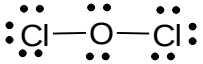
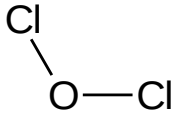
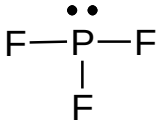
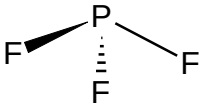
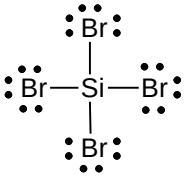
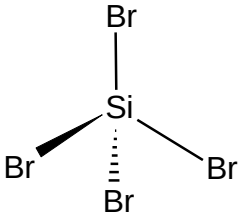
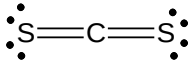
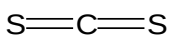
Assessment schedule
NZIC 2011
Chemistry 2.4 (AS90308)

While the writers of this assessment have worked to compile a resource that meets NCEA requirements, it has no official status and teachers may wish to adjust questions and the assessment schedule as they see fit.

<table>
<tr><th></th><th>Evidence</th><th>Achieved</th><th>Merit</th><th>Excellence</th></tr>
<tr><td>ONE
(a)</td><td>
<table>
<tr><th>Molecule</th><th>Lewis Structure</th><th>Diagram showing shape</th><th>Name of shape</th></tr>
<tr><td>Cl_2O</td><td>  </td><td>  </td><td>Bent</td></tr>
<tr><td>PF_3</td><td>  </td><td>  </td><td>Trigonal Pyramidal</td></tr>
<tr><td>$SiBr_4$</td><td>  </td><td>  </td><td>Tetrahedral</td></tr>
<tr><td>CS_2</td><td>  </td><td>  </td><td>Linear</td></tr>
</table>
</td><td>Any 3 of

2 Lewis structures (PF_3, $SiBr_4$ or CS_2) correct

2 shapes correct

Diagrams for PF_3 and CS_2 correct

Describes the number of regions around central atom for one structure.

AND</td><td>2 rows of table correct

AND

Links shape to the number and nature of regions of negative charge for one molecules</td><td>All Correct

AND

Full discussion linking shape to the number and nature of regions of negative charge.</td></tr>
<tr><td>(b)</td><td>SiF_4 has 4 electron pairs on the central atom. To minimise the repulsion between these electron pairs they take up a tetrahedral shape. Since all of these are bonding pairs, the molecule is tetrahedral.

Cl_2O is bent – there are also 4 electron pairs (clouds) on the S atom. To minimise the repulsions between these electron pairs they take up a tetrahedral shape. Two of the pairs are non–bonding (or lone pairs) the molecule shape is bent</td><td>Recognises that shape depends on repulsion between electron clouds. For any of the 3 molecules.</td><td></td><td></td></tr>
</table>

	Evidence	Achieved	Merit	Excellence
TWO **(a)**	Si-F Order of electronegativity is F > N > C > Si. Since electronegtivity difference between Si and F is the greatest the bond will have greatest polarity.	Two of Correct bond Description of polar bonds in terms of electronegativity differences between atoms. Description of polar molecules, eg polar molecules contain polar bonds / polar molecules have an uneven spread of charge (non-polar molecules have an even spread of charge) / have + and – end.	Links most polar bond to differences in electronegativity AND Links polarity of molecule to shape OR Symmetrical arrangement of polar bonds.	
(b)	Both CCl_4 and $CHCl_3$ are tetrahedral molecules. They each have 4 electron clouds about the central atom arranged in a tetrahedron (to minimise ē repulsion and each is a bonding pair). The C–Cl bonds are polar (due to the difference in electronegativity between C & Cl). However, since there are 4 C–Cl bonds the symmetry of the tetrahedral molecule means that the bond dipoles /(polarity of the bonds are cancelled so the molecule is non–polar. $CHCl_3$ is also tetrahedral molecule with 4 electron clouds about the central atom arranged in a tetrahedron. However, the electronegativity of H is different from that of Cl so the polarity of the C-H bond is different from that of the C-Cl bonds. This means that even though there is a symmetrical arrangement of the bonds, the polarity of the bonds does not cancel leaving oppositely charged regions in the molecule – i.e. the molecule is polar.			Full discussion for both molecules that includes a electronegativity differences and which links polarity of molecule to shape **AND** considers the symmetry of the arrangement of polar bonds or dipoles for both molecules.

