Cambridge Assessment International Education

Cambridge O Level

CHEMISTRY **5070/22**

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)	calcium chloride (1)	**1**
1(b)	ammonium chloride (1)	**1**
1(c)	silver chloride (1)	**1**
1(d)	hydrogen chloride (1)	**1**
1(e)	iron(III) chloride	**1**

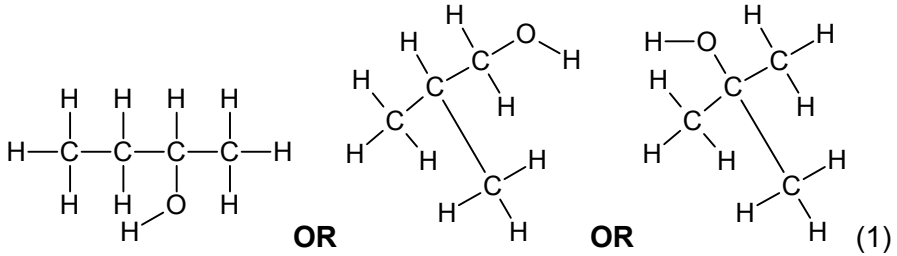
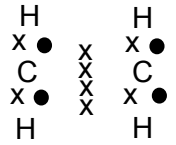
Question	Answer	Marks
2(a)	(moles of H_2) = $\frac{25}{2}$ **OR** 12.5 (1) (energy = 12.5×286) = 3575 / 3580 (kJ) (1)	**2**
2(b)	bond breaking is endothermic and bond making is exothermic / bond breaking absorbs energy and bond making releases energy (1) more energy released (during bond making) than absorbed (during bond breaking) (1)	**2**
2(c)(i)	no carbon dioxide made (during use) / only makes water as a product / more energy efficient (during use) / saves fossil fuels (1)	**1**
2(c)(ii)	$H_2 \rightarrow \mathbf{2H^+} + 2e^-$ (1) $O_2 + 4H^+ + 4e^- \rightarrow \mathbf{2H_2O}$ (1)	**2**

Question	Answer	Marks
3(a)(i)	116 (1)	1
3(a)(ii)	any value between 115 – 130 (°C) (1)	1
3(a)(iii)	melting point increases and then decreases / no clear trend (1)	1
3(b)	35 °C is greater than the boiling point (1)	1
3(c)	perfume / solvent (1)	1
3(d)(i)	moles of propanoic acid = $\frac{11.0}{74}$ **OR** 0.149 (1) (mass = 88×0.149) = 13.1 (g) (1)	2
3(d)(ii)	rate of (forward) reaction increases (1) particles have more kinetic energy / particles moving faster (1) more successful collisions / more particles with energy equal or above the activation energy (1)	3
3(d)(iii)	moves to the left / moves to the side of the reactant / moves to side of the alcohol or acid (1) (forward) reaction is exothermic / backward reaction is endothermic (1)	2

Question	Answer	Marks
4(a)	reacts to give hydrogen and chromium chloride (1)	1
4(b)	$3Zn(s) + 2Cr^{3+}(aq) \rightarrow 3Zn^{2+}(aq) + 2Cr(s)$ balanced equation (1) correct state symbols dependent on correct symbols and formulae (1)	2

Question	Answer	Marks
4(c)	aluminium has an oxide layer / aluminium oxide on the surface (1) this layer is impermeable to water / layer is non-porous / layer is protective barrier against water (1)	2
4(d)	colourless to brown (1)	1
4(e)(i)	$2Al + Cr_2O_3 \rightarrow Al_2O_3 + 2Cr$ (1)	1
4(e)(ii)	carbon monoxide / CO (1)	1
4(f)	saves natural resources / less environmental damage due to mining / saves energy (1)	1

Question	Answer	Marks
5(a)	**Any two from:** initially beaker has hydrogen ions so has a low pH (1) alkali contains hydroxide ions which react with hydrogen ions (1) at the end beaker contains hydroxide ions so pH is high (1)	2
5(b)	20 (cm^3) (1)	1
5(c)	moles of H_2SO_4 = 0.025 × 0.0500 **OR** 0.00125 (1) moles of NaOH = 2 × moles of H_2SO_4 **OR** 0.00125 × 2 **OR** 0.00250 (1) conc of NaOH = 0.125 (mol / dm^3) (1)	3

