

# Atomic Structure

## Mark Scheme 1

<b>Level</b>	IGCSE(9-1)
<b>Subject</b>	Chemistry
<b>Exam Board</b>	Edexcel IGCSE
<b>Module</b>	Double Award (Paper 1C)
<b>Topic</b>	Principles of Chemistry
<b>Sub-Topic</b>	Atomic Structure
<b>Booklet</b>	Mark Scheme 1

**Time Allowed:** 69 minutes

**Score:** /57

**Percentage:** /100

**Grade Boundaries:**

9	8	7	6	5	4	3	2	1
>90%	80%	70%	60%	50%	40%	30%	20%	10%

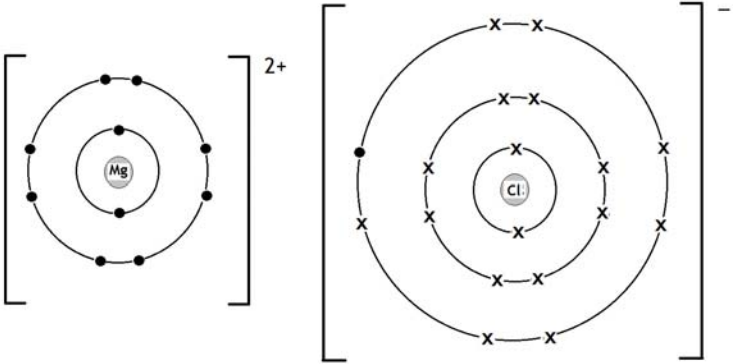
Question number	Answer	Notes	Marks
1 (a) (i)	E		6
(ii)	B		
(iii)	F		
(iv)	C		
(v)	F		
(vi)	E		
(b) (i)	<b>M1</b> (bonding/shared) electrons <b>M2</b> nuclei <b>OR</b> <b>M1</b> nuclei <b>M2</b> bonding/shared electrons	ACCEPT protons / nucleus(es)  ACCEPT nucleus(es)	2
(ii)	A <sub>2</sub> D / DA <sub>2</sub>	ACCEPT H <sub>2</sub> O  REJECT if charges shown	1

Question number	Answer	Notes	Marks
2 (a) (i)	$\text{H} \times \text{H}$ <p><b>NB</b> H does not need to be shown if touching / overlapping circles are shown</p>	ACCEPT any combination of dots and crosses  if overlapping / touching circles used both electrons must be within the overlapping/touching area	1
(ii)	<p><b>M1</b> weak forces (of attraction) between molecules / weak intermolecular forces</p> <p><b>M2</b> (therefore) little (thermal/heat) energy required to overcome these forces / separate the molecules (into the gaseous state)</p>	ACCEPT particles ACCEPT bonds for forces for both <b>M1</b> and <b>M2</b> ACCEPT correctly named IMF  IGNORE more easily separated / easier to break  REJECT atoms for both <b>M1</b> and <b>M2</b>  <b>NB</b> any mention of breaking covalent or ionic bonds scores 0	2

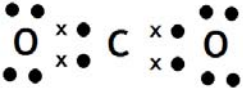
(b)	(i)	<p><b>M1</b> <u>atoms</u> of the same element</p> <p><b>M2</b> with different masses</p>	<p><u>atoms</u> with same atomic number / <u>atoms</u> same number of protons</p> <p>different mass numbers / different numbers of neutrons</p> <p>IGNORE references to electrons unless incorrect</p>	2															
	(ii)	<table border="1"> <thead> <tr> <th></th> <th><sup>1</sup>H</th> <th><sup>2</sup>H</th> <th><sup>3</sup>H</th> </tr> </thead> <tbody> <tr> <td>protons</td> <td>1</td> <td>1</td> <td>1</td> </tr> <tr> <td>neutrons</td> <td>0</td> <td>1</td> <td>2</td> </tr> <tr> <td>electrons</td> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table>		<sup>1</sup> H	<sup>2</sup> H	<sup>3</sup> H	protons	1	1	1	neutrons	0	1	2	electrons	1	1	1	<p>one mark for each correct row</p>
	<sup>1</sup> H	<sup>2</sup> H	<sup>3</sup> H																
protons	1	1	1																
neutrons	0	1	2																
electrons	1	1	1																

Question number	Answer	Notes	Marks
(c) (i)	exothermic	ACCEPT multiples and halves	1
(ii)	$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ <b>M1</b> all formulae correct <b>M2</b> balanced	IGNORE state symbols even if incorrect  turns copper(II) sulfate from white to blue scores 2	2
(iii)	<b>M1</b> (add to) <u>anhydrous/white</u> copper(II) sulfate <b>M2</b> turns blue <b>M2</b> dep on <b>M1</b> or near miss	ACCEPT equivalent description of test with anhydrous cobalt(II) chloride (blue to pink)  IGNORE any references to testing with indicators	2

