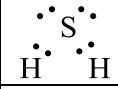
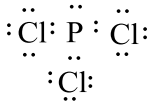
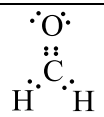
Assessment schedule 2012
AS 91164 [Chemistry 2.4] Demonstrate understanding of bonding, structure and energy changes.

Question	Expected coverage	Achievement	Achievement with Merit	Achievement with Excellence
ONE				
(a)	<table><tr><th>Molecule</th><th>Lewis structure</th></tr><tr><td>Hydrogen sulfide</td><td>  </td></tr><tr><td>Phosphorus trichloride</td><td>  </td></tr><tr><td>Methanal</td><td>  </td></tr></table>	• Two correct		
(b)	(i) Trigonal Pyramidal (ii) Linear (iii)Tetrahedral	• Two correct		
(c)	All three of the N-H bonds in ammonia are polar bonds as the nitrogen atom is more electronegative than the hydrogen atom and so has a greater attraction for the bonding electrons. As the molecule is trigonal pyramidal in shape the three bond dipoles do not cancel each other out and so the molecule is polar. In carbon dioxide the two C=O bonds are polar as the oxygen atom is more electronegative than the	• Recognises that the N-H bond is polar • Recognises that the C=O bond is polar	• Correct explanation for the ammonia molecule • Correct explanation for the carbon dioxide molecule	• Correct explanation for both molecules.

(d)	carbon atom. However in this case, since the molecule is linear, the two bond dipoles cancel each other out so the molecule is non-polar There are four areas of electron density around the central sulfur atom. These four areas will repel each other. They will take up a position so as to be as far away from each other as possible. The four areas of electrons will occupy the tetrahedral position. Since the molecule has only two bonding pairs its shape will be v-shaped or bent.		• Explains that there are 4 pairs of electrons around the central atom	• Full discussion of how the shape is derived

N0	N1	N2	A3	A4	M5	M6	E7	E8
No response OR response does not relate to the question	Describes ONE idea at the Achievement level.	Describe TWO ideas at the Achievement level.	Describes THREE ideas at the Achievement level.	Describes FOUR ideas at the Achievement level.	Explains TWO points at Merit level	Explains THREE points at Merit level	Discusses ONE point at Excellence level	Discusses BOTH points at Excellence level

Question	Expected coverage	Achievement	Achievement with Merit	Achievement with Excellence
TWO **(a)**	Bonds broken: C-H Br-Br Bonds formed: C-Br H-Br	• Three correct		
(b)	In solid water, the water molecules are bonded to each other in the solid structure by intermolecular bonds. If the solid water is to change into gaseous water, in sublimation, then these intermolecular bonds must be broken. Bond breaking is an endothermic process; energy is needed to break bonds. This reaction is therefore endothermic.	• Recognises energy is need for sublimation	• Recognises bonds are broken in sublimation	• Full explanation
(c)	$\Delta_r H$ = 175- 450 = -275kJmol^{-1}	• Correct answer		
(d)	Energy change = 275 x 3.47 = 954kJ	• Correct answer		
(e)	Since this is an exothermic reaction, indicated by the negative value of ΔH, then the energy is released.	• Energy is released	• Correct answer with units	
(f)	n(C_3H_8) = 110/44 = 2.5mol Energy released = 5537kJ Energy released when 1 mole of propane burns = 5537/2.5 = 2215kJ $\Delta_r H$ = -2215Jjmol^{-1}	• Moles correctly calculated	• Energy released calculated correctly	• Correct answer with units

N0	N1	N2	A3	A4	M5	M6	E7	E8
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<tr>
<td>THREE

(a)

(b)</td>
<td>
<table>
<tr><th>Particles</th><th>Bonds</th></tr>
<tr><td>Molecules</td><td>Intermolecular forces</td></tr>
<tr><td>Atoms</td><td>Covalent bonds</td></tr>
<tr><td>Ions</td><td>Ionic bonds</td></tr>
<tr><td>Atoms</td><td>Covalent bonds</td></tr>
</table>

Solid lead has a metallic structure with lead ions/atoms held together by a ‘sea’ of delocalised electrons. These electrons allow an electric current to flow even in solid lead.

Lead bromide solid is made up of positive and negative ions held together by ionic bonds. There are no free electrons and the ions are not free to move. However if the lead bromide is melted, the ions are free to move and an electric current can flow, carried by the positive lead and negative bromide ions.
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<td>
• Two pairs of particles/bonds correct.

• Mentions ‘delocalised’ electrons in lead structure.

• Identifies lead bromide as an ionic compound.

• Identifies ions as current carriers in molten lead bromide.
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<td>
• All correct

• Correct explanation for solid lead conductivity

• Correct explanation for conductivity of molten lead bromide
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<td>
• Full explanation for why lead conducts and lead bromide only conducts when melted
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</table>

(c)	Sodium chloride is an ionic solid consisting of positive sodium ions and negative chloride ions held together by strong ionic bonds extending through the whole crystal. In order to melt sodium chloride these strong ionic bonds must be broken. This involves a large amount of energy. This gives sodium chloride its very high melting point. Hydrogen chloride is made up of covalent molecules held together by relatively weak intermolecular forces. To melt solid hydrogen chloride only the weak intermolecular forces have to be broken. This requires only a small amount of energy. This gives hydrogen chloride a very low melting point.	• States that sodium chloride is ionic • States that hydrogen chloride is made up of molecules	• Correct explanation of high melting point of sodium chloride • Correct explanation of low melting point of hydrogen chloride.	• Comparison of sodium chloride structure and high melting point and hydrogen chloride structure and low melting point

N0	N1	N2	A3	A4	M5	M6	E7	E8
No response OR response does not relate to the question	Describes ONE idea at the Achievement level.	Describe TWO ideas at the Achievement level.	Describes THREE ideas at the Achievement level.	Describes FOUR ideas at the Achievement level.	Explains THREE points at Merit level	Explains FOUR points at Merit level	Discusses ONE point at Excellence level	Discusses BOTH points at Excellence level

Judgment statement

	Not Achieved	Achieved	Merit	Excellence
Score range	0-8	9-14	15-19	20-24