

Assessment Schedule – 2007**Chemistry: Describe the nature of structure and bonding in different substances (90308)****Evidence Statement**

Q	Evidence		Achievement	Achievement with Merit	Achievement with Excellence
One (a)	(i) <div style="display: flex; flex-direction: column; align-items: center;"> <div> $\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\ddot{\text{Cl}}: \\ \\ \text{H} \end{array}$ </div> <div> $\begin{array}{c} \text{H} \\ \\ :\ddot{\text{Cl}}-\ddot{\text{N}}-\ddot{\text{Cl}}: \\ \\ :\ddot{\text{Cl}}: \end{array}$ </div> <div> $\begin{array}{c} \text{H} \\ \diagup \\ \text{C}=\ddot{\text{O}} \\ \diagdown \\ \text{H} \end{array}$ </div> </div>	(ii) <div style="display: flex; flex-direction: column; align-items: center;"> <div>tetrahedral</div> <div>trigonal pyramid</div> <div>trigonal planar</div> </div>	Lewis structure and shape correct for TWO molecules OR all THREE Lewis structures correct OR All THREE shapes correct (All electrons must be clearly shown as pairs. Bonding pairs may be a single line or a pair of dots, but not both.)	All THREE Lewis structures and shapes correct.	
(b)(i) (ii) (iii)	There are 4 electron repulsions about the central C atom and no lone pairs on the C. Therefore, the molecule is a tetrahedral shape. There are 4 electron repulsions about the central N atom (tetrahedral) and one lone pair on the N. Therefore, the molecule is a trigonal pyramid shape. There are 3 electron repulsions around the central C atom and no lone pairs on the C. Therefore, the shape is trigonal planar.		TWO shapes correctly explained OR all THREE answers recognise the regions of negative charge about the central atom that determine shape.	Shapes of all THREE molecules correctly explained including recognition of repulsion of electron pairs around the central atom and effect of lone pairs.	

Two (a)	SiH ₄ is non-polar. <ul style="list-style-type: none">The Si–H bonds are polar, because of differing electronegativities of Si and H.However, as there are 4 electron repulsions around the central Si atom, the polar bonds are arranged symmetrically around the central atom / tetrahedral shape.The net effect is that the bond dipoles cancel, therefore the molecule is non-polar.			BOTH molecules correctly classified and ONE supporting idea given in each explanation (such as shape, asymmetry, presence of polar bonds etc) OR ONE molecule correctly classified and explained in detail.	BOTH molecules correctly classified AND explanation of both molecules includes: <ul style="list-style-type: none">Polarity of bondsShape of moleculeSymmetry of molecule	BOTH polarities correct. A full discussion of each compound is given that includes reference to: <ul style="list-style-type: none">electronegativity difference of atomspolarity of bondsshape of molecule identified (as result of electron repulsions)recognising 4 electron repulsions on S of H₂S but only 2 bonds.symmetry / asymmetry of polar bonds / bond dipoles due to shape of molecule.
(b)	H ₂ S is polar. <ul style="list-style-type: none">The H–S bonds of the molecule are polar, because of differing electronegativities of H and S.There are 4 electron repulsions around the central S atom, including 2 lone pairs.The lone pairs of electrons on the S atom cause the H–S bonds to occupy a bent shape.Therefore, the bond dipoles do not cancel and the molecule is polar.					
Three (a)		Particle	Bonding	TWO solids correctly described – particle and bonding OR all THREE particles correctly identified OR ALL bonding correctly described.		
(i)	Ag	(Ag) atoms	Metallic bonding / valence electrons are attracted to the nuclei of neighbouring atoms.			
(ii)	S ₈	(S ₈) molecules	Intermolecular forces / dispersion forces / Van Der Waals forces / London forces.			
(iii)	SiO ₂	(Si and O) atoms	Covalent bonds.			
(b)	The atoms in SiO ₂ are held together by strong covalent bonds. A lot of energy is required to break these bonds in order for the substance to melt. When S ₈ melts, the weak intermolecular forces between molecules must be broken. Less energy is required to break these forces.			Recognises that the strength of these forces determines melting point OR recognises that melting involves separating atoms in SiO ₂ / molecules in S ₈	Full explanation given for BOTH substances AND it must be obvious for S ₈ where the intermolecular forces exist.	

