
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.

Cambridge International is publishing the mark schemes for the May/June 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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.

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

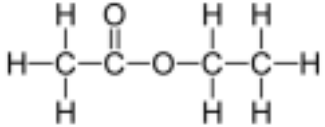
Question	Answer	Marks
2(a)	difference: M1 (number of) neutrons similarities: M2 (number of) protons M3 (number of) electrons	3
2(b)(i)	M1 same number of electrons M2 (same number of) electrons in outer shell	2
2(b)(ii)	$\text{Mg} + 2 \text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$ M1 MgCl_2 as product M2 fully correct equation	2
2(b)(iii)	M1 Test: lighted / burning splint M2 Result: (squeaky) pop	2

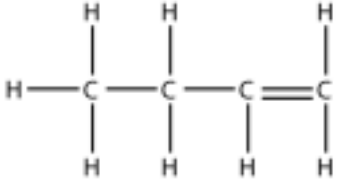
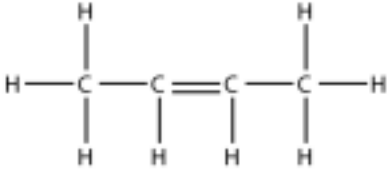
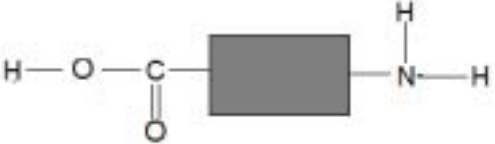
Question	Answer	Marks
2(c)	<p>M1 (lattice of) positive ions / cations</p> <p>M2 (delocalised / sea of) electrons</p> <p>M3 attraction / attract between positive and negative</p>	3
2(d)(i)	<p>M1 magnesium ion second shell shown containing 8 electrons shown as X</p> <p>M2 oxide ion second shell shown containing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

Question	Answer	Marks
3(a)(i)	<p>any two from:</p> <ul style="list-style-type: none"> • low melting point or low boiling point • soft • low density 	max 2
3(a)(ii)	<p>any one from:</p> <ul style="list-style-type: none"> • fizz / bubbles • moves • floats • melts / forms a ball • gets smaller / disappears 	max 1

Question	Answer	Marks
3(b)	mass sodium azide = 260 (g) <ul style="list-style-type: none"> • Moles $N_2 = (144 / 24 =) 6$ • Moles $NaN_3 = (6 \times 2 / 3 =) 4$ • $M_r NaN_3 = 65$ • $(4 \times 65 =) 260$ 	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 $(Pb(NO_3)_2 +) 2 (NaN_3) \rightarrow (Pb(N_3)_2 +) 2NaNO_3$	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 $C_4H_7N_3$	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: <ul style="list-style-type: none"> • Improves appearance • prevent / resist corrosion / oxidation • antibacterial 	max 1

Question	Answer	Marks
5(a)(i)	ethyl ethanoate	1
5(a)(ii)	correct structure of ethyl ethanoate showing all bonds 	1
5(b)	<p>M1 right hand energy level lower than left hand side energy level</p> <p>M2 reactants and product positions identified</p> <p>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</p>	3
5(c)	<p>M1 (a substance which) increases the rate of a reaction</p> <p>M2 without being used up (at the end) OR unchanged (chemically) at the end OR without changing mass</p>	2
5(d)	<p>M1 particles / molecules in explanation</p> <p>M2 (particles) move faster / more energy</p> <p>M3 more collisions per second or greater collision rate</p> <p>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</p>	4
5(e)(i)	<p>M1 less ester</p> <p>M2 equilibrium moves left and because forward reaction is exothermic</p>	2
5(e)(ii)	<p>M1 more ester</p> <p>M2 (equilibrium moves right) to replace water</p>	2

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