**Cambridge Assessment International Education**
Cambridge International General Certificate of Secondary Education

**CHEMISTRY** **0620/41**

Paper 4 Extended Theory **October/November 2018**

MARK SCHEME

Maximum Mark: 80

**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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This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **9** printed pages.

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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.

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|---|
| GENERIC MARKING PRINCIPLE 5:<br><br>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:<br><br>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. |

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| Question | Answer | Marks |
|---|---|---|
| 1(a) | A*l* / aluminium | **1** |
| 1(b) | $CaCO_3$ / calcium carbonate | **1** |
| 1(c) | $CH_4$ / methane | **1** |
| 1(d) | $SO_2$ / sulfur dioxide | **1** |
| 1(e) | C*l*$_2$ / chlorine | **1** |
| 1(f) | $CH_4$ / methane | **1** |

| Question | Answer | Marks |
|---|---|---|
| 2(a) | **M1** 11<br>**M2** 18<br>**M3** 2.8.8<br>**M4** –1 | **4** |
| 2(b) | A **and** B | **1** |
| 2(c) | Li / Lithium | **1** |
| 2(d) | it has a complete **or** full **or** 8 electrons in the outer shell | **1** |

| Question | Answer | Marks |
|---|---|---|
| 3(a)(i) | $4NO_2$ 2CuO<br>**M1** CuO as a product (1)<br>**M2** rest fully correct (1) | **2** |
| 3(a)(ii) | nitrogen dioxide is acidic<br>**OR**<br>nitrogen dioxide reacts with sodium hydroxide | **1** |

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| Question | Answer | Marks |
|---|---|---|
| 3(b) | **M1** nitrogen and oxygen (from the air)<br>**M2** (react) at high temperatures (in engine) **or** (electrical) spark (in engine) | **2** |
| 3(c)(i) | **M1** 188<br>**M2** (18.8 / 188) = 0.1(00) | **2** |
| 3(c)(ii) | 0.05 | **1** |
| 3(c)(iii) | 1200 | **1** |
| 3(d)(i) | $Cu(OH)_2$ | **1** |
| 3(d)(ii) | Any three from:<br><br>**1** zinc more reactive than copper<br>**2** displacement / redox reaction **OR** zinc displaces copper **OR** zinc reacts with copper **ions**<br>**3** copper is solid / copper is brown<br>**4** zinc nitrate is colourless (solution)<br>**OR**<br>blue colour disappears because $Cu^{2+}$ ions removed (from solution) | **max 3** |
| 3(d)(iii) | **M1** sodium hydroxide / NaOH<br>**M2** aluminium / A*l* | **2** |
| 3(e)(i) | $CuCO_3 + 2HNO_3 \rightarrow Cu(NO_3)_2 + CO_2 + H_2O$<br>**M1** carbon dioxide and water as products<br>**M2** rest correct | **2** |
| 3(e)(ii) | respiration | **1** |
| 3(e)(iii) | photosynthesis | **1** |

| Question | Answer | Marks |
|---|---|---|
| 4(a)(i) | from petroleum or (crude) oil or fossil fuels | **1** |
| 4(a)(ii) | Contact (process) | **1** |
| 4(a)(iii) | **M1** vanadium pentoxide **or** vanadium(V) oxide **or** $V_2O_5$ (catalyst); | **1** |
| | **M2** 1–5 atmospheres; (Units required) | **1** |
| | **M3** 450°**C**; units required | **1** |
| | **M4** $2SO_2 + O_2 \rightarrow 2SO_3$ ; | **1** |
| | **M5** equilibrium / reversible reaction in equation or text | **1** |
| 4(b)(i) | water / $H_2O$ | **1** |
| 4(b)(ii) | carbon / C | **1** |
| 4(c)(i) | (oxidation is) loss of electrons | **1** |
| 4(c)(ii) | **M1** one shared pair between each H and S | **1** |
| | **M2** four unpaired electrons on S giving S a total of 8 outer shell electrons and no other unpaired electrons | **1** |
| 4(c)(iii) | **M1** weak (attractive) forces **OR** (attractive) forces need little energy to overcome | **1** |
| | **M2** forces between molecules / intermolecular | **1** |
| 4(d)(i) | 0.003 | **1** |
| 4(d)(ii) | 0.006 | **1** |
| 4(d)(iii) | 30 | **1** |

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| Question | Answer | Marks |
|---|---|---|
| 5(a) | **M1** forward and back reactions occur at equal rates | **1** |
| | **M2** concentration (of substances) remains constant | **1** |
| 5(b)(i) | equal / same number of moles on each side<br>**or**<br>amount / molecules (of gas) on each side is the same | **1** |
| 5(b)(ii) | **M1** (forward) reaction exothermic **or** reverse reaction endothermic<br>**M2** yield lower at higher temperature **or** (position of) equilibrium moves left at higher temperature ORA | **2** |
| 5(c)(i) | at the start / beginning | **1** |
| 5(c)(ii) | **M1** new line is steeper than printed line and starts at origin | **1** |
| | **M2** new line reaches same final volume as printed line | **1** |
| 5(d)(i) | **M1** Faster<br>**and**<br>More particles per unit volume / $dm^3$ / $cm^3$<br>**M2** More collisions per second / unit time or greater collision rate | **2** |
| 5(d)(ii) | Reaction faster **and** (particles) have more energy **or** (particles) move faster | **1** |
| | more collisions per second **or** greater collision rate | **1** |
| | more (of the) particles / collisions have energy greater than the activation energy **or** more particles / collisions have sufficient energy to react **or** a greater percentage / proportion / fraction of collisions are successful | **1** |

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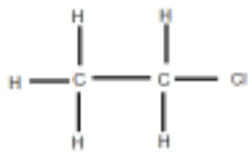
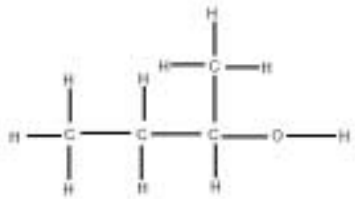
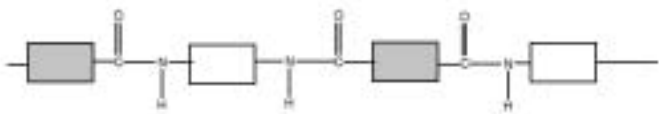
| Question | Answer | Marks |
|---|---|---|
| 6(a)(i) | **M1** (compound that) contains carbon and hydrogen | **1** |
| | **M2** and no other elements / only | **1** |
| 6(a)(ii) | Alkanes: $C_nH_{2n+2}$ | **1** |
| | Alcohols $C_nH_{2n+1}OH$ **OR** $C_nH_{2n+2}O$ | **1** |
| 6(a)(iii) | any **two** from:<br><br>Similar / same chemical properties<br>Same functional group<br>Trend **or** gradual change in physical properties<br>(Neighbouring) members differ by $CH_2$ | **max 2** |
| 6(b)(i) | ultraviolet light / sunlight | **1** |
| 6(b)(ii) |  | **1** |
| 6(b)(iii) | hydrogen chloride | **1** |
| 6(c) | propyl ethanoate | **1** |
| 6(d)(i) | $C_5H_{10}O_2$ | **1** |

| Question | Answer | Marks |
|---|---|---|
| 6(d)(ii) | **M1** | **1** |
| | **M2** methanoic acid | **1** |
| | **M3**  | **1** |
| | **M4** butan-2-ol | **1** |
| 6(e) |  <br>**M1** correct amide link between at least one pair of boxes<br>**M2** all three amide linkages between boxes are correct<br>**M3** continuation bonds shown | **3** |