**Cambridge Assessment International Education**
Cambridge International General Certificate of Secondary Education (9–1)

**CHEMISTRY** **0971/32**

Paper 3 Theory (Core) **October/November 2019**

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.

Cambridge International is publishing the mark schemes for the October/November 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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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. |

| Question | Answer | Marks |
|---|---|---|
| 1(a)(i) | octane | **1** |
| 1(a)(ii) | (aqueous) potassium manganate (VII) | **1** |
| 1(a)(iii) | hydrochloric acid | **1** |
| 1(a)(iv) | water | **1** |
| 1(a)(v) | ethanol | **1** |
| 1(b)(i) | A: freezing (1)<br>B: condensing / condensation (1) | **2** |
| 1(b)(ii) | ***liquid:***<br>particles sliding over each other / particles moving slower than in gas (1)<br><br>particles close together / particles touching (1)<br><br>***gas:***<br>particles moving rapidly / particles moving randomly (1)<br><br>particles far apart (1) | **4** |

| Question | Answer | Marks |
|---|---|---|
| 2(a) | 26.7 (%) | **1** |
| 2(b)(i) | 4 ($H_2$) (1)<br><br>2 ($H_2O$) (1) | **2** |
| 2(b)(ii) | (group of organic compounds) with similar chemical properties (1)<br><br>(due to) same functional group (1) | **2** |
| 2(b)(iii) | 1 pair of bonding electrons between each H and the C atom (1)<br><br>no additional outer shell electrons on the H or C atoms (1) | **2** |
| 2(c) | helium is inert / helium is unreactive / hydrogen is flammable / hydrogen is explosive | **1** |
| 2(d)(i) | circle around one or both the C=C groups | **1** |
| 2(d)(ii) | 4 | **1** |
| 2(e) | 1 mark each for any four of:<br>(flask attached to) condenser<br>(fractionating) column<br>heat the flask / heat the mixture<br>idea of different boiling points (of materials in flask)<br>ethanol evaporates<br>different compounds reach the condenser at different times / ethanol collects first in (collection) flask<br>ethanol turns to liquid (in condenser)<br>solids / plant material remain in flask | **4** |

| Question | Answer | Marks |
|---|---|---|
| 3(a)(i) | 22 s | **1** |
| 3(a)(ii) | P (1)<br>the gradient / slope of the graph is steep(est) (1) | **2** |
| 3(a)(iii) | 0.9 (g) | **1** |
| 3(a)(iv) | (increasing temperature) increases / faster (1)<br>(larger pieces of carbonate) decreases / slower (1) | **2** |
| 3(b)(i) | heat / high temperature (1)<br>break down a substance (into two or more substances) (1) | **2** |
| 3(b)(ii) | manufacture of iron / manufacture of steel / manufacture of cement / neutralising acidic soils or lakes | **1** |
| 3(b)(iii) | neutralisation | **1** |

| Question | Answer | Marks |
|---|---|---|
| 4(a)(i) | protons: 20 (1)<br><br>electrons: 20 (1)<br><br>neutrons: 24 (1) | **3** |
| 4(a)(ii) | any suitable uses e.g. measuring thickness of paper / testing for leaks in pipes / energy production | **1** |
| 4(b) | 2 electrons in outer shell (1)<br><br>inner shells 2, 8, 8 (1) | **2** |
| 4(c) | copper < iron < samarium < sodium (2)<br>if 2 marks not scored allow 1 mark for 1 consecutive pair reversed | **2** |

| Question | Answer | Marks |
|---|---|---|
| 5(a)(i) | boiling point of chlorine: any value between –180 °C and + 50 °C (inclusive) (1)<br>density of iodine: any value between 3.2 g / $cm^3$ and 10.0 g / $cm^3$ (inclusive) (1) | **2** |
| 5(a)(ii) | increases (down the group) | **1** |
| 5(a)(iii) | solid | **1** |
| 5(a)(iv) | 3rd box down ticked (light yellow) | **1** |
| 5(b)(i) | potassium iodide (on left) (1)<br>potassium chloride (on right) (1) | **2** |
| 5(b)(ii) | fluorine is more reactive than chlorine / chlorine less reactive than fluorine | **1** |
| 5(b)(iii) | water purification / swimming pools | **1** |
| 5(c)(i) | (hydrochloric acid contains) chloride (ions) / it contains a chloride / you would get a white precipitate | **1** |
| 5(c)(ii) | chloride: white (precipitate) (1)<br><br>iodide: yellow (precipitate) (1)<br><br>precipitate (formed) for both chloride and iodide (1) | **3** |
| 5(d) | 147 (2)<br><br>If 2 marks not scored: 1 mark for 4 · 1 **OR** 4 (for H) **OR** 2 · 35.5 **OR** 71 for C$l$ | **2** |

| Question | Answer | Marks |
|---|---|---|
| 6(a)(i)i | pH 9 | **1** |
| 6(a)(ii) | 1 mark each for any three of:<br>evaporation / molecules escape from surface of ammonia<br>diffusion<br>molecules in (constant) movement / molecules collide<br>(movement of) molecules is random / in every direction<br>molecules spread out / molecules mix<br>(molecules spread) from higher concentration to lower concentration<br>(smell occurs when) molecules hit (the sensory cells in) the nose | **3** |
| 6(b)(i) | 4 (NO) | **1** |
| 6(b)(ii) | heat released / heat given out | **1** |
| 6(b)(iii) | oxygen added (to NO) | **1** |
| 6(b)(iv) | acidic oxide (no mark alone)<br>**AND**<br>nitrogen is a non-metal | **1** |
| 6(c) | irritates eyes / nose / mouth / skin / airways / lungs | **1** |
| 6(d) | ammonium nitrate | **1** |

| Question | Answer | Marks |
|---|---|---|
| 7(a)(i) | positive electrode: chlorine / $Cl_2$ (1)<br><br>negative electrode: hydrogen / $H_2$ (1) | **2** |
| 7(a)(ii) | bubbles (of gas) | **1** |
| 7(b) | (hydrochloric acid + zinc) → zinc chloride (1) + hydrogen (1) | **2** |
| 7(c) | (B), A, E, C, D, F (2)<br>If 2 marks not scored: 1 mark for 1 consecutive pair reversed | **2** |
| 7(d)(i) | 1 mark each for any three of:<br>conducts electricity / conducts heat<br>malleable<br>ductile<br>shiny / lustrous | **3** |
| 7(d)(ii) | (alloy is) harder / more durable / more resistant to wear ORA for copper (1)<br><br>(alloy is) stronger ORA for copper<br>(alloy is) more resistant to corrosion ORA for copper (1) | **2** |