4. States of matter

4.2 Bonding and structure

Paper 2

Marking Scheme

Q1.

(d)(i)	BN	**1**
(d)(ii)	graphite	**1**

Q2.

(a)(i)	<table><tr><td>element</td><td>C (graphite)</td><td>Sn</td></tr><tr><td>state and appearance</td><td>grey shiny solid</td><td>silvery solid</td></tr><tr><td>electrical conductivity</td><td>• good/ conductor</td><td>good</td></tr><tr><td>type of bonding</td><td>• covalent</td><td>metallic</td></tr><tr><td>type of structure</td><td>giant</td><td>• giant</td></tr></table>	**3**
(a)(ii)	giant molecular	**1**
(a)(iii)	its **delocalised** electrons are free to **move**	**1**

Q3.

(e)	simple molecular (lattice structure)	**1**

Q4.

(a)(i)	bonding in magnesium – metallic **AND** bonding in sodium chloride – ionic	**1**
(a)(ii)	bonds in NaC*l* are stronger than bonds in Mg	**1**
(a)(iii)	**M1** S_8 / molecules of sulfur have more electron**s** (than P_4 / molecules of phosphorus) **M2** S has stronger instantaneous dipole–induced dipole forces (than phosphorus / P)	**2**

Q5.

(d)(i)	$pV = nRT \therefore V = 8.31 \times 630 \div 100\,000 =$ **0.0524** (m^3)	**1**

Q6.

(a)	**M1** *comment explaining high melting point of Mg in terms of* many strong metallic bonds **OR** many strong (electrostatic) attractions between cations and delocalised electrons **OR** strong bonds in giant metallic structure. **M2** *comment explaining electrical conductivity of Mg in terms of movement of delocalised electrons* delocalised electrons can move through the structure	**2**

Q7.

(a)	giant ionic	**1**

Q8.

(a)(i)	Li^+ AND S^{2-}	**1**
(a)(ii)	**M1** giant	**1**
	M2 (many) strong force(s) of attraction between oppositely charged ions OR (many) strong ionic bond(s)	**1**

Q9.

(a)(i)	easily vaporised / easily evaporates / turns to gas easily	**1**

Q10.

(a)(i)	**M1** simple molecular **M2** giant molecular **M3** weak IMFs (overcome) in P_4 **AND** strong (covalent) bonds (broken) in P	**3**

Q11.

(a)(i)	M M M C C C C	**1**

Q12.

(a)(iii)	Simple and covalent OR molecular and covalent	1

Q13.

(e)(i)	**M1:** ionic	2
	M2: ions only able / free to move / free to conduct (when liquid / molten)	
(e)(ii)	**M1:** covalent	2
	M2: hydrolysed (by water)	

Q14.

(d)	**M1:** *identification of forces broken during melting of phosphorus(V) oxide* intermolecular forces in phosphorus(V) oxide (are broken)	3
	M2: *identification of force broken during melting of magnesium oxide* electrostatic forces of attraction between (many oppositely charged) **ions** in magnesium oxide	
	M3: *statement linking difference in strength of appropriate forces described in M1& M2 to explain difference in melting point* (only) **intermolecular forces** weaker than forces (of attraction) between ions / ionic bonds	

(f)	**M1:** giant	2
	M2: covalent **AND** tetrahedral / four Si—O bonds	

Q15.

(c)	**M1** simple (covalent) / molecular / molecules	1
	M2 weak IMF / (temporary) induced dipole (forces)	1

Q16.

(b)	**M1:** decreases (down the group) **M2:** increasing induced dipoles **M3:** greater number of electrons	3