Question number	Answer	Notes	Marks
(iv)	<p><b>M1</b> <u>measure/determine</u> the boiling point</p> <p><b>M2</b> 100 °C</p> <p><b>OR</b></p> <p><b>M1</b> <u>measure/determine</u> the melting/freezing point</p> <p><b>M2</b> 0 °C</p> <p><b>OR</b></p> <p><b>M1</b> <u>measure/determine</u> the density</p> <p><b>M2</b> 1 g/cm<sup>3</sup></p>	<p>ACCEPT boil the water / heat until it boils</p> <p>it boils at 100 °C</p> <p>ALLOW "heat it and it boils at 100 °C " for 2</p> <p>ACCEPT freeze the water / cool until it freezes</p> <p>it freezes at 0 °C</p> <p>ALLOW "cool it and it freezes at 0 °C " for 2</p>	2

Question number	Answer	Notes	Marks
3 a	A simple molecular B giant covalent C giant metallic D giant ionic		4
b i	M1 electron transfer AND correct direction  M2 magnesium (atoms) lose 2 electrons  M3 (each) chlorine (atom) gains an electron	If any reference to sharing electrons, 0/3 If any reference to covalent bonds, MAX 2 Penalise atoms in place of electrons each time  Accept two chlorine (atoms) gain two electrons Reject chloride in place of chlorine  M2 and M3 both correct also scores M1	3
ii		M1 for electronic configuration of $Mg^{2+}$ ion M2 for electronic configuration of $Cl^-$ ion M3 for both charges correct  Accept any combination of dots and crosses Charges can be shown anywhere so long as there is no ambiguity Brackets not essential Ignore 2 before or after chloride ion 0/3 for any diagram showing shared electrons Ignore diagrams showing electron transfer – mark only the ions formed Penalise missing inner shell(s) once only If two $Cl^-$ ions shown, both must be correct	3

Do not penalise empty third shell in  $Mg^{2+}$   
 If only 2.8 etc notations without diagram, only  
 M3 can be awarded

Question number	Answer	Notes	Marks
3 c		<p>M1 for 4 electrons in both C=O bonds          These can be shown in a vertical or horizontal line</p> <p>M2 all other electrons correct</p> <p>M2 DEP on M1          Accept any combination of dots and crosses          Ignore inner electrons even if wrong          Ignore circles around atoms          Non-bonding electrons do not need to be paired</p>	2
d i	<p>M1 positive ions / cations</p> <p>M2 delocalised electrons / sea of electrons</p> <p>M3 crystal / lattice / regular arrangement / array          / giant structure / OWTTE</p>	<p>Not just ions          Reject reference to protons/nuclei/atoms in place of cations for M1, but M2 and M3 can still be awarded</p> <p>Ignore free electrons</p> <p>Ignore layers / planes / rows or similar          Accept (electrostatic) attraction between positive ions and electrons</p> <p>0/3 if reference to ionic bonding / covalent bonding / molecules          / intermolecular forces (eg van der Waals')</p>	3



Question number	Answer	Notes	Marks
3 d ii	M1 layers / sheets / planes / rows AND (positive) ions / atoms / particles  M2 slide (over each other)	Allow OWTTE, eg slip / flow / shift / roll / move  M2 DEP on mention of EITHER layers or equivalent OR mention of ions or equivalent  Do not award M2 if protons / electrons / nuclei / molecules in place of ions, etc  If reference to ionic bonding / covalent bonding / molecules / intermolecular forces, no marks	2
			<b>Total 17 marks</b>

Question number	Expected Answer	Accept	Reject	Marks
4(a) (i)	12			1
(ii)	<b>M1</b> – 2 <b>M2</b> – two electrons in <u>outer/valence</u> shell Award M2 if M1 missing but not if incorrect Ignore references to magnesium and 2.8.2	roman numeral		1 1
(iii)	X <sup>2+</sup>	Mg <sup>2+</sup>		1
(b)	<b>M1</b> – (79 x 24) + (10 x 25) + (11 x 26) <b>M2</b> – divide by <u>100</u> <b>M3</b> – 24.3 Mark <b>M2</b> and <b>M3</b> csq on <b>M1</b> if one minor slip in numbers in M1 (eg 97 instead of 79 or 25 instead of 24) <b>M3</b> dep on <b>M2</b> Correct answer with no working scores 3 IGNORE units	(0.79 x 24) + (0.10 x 25) + (0.11 x 26) for 2 marks  24.32 with no working scores 2		1 1 1

(Total marks for Question 4= 7 marks)

Question number	Answer	Notes	Marks
5 (a) i	5		1
ii	11		1
iii	5		1
iv	6		1
v	5		1
5 (b) i	more		1
ii	more		1
iii	the same number of		1
5 (c)	cross in box D (2.8.3)		1
		<b>Total</b>	<b>9</b>