Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/43**

Paper 4 Theory (Extended) **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.

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

PUBLISHED

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.

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)</td><td>
<table>
<tr><td>particle</td><td>charge</td><td>relative mass</td></tr>
<tr><td>electron</td><td>M1 –1</td><td></td></tr>
<tr><td>neutron</td><td>M2 0</td><td>M3 1</td></tr>
<tr><td>proton</td><td></td><td>M4 1</td></tr>
</table>
(1) (1)
Mark by column
</td><td>2</td></tr>
<tr><td>1(b)</td><td>
<table>
<tr><td>number of electrons</td><td>number of neutrons</td><td>number of protons</td><td>symbol</td></tr>
<tr><td>M1 13 (1)</td><td></td><td></td><td></td></tr>
<tr><td>M2 10 (1)</td><td>M3 13 (1)</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>M4 19
9 (1)
M5 F (1)
M6 – (1)</td></tr>
</table>
</td><td>6</td></tr>
</table>

Question	Answer	Marks
2(a)	F	**1**
2(b)	I	**1**
2(c)	F (1) H (1) I (1)	**3**
2(d)	G (1) good conductor when solid (1)	**2**
2(e)	D (1) high melting point (1) non-conductor of electricity when solid or liquid (1)	**3**
2(f)	E (1) only conducts when liquid / conducts when liquid but not when solid (1)	**2**

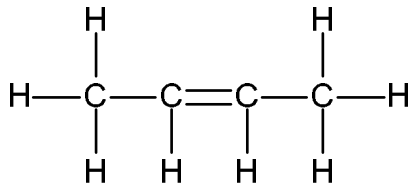
Question	Answer	Marks
3(a)	bauxite	**1**
3(b)(i)	improves conductivity / better conductor (1) lower (operating) temperature (1)	**2**
3(b)(ii)	positive: $2O^{2-} \rightarrow O_2 + 4e^-$ (1) negative: $Al^{3+} + 3e^- \rightarrow Al$ (1)	**2**
3(b)(iii)	anodes **or** carbon react with oxygen (1) (form) carbon dioxide (1)	**1**
3(c)(i)	$Mg(s) + Cu^{2+}(aq) \rightarrow Cu(s) + Mg^{2+}(aq)$ ionic equation correct (1) state symbols (1)	**2**
3(c)(ii)	any two from: • solid dissolves / disappears • blue colour of solution fades **OR** paler solution **OR** colour of solution disappears **OR** becomes colourless solution • pink or orange or brown **AND** solid	**2**
3(c)(iii)	unreactive coating of aluminium oxide	**1**
3(d)	$2Al + Fe_2O_3 \rightarrow 2Fe + Al_2O_3$ Fe_2O_3 and Al_2O_3 both correct (anywhere) (1) Equation completely correct (1)	**2**
4(a)	P_4	**1**

Question	Answer	Marks
4(b)(i)	$P_4 + 6Cl_2 \rightarrow 4PCl_3$ formulae correct (1) equation balanced (1)	**2**
4(b)(ii)	3 bonding pairs and 1 lone pair on P (1) six non-bonding electrons on 3 chlorine atoms (1)	**2**
4(c)(i)	**method 1** • (bond breaking) = 1221 or (326 × 3) + 243 (1) • (bond forming) = 1630 or (326 × 5) (1) • energy change = –409 kJ (1) negative sign essential **OR** **method 2** (ignoring 3 P–Cl bonds on both sides) • bond breaking = 243 .(1) • bond forming = 652 or 326 × 2 (1) • energy change = –409 kJ (1) negative sign essential	**3**
4(c)(ii)	exothermic **AND** energy released when bonds form is greater than energy absorbed to break bonds **OR e**xothermic **AND** overall energy change has a negative sign	**1**
4(d)	fewer **OR** less molecules **OR** moles + on right **OR** in product (1) ORA equilibrium shifts to the right (1)	**2**

Question	Answer	Marks
4(e)	any two numbers correct (1) equation fully balanced (1) $Ca_3P_2 + 6H_2O \rightarrow 3Ca(OH)_2 + 2PH_3$	**2**
4(f)(i)	NH_4^+	**1**
4(f)(ii)	PH_4I	**1**
4(g)	$Ca_3(PO_4)_2$	**1**
4(h)(i)	93.94 / 31 and 6.06 / 1 **OR** 3.03 and 6.06 **OR** 1 : 2 ratio (1) PH_2 (1)	**2**
4(h)(ii)	P_2H_4	**1**

Question	Answer	Marks
5	**M1** 5 moles of calcium nitrate (1) **M2** 10 moles ammonium nitrate (1) or ecf **M1** × 2 **M 3** M_r of ammonium nitrate = 80 **M4** 800 g or ecf **M2** × **M3**	**4**

Question	Answer	Marks
6(a)	strong = exists entirely as ions in solution / fully dissociated 100% dissociated in solution (1) acid = proton donor (1)	**2**
6(b)	50.0 (cm^3)	**1**
6(c)(i)	yellow flame	**1**
6(c)(ii)	solid dissolves / disappears (1) blue solution (1)	**2**
6(d)(i)	white precipitate	**1**
6(d)(ii)	$Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$ correct ionic equation (1) state symbols (1)	**2**

Question	Answer	Marks
7(a)	carbon-carbon double bond / C = C	**1**
7(b)(i)	3	**1**
7(b)(ii)	 (1) but-2-ene (1)	**2**

Question	Answer	Marks
7(b)(iii)	CH_2 (1) CH_2 (1)	**2**
7(c)	(broken down by) hydrolysis (1) acid (used to break down) (1) enzymes (used to break down) (1) chromatography (used to separate) (1) locating agent / (view under) UV light (used to detect) (1) measure R_f (values) or retention factor / compare with standards (used to identify) (1)	**6**
7(d)(i)	Nylon / Kevlar	**1**
7(d)(ii)	water	**1**