Four	<p>LiCl consists of positive Li^+ and negative Cl^- ions in a lattice, held together by strong electrostatic attractions / strong ionic bonds between oppositely charged ions.</p> <ul style="list-style-type: none"> • When solid, the ions are held in fixed positions in the lattice and cannot move. As there is no free moving charge, LiCl cannot conduct electricity when solid. • When LiCl melts, the strong electrostatic attractions / ionic bonds between the ions need to be broken so that ions are separated. This requires a lot of energy. Hence, the high melting point of 610°C. • Water molecules are polar, meaning they have a partial negative charge on the oxygen atoms and a partial positive charge on the hydrogen atoms. When LiCl is placed in water, the oxygen ends of the water molecules are attracted to the positive Li^+ ions, and the hydrogen ends of the molecules are attracted to the negative Cl^- ions. The water molecules then pull ions from the lattice, resulting in the solid dissolving. Cyclohexane is a non-polar solvent, meaning that the molecule has no charge separation. Therefore, cyclohexane is unable to attract ions from the lattice and the LiCl will not dissolve in the non-polar solvent. 	<p>Identifies (Li^+ and Cl^-) ions AND ionic bond / electrostatic attraction between these.</p>	<p>All THREE properties explained but discussion may lack some detail</p> <p>OR</p> <p>TWO properties clearly explained.</p>	<p>Full discussion of all THREE properties.</p>
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<p>Five</p>	<p>Diamond consists of C atoms each covalently bonded to 4 other C atoms (tetrahedrally) in a 3D arrangement. Graphite consists of C atoms each covalently bonded to 3 other C atoms (in a trigonal planar shape) in a 2D arrangement, forming layers with weak van der Waals forces between them.</p> <p><i>Diamond is very hard, while graphite is soft and slippery.</i> The covalent bonds between C atoms are in 3D and very strong, thus difficult to break. Therefore, diamond is very hard. The weak attractions between the layers of atoms in graphite are easily broken. Therefore, graphite is soft and the layers can slide over each other.</p> <p><i>Graphite will conduct electricity while diamond will not.</i> Graphite will conduct electricity, as each carbon atom is bonded to only three others, resulting in one valence electron being free to move. These free-moving electrons result in graphite's being an electrical conductor. In diamond, all of the valence electrons in each C atom are involved in bonding to other carbons. Therefore, diamond is unable to conduct.</p> <p><i>Both diamond and graphite have a high melting point.</i> In order to melt both diamond and graphite, strong covalent bonds between carbon atoms must be broken. Because of their strength, a lot of energy is required to break these bonds and separate atoms. Therefore, both diamond and graphite have a high melting point.</p>	<p>ONE property correctly compared / contrasted and explained for BOTH diamond and graphite with reference to relevant aspects of the structure and bonding of diamond and graphite.</p>	<p>TWO properties correctly compared / contrasted and explained for BOTH diamond and graphite with reference to relevant aspects of the structure and bonding of diamond and graphite.</p>	<p>THREE properties correctly compared / contrasted and explained for BOTH diamond and graphite with a full description of the structure and bonding of diamond and graphite..</p>
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Judgement Statement

Achievement	Achievement with Merit	Achievement with Excellence
<p>FIVE opportunities answered at Achievement level (or higher).</p> <p>Minimum of $5 \times A$</p>	<p>SIX opportunities answered including at least FOUR at Merit level (or higher) and TWO at Achievement level (or higher).</p> <p>Minimum $4 \times M + 2 \times A$</p>	<p>SIX opportunities answered including at least TWO at Excellence level plus THREE at Merit level (or higher) and ONE at Achievement level (or higher).</p> <p>Minimum $2 \times E + 3 \times M + 1 \times A$</p>