<table>
<tr><th></th><th>Evidence</th><th>Achieved</th><th>Merit</th><th>Excellence</th></tr>
<tr><td>THREE
(a)</td><td><table><tr><th></th><th>Type of solid</th></tr><tr><td>1</td><td>METALLIC</td></tr><tr><td>2</td><td>MOLECULAR</td></tr><tr><td>3</td><td>IONIC</td></tr><tr><td>4</td><td>COVALENT NETWORK</td></tr></table></td><td rowspan="3">3 of:

Types of solid all correct

OR

(States that conductance needs mobile charged particles

OR

Describes ionic bonding

OR

Describes metallic bonding

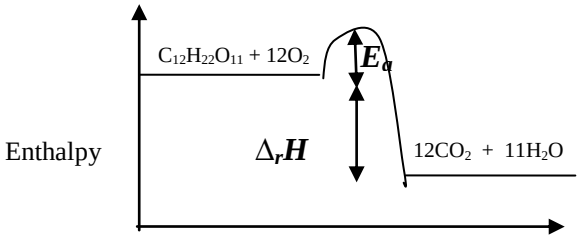
OR

describes the bonding in molecular solids (weak intermolecular forces)</td><td rowspan="3">Conductivity correctly linked to movement of particles for two solids

OR

Conductivity correctly linked to movement of charged particles in solid, molten and aqueous ionic solids.</td><td rowspan="3">Conductance fully discussed with reference to particles, type of solid and the attractive forces between particles for all solids in the states described.</td></tr>
<tr><td>(b)</td><td>To conduct an electrical current, a substance needs charged particles that are free to move Solid 3 is an ionic solid made up of a 3-D lattice of positive and negative ions. In the solid state these ions are rigidly held by strong ionic bonds and do not move around. When melted the ions move freely so are able to conduct. Similarly in aqueous solution the ions are free to move so the solution is able to conduct.</td></tr>
<tr><td>(c)</td><td>Solid 1 is a metal is made of a 3-D lattice of ions held in a sea of delocalised valence electrons. These electrons are mobile and so can conduct electricity. When heated, the lattice of ions breaks down but the electrons are still delocalized and able to conduct. In the solid state, solid 2 is composed of discrete molecules held together by weak intermolecular forces. There are no mobile charged particles (all the electrons are locked into bonds) This means that Solid 2 cannot conduct. In molten solid 2 the only particles are neutral molecules so conductance cannot occur.</td></tr>
</table>

	Evidence	Achieved	Merit	Excellence
FOUR **(a)** **(b)** **(c)**	Both Cl and S are non metals (with similar electronegativities) so they form covalent bonds by sharing electrons To melt a substance, the forces of attraction between the particles of a substance must be broken/overcome in order to separate the particles. If the forces of attraction between the particles is strong then more energy (heat) will be needed to to break the bonds/overcome the forces and the melting point will be higher. NaCl and $MgCl_2$ are both ionic solids. The ionic bonding between the ions is very strong. Therefore a large amount of energy / high temperature is needed separate the ions and change the solid to a liquid. SCl_2 and Cl_2 are both molecular substances where the molecules are held together by weak intermolecular forces. Therefore much less energy /much lower temperature is needed overcome the weak intermolecular forces and separate the molecules when changing the solid to a liquid.	Two of: Correct description of a covalent bond OR OR States criteria required to melt a substance. OR States that magnesium chloride/sodium chloride is ionic and held together by strong ionic bonds. OR States that SCl_2 and Cl_2 are molecular and held together by intermolecular forces.	Correctly identifies the type of bonding and links high/low melting point to the nature of the attractive forces for one type of solid	Reasons for differences fully discussed including relationship between meltng point and attractive forces.

FIVE	(a) (i) Exothermic (ii) Endothermic (iii) Exothermic (iv) Exothermic  (ii) Activation energy is the energy needed to get a reaction started (iii) 0.248 mol × -5645 kJ mol^{-1} = -1400 kJ (b) (i) $n(CH_3COOH)$ = 1044 g / 60 g mol^{-1} = 17.37 mol 1 mol produces 356 kJ 17 37 mol produces 356 × 17.37 = 6184 kJ (ii) 356 kJ produced from 1 mol 3.00×10^6 produced from 3 x 10^6 / 356 = 8427 mol $m(CH_3COOH) = n \times M$ = 8427 mol × 60.1 g mol^{-1} = 506463 g = 506.5 kg $V(CH_3COOH)$ = 506.5 kg / 1.044 kg L^{-1} = 485 L	Any 3 of: 3 out of 4 exo or endo Reaction profile represents exothermic reaction but some details missing Definition of E_A Calculation of energy from sucrose One step of either calculation in (b) correct	Reaction profile correct AND Either (b) (i) correct OR Mass of ethanoic acid correct	All calculations correct

Achievement	Achievement with Merit	Achievement with Excellence
4 x A	2 x M + 2 x A	3 × E + 1 × M + 1 × A OR 4E