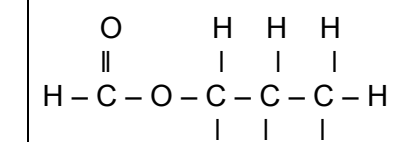
Question	Answer	Marks
2(e)(i)	mol C = $\frac{14.4}{12}$ mol Cl = $\frac{21.3}{35.5}$ mol H= $\frac{0.600}{1}$ **OR** mol C = 1.20 mol Cl = 0.60 mol H = 0.60 (1) empirical formula is C_2HCl (1)	**2**
2(e)(ii)	$C_6H_3Cl_3$	**1**

Question	Answer	Marks
3(a)	any **three** from: • diffusion • particles move (from place to place) / particles collide • random (movement) of particles / particles go anywhere / particles (move) in all directions / particles disperse • intermingling of particles / mixing of particle • (bulk movement of ink particles) from higher to lower concentration	**3**
3(b)(i)	(aqueous) sodium hydroxide / (aqueous) ammonia (1) (light) green precipitate (1)	**2**
3(b)(ii)	$Fe^{2+} \rightarrow Fe^{3+} + e^-$	**1**
3(b)(iii)	lowers the activation energy	**1**
3(c)(i)	starch	**1**
3(c)(ii)	reflux / heat / boil (1) with (concentrated) hydrochloric acid (1)	**2**

Question	Answer	Marks
4(a)	oxygen	**1**
4(b)	$2Li + 2H_2O \rightarrow 2LiOH + H_2$	**1**
4(c)(i)	all have one electron in their outer shell	**1**
4(c)(ii)	increases down the Group ORA	**1**
4(d)	mol hydrogen peroxide = $\frac{16}{34}$ **OR** 0.471 mol oxygen = $\frac{0.471}{2}$ **OR** 0.235 (1) volume of oxygen = 5.65 (dm^3) (1)	**3**
4(e)(i)	cracking (hydrocarbons) / electrolysis (of water)	**1**
4(e)(ii)	any **two** from: • water is only product / no other product than water • no pollutants made / no harmful exhaust fumes / no harmful gas made • greater efficiency / less heat loss / more energy per gram of fuel • (hydrogen is) renewable source of fuel / uses renewable source of fuel / uses renewable source of energy	**2**

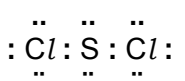
Question	Answer	Marks
5(a)(i)	to make petrol / to produce fuels which are needed the most / to make hydrogen	**1**
5(a)(ii)	$C_{10}H_{22}$	**1**
5(b)(i)	C_nH_{2n}	**1**
5(b)(ii)	C_3H_8O	**1**

Question	Answer	Marks
5(b)(iii)	carbon monoxide (1) water (1)	**2**
5(c)	 (2) if 2 marks not scored: 1 mark for this structure without extension bonds / 1 mark for this structure terminating with H atom(s) at one or both ends	**2**

Question	Answer	Marks
6(a)	(acid which is) partially / slightly ionised (in water) / (acid which is) partially / slightly dissociated (in water)	**1**
6(b)(i)	$2HCO_2H + Mg \rightarrow (HCO_2)_2Mg + H_2$	**1**
6(b)(ii)	rate decreases because: fewer (magnesium) particles exposed / fewer particles on the surface (of the magnesium) (1) less frequent collisions / particles collide less often / collision rate decreases (1)	**2**
6(c)	propyl methanoate (1)  (1)	**2**
6(d)(i)	ethanol	**1**

Question	Answer	Marks
6(d)(ii)	oxidation	**1**
6(e)(i)	values between 1.00 and 1.21 (inclusive)	**1**
6(e)(ii)	(boiling points) increase because forces of attraction between molecules are larger / (boiling points) increase because the intermolecular forces increase	**1**

Question	Answer	Marks
7(a)	haematite	**1**
7(b)	bond breaking endothermic and bond making exothermic/ heat absorbed to break bonds and heat released on making bonds (1) more heat released than absorbed / more energy released than absorbed (1)	**2**
7(c)(i)	oxygen removed from iron oxide / it loses oxygen	**1**
7(c)(ii)	mol iron oxide = $\frac{12.5}{160}$ **OR** 0.078 mol (1) mass of iron = 8.75 g(1)	**2**
7(d)	limestone decomposes to calcium oxide / calcium oxide formed from calcium carbonate (1) calcium oxide reacts with silicon dioxide to form slag / calcium oxide reacts with impurities to form calcium silicate (1)	**2**
7(e)	idea of metallic structure: (positive) <u>ions</u> and sea of electrons (1) <u>electrostatic</u> attraction between the <u>ions</u> and electrons (1)	**2**

Question	Answer	Marks
8(a)(i)	mol sodium hydroxide = $0.0150 \times \frac{24.0}{1000}$ **OR** 3.60×10^{-4} (1) mol sulfuric acid = 1.80×10^{-4} (1) concentration sulfuric acid = 7.2×10^{-3} / 0.0072 mol / dm^3 (1)	**3**
8(a)(ii)	evaporate solution until crystallisation point / evaporate until solution is saturated (1) filter off crystals **AND** wash with organic solvent / wash with cold water (1) dry crystals with filter paper (1)	**3**
8(b)	**4**As + **6**H_2SO_4 → As_4O_6 + **6**H_2O + 6SO_2	**1**
8(c)		**1**
8(d)	liquid (1) room temperature is higher than the melting point and lower than the boiling point / room temperature is between the melting point and boiling point (1)	**2**

Question	Answer	Marks
9(a)	electrons = 80 (1) neutrons = 125 (1)	**2**
9(b)(i)	add (aqueous) potassium iodide (1) (colour change) from colourless to brown (1)	**2**

Question	Answer	Marks
9(b)(ii)	$PbO_2 + 4HCl \rightarrow PbCl_4 + 2H_2O$	**1**
9(c)(i)	equilibrium moves to the left / more reactant formed (1) lead(II) chloride combines with chlorine to reduce the concentration of added chlorine (1)	**2**
9(c)(ii)	equilibrium moves to the left / more reactant formed (1) (increasing temperature) pushes the reaction in the direction of absorbing energy / (increasing temperature) pushes the reaction in the direction of the endothermic reaction (1)	**2**
9(d)	lead nitrate	**1**