

## Mark Scheme - 2.1 Bonding, Structure and Properties

1.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	3	Ba(OH) <sub>2</sub> (1) Fe <sup>3+</sup> (1) HPO <sub>4</sub> <sup>2-</sup> (1)			
(b)	2	sodium loses an electron (1) bromine gains an electron (1)	electrons transferred (1)		

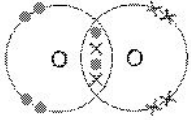
2.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	3	two discrete diagrams needed - diagram 1 showing transfer of electrons - diagram 2 showing ions  diagram 1 two potassium atoms lose 1 electron each (1) one sulfur atom gains 2 electrons (1)  diagram 2 two K <sup>+</sup> ions and one S <sup>2-</sup> ion formed (1) <i>octet of electrons around S<sup>2-</sup> not needed</i>	if transferred electrons on both potassium and sulfur award (1)		
(b)	2	two shared pairs of electrons (S—F) (1)  octet of electrons around S and both F atoms (1)			

3.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	3	<p>diagrammatic representation showing clearly two Na atoms losing 1 outer electron each (1)</p> <p>one O atom gaining 2 electrons (1)</p> <p>Na<sup>+</sup> and O<sup>2-</sup> (both needed) (1)</p> <p>there must be no ambiguity e.g. electrons cannot be on atoms and ions at the same time</p>			
	(ii)	1	<p>sodium ion 2, 8</p> <p>oxide ion 2, 8          both needed</p>			
(b)		3	<p>simple molecular (1)</p> <p>weak bonds between molecules (1)</p> <p>only a small amount of energy needed to break them (1)</p>	simple covalent	covalent	

4.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	3	<p>many strong bonds in all directions in diamond (1)</p> <p>lots of energy needed to separate atoms / break bonds (1)</p> <p>weak bonds <b>between molecules</b> therefore less energy needed to separate them (1)</p>	<p>hydrogen is simple molecular but diamond is giant covalent for (1)</p> <p>if no other credit awarded</p>		
(b)	2	<p>thermal/electrical conductivity (1)</p> <p>free moving / delocalised electrons between layers (1)</p> <p>or</p> <p>slippery / soft (1)</p> <p>layers able to move over each other / weak bonds / forces between layers (1)</p> <p>must have property for explanation mark to be awarded</p>			brittle
(c)	2	<p>two shared pairs of electrons (1)</p> <p>outer shells of both atoms complete (1)</p>  <p>must have double bond to be awarded second mark</p>			

5.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	1	B			
	(ii)	1	water		H <sub>2</sub> O hydrogen oxide	hydroxide
(b)	(i)	1	8			
	(ii)	1	4			
	(iii)	1	C <sub>2</sub> H <sub>6</sub>	CH <sub>3</sub> CH <sub>3</sub>		$  \begin{array}{c}  \text{H} \quad \text{H} \\    \quad   \\  \text{H}-\text{C}-\text{C}-\text{H} \\    \quad   \\  \text{H} \quad \text{H}  \end{array}  $

6.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		2	graphite ——— giant covalent potassium ——— metallic sodium chloride ——— giant ionic  three correct answers (2) one correct answer (1)			
(b)		1	graphite		giant covalent	
(c)		1	carbon dioxide, water, etc	CO <sub>2</sub> , H <sub>2</sub> O, etc		

7.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	2	graphite and nanotube (1) both have <b>free moving / delocalised</b> electrons (1)	mark independently		
(b)	2	graphite (1) weak bonds <b>between</b> layers / <b>layers</b> able to slide over each other (1)  [marks linked i.e. second mark cannot be awarded if first is not given]			

8.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	1	C			
(b)	1	any named metal e.g. sodium, magnesium	symbol e.g. Na, Mg		
(c)	1	A / D	graphite / metal named in part (b)	carbon	
(d)	1	B			

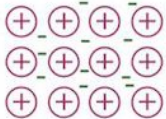
9.

Mark	Answer
6	<p data-bbox="289 289 533 315"><b>Indicative content:</b></p> <p data-bbox="289 344 1041 370">diagram showing bonding in lithium chloride with no ambiguity</p> <div data-bbox="304 407 871 665"><p data-bbox="394 630 499 662">Atom with spare electron</p><p data-bbox="730 636 865 669">Needs one electron to become stable</p><p data-bbox="499 412 667 428">Electron is given away</p></div> <p data-bbox="903 646 1587 672">to form <math>\text{Li}^+</math> and <math>\text{Cl}^-</math> (outer electrons only need be shown)</p> <p data-bbox="289 711 1797 831">description of bonding in words i.e. lithium atom loses an electron to become a positive ion, chlorine atom gains an electron to become a negative chloride ion, strong force of attraction between oppositely charged ions; high melting point due to strong bonds between the ions; conducts electricity when molten or in solution as charged ions are free to move; does not conduct when solid as ions are immobile</p> <p data-bbox="289 857 1797 977"><b>5-6 marks:</b> The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p data-bbox="289 987 1797 1075"><b>3-4 marks:</b> The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p data-bbox="289 1084 1797 1172"><b>1-2 marks:</b> The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p data-bbox="289 1182 1444 1208"><b>0 marks:</b> The candidate does not make any attempt or give a relevant answer worthy of credit.</p>

10.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		2	(silicon difficult to classify) because it has metallic and non-metallic properties (1)  response clearly indicating one or more metallic property and contrasting non-metallic property, e.g. it has a high melting point/boiling point like a metal but is brittle like a non-metal (2)	semi-metal / metalloid		it is a metal and a non-metal
(b)		1	Mg (ignore atomic number / mass number)		magnesium	
(c)	(i)	1	2			
	(ii)	1	Ag <sub>2</sub> O	Ag <sup>+</sup> <sub>2</sub> O <sup>2-</sup>		
(d)	(i)	1	antibacterial / antiviral / antifungal	kills germs / kills bacteria / antiseptic	disinfectant reduces smells	
	(ii)	1	silver nanoparticles can get into drinking water / water supplies / lakes / rivers  could be dangerous to health / harmful / toxic don't know the effect / long term effect not known  <i>uncertainty must be implied</i>		reference to the air / atmosphere / rain pollutes water / the environment	

11.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		1	2,8,1			
(b)		2	 <p>positive ions fixed positions electrons mobile / sea</p> <p>– all four points (2) – two/three points (1)</p>			
(c)	(i)	1	floats moves fizzes / bubbles goes into a round shape / melts – any two		vigorous reaction dissolves	
	(ii)	1	sodium hydroxide and hydrogen – both needed	NaOH + H <sub>2</sub>	H	
(d)		1	potassium burns / lilac flame		potassium moves faster	yellow / orange / red / green flame
(e)		2	atoms get bigger / greater distance between the (positive) nucleus and the (outer) electron (1)  outer electron more weakly held (1)			



12.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		1	C	98 and 890		
(b)		1	to prevent sodium reacting with air/oxygen/water (vapour)	prevent from oxidising / corroding	because it reacts with air/oxygen/water (vapour)	
(c)	(i)	1	yellow yellow/orange	orange		
	(ii)	2	sodium + oxygen (1) sodium oxide (1)	Na + O <sub>2</sub> (1) Na <sub>2</sub> O (1) – ignore balancing		
	(iii)	1	2Na + Cl <sub>2</sub> → 2NaCl			

13.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
		3	nanosilver has antibacterial / antiviral / antifungal properties / kills germs (1)  could be absorbed through skin / breathed in (1)  long term effects <b>unknown</b> (1)	toxic  could be released into environment		<b>can</b> cause ...