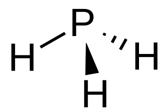
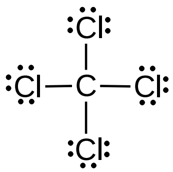
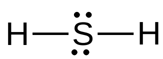
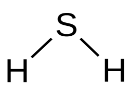
Assessment schedule
NZIC 2009
Chemistry 2.4 (AS90308)

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><td>PH_3</td><td></td><td></td><td>Trigonal pyramid</td></tr>
<tr><td>CCl_4</td><td></td><td></td><td>Tetrahedral</td></tr>
<tr><td>H_2S</td><td></td><td></td><td>Bent</td></tr>
</table></td><td>2 rows of table correct

AND</td><td>All correct

AND</td><td>All Correct

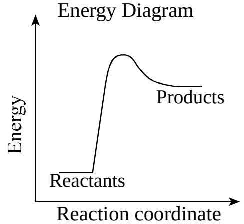
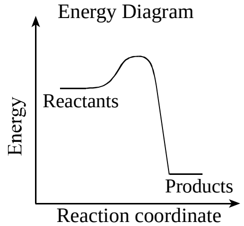
AND</td></tr>
<tr><td>(b)</td><td>PH_3 has 4 regions of electrons on the central atom. To minimise the electron repulsion these will take up a tetrahedral arrangement. Since only 3 of the electron ‘clouds’ are so bonding the shape of the molecule is a trigonal pyramid

CCl_4 also has 4 electron pairs on the central atom. Since all of these are bonding the molecule is tetrahedral.

H_2S is bent – there are 4 electron pairs (clouds) on the S atom. Because of the maximum repulsion 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>Makes link between Lewis diagram, number of regions of electrons and shape but explanation is incomplete</td><td>For all 3 molecules correctly links Lewis diagram to arrangement of electron regions and hence to positions of atoms</td></tr>
</table>

TWO	CO_2 is a linear molecule O=C=O. There are only 2 electron clouds on the central atom arranged linearly to minimise e^- repulsion. Although the C–O bonds are polar the symmetry of the molecule means that the polarity of the bonds is cancelled so the molecule is non–polar. SO_2 is a bent molecule (see Q1) The S–O bond is polar. The molecule is also polar because the lone bent shape means that the polarity of the bonds is not cancelled. Polar molecules are able to dissolve in water because they are attracted to the very polar water molecules.. However, there is very little attraction between non–polar molecules and water molecules so there is less chance that they will dissolve.	Recognizes that each molecule has a different shape and therefore different polarity.	Polarities correct and recognises relationship between polarity and shape or symmetry. AND Links solubility to polarity with limited discussion	Full discussion for both molecules that includes a electronegativity differences and acknowledges shape and symmetry AND Correctly links polarity to solubility in water
THREE (a)	A — Ionic — $BaCl_2$ B — Metallic — Cu C — Molecular — N_2 D — Covalent network — SiO_2 E — Molecular — I_2	**Any 2 of :** • 3 rows or one column	**Any 2 of :** • All correct	All table correct **AND**
(b)	• A is an ionic solid. The ions are arranged in a 3D array of alternating positive and negative ions. When pressure is placed on the solid the layers of ions can move and when ions of a similar charge are aligned they repel and cause the structure to split apart. • B is malleable because it is a metal with layers of metal atoms/ions held together by the delcoalisation of the valence electrons. The layers of atoms are able to slide over each other with out affecting the bonding • Cu is a metal. In the solid the valence electrons are delocalized and free to move through the lattice structure so it can conduct electricity. $BaCl_2$ is an ionic compound. In the solid the ions are locked into the lattice and since they are not free to move the compound does not conduct electricity.. In the molten state the ions are free to move they are able to conduct.	• Relates malleable or brittleness to arrangement of particles • Recognises that conductivity due to free moving particles.	• Either A or B All correct OR limited discussion on both • Correctly identifies the particles responsible for conductance	Correctly accounts for properties of A, B **AND** Correctly discuss the differences in conductivity

FOUR (a)	• Diamond – a 3–D array with each C atom covalently bonded to 4 other C atoms in a tetrahedral arrangement. The boiling point of diamond is extremely high because of the large number of strong C–C bonds that must be broken in this process. The hardness is due to the regular arrangement of atoms. Graphite has a similar high boiling point because a large number of strong C–C bonds must be broken before the graphite melts. However, in the case of graphite the C–C bonds lie in a trigonal planar arrangement with each C atom bonded to 3 other C atoms. The 4th valence electron is delocalized between the planes and the resulting weak force of attraction between the planes allows them to slide over each other accounting for the lubricating properties of graphite. • CO_2 is a molecular solid with weak forces of attraction between the molecules. Molecules are easy to separate so melting point is low. SiO_2 is a network solid with only strong covalent bonds between the atoms. This means that it takes a large amount of energy to separate the atoms and so it has a high melting point	Melting point linked to forces between particles AND Differences between hardness linked to solid structure.	Achieved AND One comparison correctly discussed	Comprehensive correct discussion Melting point similarity related to strength of bond AND differences in softness related to structure AND Melting point correctly related to strength of forces between particles

Question	Evidence	Achieve	Merit	Excellence
FIVE **(a)**	 The test tube would feel **COLDER** The reaction is **ENDOTHERMIC** $\Delta_r H$ is positive – energy is absorbed and the reactants have less energy than the products  The test tube would feel **WARMER** The reaction is **EXOTHERMIC** $\Delta_r H$ is negative– energy is released and the reactants have greater energy than the products	**TWO** out of **FOUR** • Both graphs • Both pairs of statements correct.	Both graphs correct AND	Both justifications AND
(b)(i)	$n = \frac{m}{M} = \frac{250}{80} = 3.125\,mol$ $\Delta_r H \times$ n = 3.125 × -630.0 = –1969 kJ Energy released = 1969 kJ	• Correct calculation of moles • Incorrect answer but correct method used for either calculation	one correct calculation OR • method correct for both calculations but minor errors	Both calculations correct
(ii)	$\frac{-200kJ}{-630\,kJ/mol} X\ 80\,g/mol = 25.4\,g$			

SIX		One step correct	One minor mistakes	All correct including units
(i)	n(HCl) = 43.1 × 11.6/1000 = 0.500mol ΔH = 500 x 4.18 × 2.6 = 5434J			
(ii)	For the dissolving of 1 mole ΔH = 5434/0.5 = 10 868 J =10.9 $kJ.mol^{-1}$			