Question	Answer	Marks
6(a)	butanol (1)	1
6(b)	 **OR** **OR** (1)	1
6(c)	oxygen / (acidified) potassium manganate(VII) (1)	1
6(d)	electrons cannot move / no mobile electrons (1)	1
6(e)	 two shared pairs of electrons between both carbon atoms (1) two shared pairs between carbon and hydrogen atoms for each carbon atom (1)	2

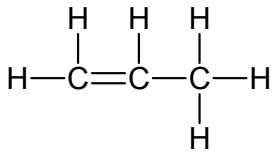
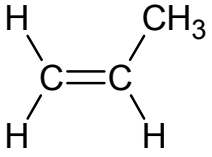
Question	Answer	Marks
7(a)	2.8	1
7(b)	use sulfuric acid (1) excess base (added to warm acid) (1) mixture filtered (and the filtrate collected) (1) filtrate partially evaporated and then left to crystallise / filtrate left to crystallise / filtrate heated until saturated and then left to form crystals (1)	4

Question	Answer	Marks
7(c)(i)	mole ratio P to O is $\frac{43.7}{31}$ to $\frac{56.3}{16}$ **OR** 1.41 to 3.52 (1) divide by smallest $\frac{1.41}{1.41}$ to $\frac{3.52}{1.41}$ = 1 to 2.5 and evidence of multiplying by 2 (1)	**2**
7(c)(ii)	284 (1) P_4O_{10} (1)	**2**
7(d)	giant covalent (1)	**1**

Question	Answer	Marks
8(a)	**Any two from:** catalysts (1) coloured (1) show variable oxidation number (of the transition element) (1)	**2**
8(b)	iodide (ion) loses electrons / I^- loses electrons (1)	**1**
8(c)	M_r of $CuSO_4$ = 160 (1) moles of $CuSO_4$ or moles of SO_3 = 0.04 (1) volume of SO_3 (= 24×0.04) = 0.96 (dm^3) (1)	**3**
8(d)(i)	$Fe + Cu^{2+} \rightarrow Fe^{2+} + Cu$ (1)	**1**
8(d)(ii)	solution changes from blue to green / pink solid formed / pink coating / pink deposit	**1**

Question	Answer	Marks
8(e)	(aqueous) ammonia (1) iron(II) sulfate – green ppt **AND** copper(II) sulfate blue ppt that redissolves in excess to give dark blue solution with NH_3 (1) **OR** (aqueous) sodium hydroxide (1) iron(II) sulfate – green ppt **AND** copper(II) sulfate blue ppt (1)	**2**

Question	Answer	Marks
9(a)	acid rain / one effect of acid rain e.g. acidification of lakes or killing trees etc. (1)	**1**
9(b)	$4FeS_2 + 11O_2 \rightarrow 2Fe_2O_3 + 8SO_2$ correct formulae for reactants and products (1) balanced – dependent on correct formulae for reactants and products (1)	**2**
9(c)	food preservation / antioxidant / making sulfuric acid / bleaching wood pulp (1)	**1**
9(d)	movement – particles move faster (1) arrangement – particles spread out / particles no longer touching each other (1)	**2**
9(e)	has a simple (molecular) structure (1) weak intermolecular forces / weak attraction between molecules (1)	**2**
9(f)	test – (filter paper dipped in) acidified potassium manganate(VII) (1) observation goes from purple to colourless (1)	**2**

Question	Answer	Marks
10(a)(i)	boiling point (1)	**1**
10(a)(ii)	crude oil is heated in a fractionating column (1) fractions leave at different exits of column / the lower the boiling point the higher the exit point from the column or **ORA** (1)	**2**
10(a)(iii)	surface of roads / waterproofing (1)	**1**
10(b)	general formula of alkane is C_nH_{2n+2} (1) idea that if n = 10 then (2n + 2) will be 22 (1)	**2**
10(c)(i)	hydrogen / H_2 (1)	**1**
10(c)(ii)	C_7H_{14} (1) must be an alkene because it delocolourises bromine / alkenes are C_nH_{2n} and n=7 if relative formula mass is 98	**2**
10(c)(iii)	 **OR**  **OR** $CH_2=CHCH_3$ (1)	**1**