Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/43**

Paper 4 Theory (Extended) **May/June 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.

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

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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: 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.

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)</td><td>
<table>
<tr><th>particle</th><th>where found in an atom</th><th>relative mass</th><th>relative charge</th></tr>
<tr><td>electron</td><td>orbiting nucleus</td><td>1/1840</td><td>–1</td></tr>
<tr><td>proton</td><td>(in the) nucleus</td><td>1</td><td>+1</td></tr>
<tr><td>neutron</td><td>in the nucleus</td><td>1</td><td>0 / nil</td></tr>
</table>
</td><td>3</td></tr>
<tr><td>1(b)</td><td>M1 electrons 18
M2 neutrons 24
M3 protons 20</td><td>3</td></tr>
</table>

Question	Answer	Marks
2(a)	difference: **M1 (**number of) neutrons similarities: **M2** (number of) protons **M3** (number of) electrons	**3**
2(b)(i)	**M1** same number of electrons **M2** (same number of) electrons in outer shell	**2**
2(b)(ii)	$Mg + 2\,HCl \rightarrow MgCl_2 + H_2$ **M1** $MgCl_2$ as product **M2** fully correct equation	**2**
2(b)(iii)	**M1** Test: lighted / burning splint **M2** Result: (squeaky) pop	**2**

Question	Answer	Marks
2(c)	**M1** (lattice of) positive ions / cations **M2** (delocalised / sea of) electrons **M3** attraction / attract between positive and negative	**3**
2(d)(i)	**M1** magnesium ion second shell shown containing 8 electrons shown as X **M2** oxide ion second shell shown containing 8 electrons, two as X and six as ● **M3** charges: magnesium ion as 2+ **and** oxide as 2-	**3**
2(d)(ii)	strong forces of **attraction** (between oppositely charged ions)	**1**
2(d)(iii)	ion**s** / Mg^{2+} **and** O^{2-} / anions **and** cations can move (throughout the structure)	**1**

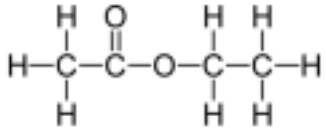
Question	Answer	Marks
3(a)(i)	any two from: • low melting point **or** low boiling point • soft • low density	**max 2**
3(a)(ii)	any one from: • fizz / bubbles • moves • floats • melts / forms a ball • gets smaller / disappears	**max 1**

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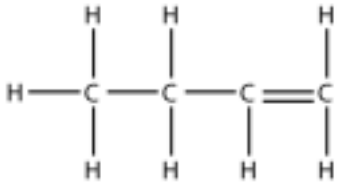
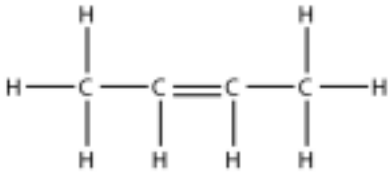
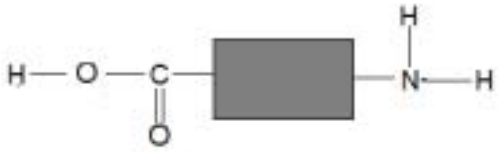
Question	Answer	Marks
3(b)	mass sodium azide = 260 (g) • Moles N_2 = (144 / 24 =) 6 • Moles NaN_3 = (6 × 2 / 3 =) 4 • M_r NaN_3 = 65 • (4 × 65 =) 260	**4**
3(c)	**M1** (sodium oxide) basic **M2** (silicon dioxide) acidic	**2**
3(d)(i)	N_3^-	**1**
3(d)(ii)	**M1** state symbols on right correct (s) then (aq) **M2** ($Pb(NO_3)_2$ +) 2 (NaN_3) → ($Pb(N_3)_2$ +) $2NaNO_3$	**2**
3(d)(iii)	**M1** filter **M2** wash with water	**2**
3(e)	**M1** 49.5 / 12 7.2 / 1 43.3 / 14 OR 4.125 7.2 3.093…. **M2** 1.33 : 2.33 : 1 OR 4 : 7 : 3 **M3** $\mathbf{C_4H_7N_3}$	**3**

Question	Answer	Marks
4(a)(i)	inert / unreactive / does not react with chlorine	**1**
4(a)(ii)	bubbles / fizzing / effervescence	**1**
4(a)(iii)	**M1** increases **M2** (solid) copper deposited	**2**
4a(iv)	**M1** colour fades / becomes pale(r) / becomes colourless / becomes lighter **M2** copper (ions) removed (from solution)	**2**
4(a)(v)	**M1** species oxidised: chloride (ions) / Cl^- **M2** explanation: loss of electrons / increase in oxidation state	**2**
4(b)(i)	**M1** spoon as cathode **M2** (pure)silver as anode **M3** aqueous silver nitrate as electrolyte **M4** $Ag^+ + e^- \rightarrow Ag$	**4**
4(b)(ii)	any one from: • Improves appearance • prevent / resist corrosion / oxidation • antibacterial	**max 1**

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Question	Answer	Marks
5(a)(i)	ethyl ethanoate	**1**
5(a)(ii)	correct structure of ethyl ethanoate showing all bonds 	**1**
5(b)	**M1** right hand energy level lower than left hand side energy level **M2** reactants and product positions identified **M3** energy change shown as approximately vertical line indicating gap between reactants and products with arrow head pointing from reactant to products. Arrow needs to be labelled	**3**
5(c)	**M1** (a substance which) increases the rate of a reaction **M2** without being used up (at the end) OR unchanged (chemically) at the end OR without changing mass	**2**
5(d)	**M1** particles / molecules in explanation **M2** (particles) move faster / more energy **M3** more collisions per second or greater collision rate **M4** more of the (colliding) molecules / particles have sufficient energy (activation energy) to react / more of the collisions have sufficient energy (activation energy) to react	**4**
5(e)(i)	**M1** less ester **M2** equilibrium moves left **and** because forward reaction is exothermic	**2**
5(e)(ii)	**M1** more ester **M2** (equilibrium moves right) to replace water	**2**

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Question	Answer	Marks
6(a)(i)	**M1** contain hydrogen and carbon **M2** only	**2**
6(a)(ii)	**M1** (Reagent): Bromine (water / solution) **M2** (Result with hydrocarbon A): becomes colourless / decolourised **M3** (Result with hydrocarbon B): no change / stays orange	**3**
6(b)		**1**
6(c)(i)	addition	**1**
6(c)(ii)		**1**
6(c)(iii)	**M1** CO on right **M2** 2n O_2 2n(CO)	**2**
6(d)	 **M1** $–NH_2$ group drawn as displayed on one end **M2** carboxylic acid group drawn as displayed on the other end	**2**

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