Chemistry 2.4 AS 91164 Bonding and Energy

Molecular Solids – Predicting polarity

Success Criteria:

- Compare the shape and polarity in different molecules

Steps to answering polarity questions (x - name of atom / molecule- name of molecule given in question)

1. State: [molecule 1] is [polar/non-polar]. [molecule 2] is [polar/non-polar]

2. Explain shape of each molecule: There are [2/3/4] regions of electron clouds around the central [x] atom. These regions repel for maximum separation into a [linear/bent/trigonal planar/tetrahedral/trigonal pyramid] shape with a bond angle of approximately [180˚/120˚/109˚]. There are [2/3/4] bonding regions and [1/2] lone pairs. Therefore, the final shape of the [molecule] is [linear/bent/trigonal planar/tetrahedral/trigonal pyramid]

3. State for a polar molecule: [molecule] has [2/3/4] [x-x] polar bonds. Since there is an electronegativity difference between the 2 atoms ([x] is more electronegative than[x]) it forms bond dipoles. Due to the [bent/trigonal pyramid] shape of the molecule having [1/2] lone pairs around the central [x] atom the molecule is not symmetrical so the bond dipoles do not cancel out. Therefore [molecule] is polar.

4. State for a non-polar molecule (with polar bonds): [molecule] has [2/3/4] [x-x] polar bonds. Since there is an electronegativity difference between the 2 atoms ([x] is more electronegative than[x]) it forms bond dipoles. Due to the [linear/trigonal planar/tetrahedral] shape of the molecule having no lone pairs around the central [x] atom the molecule is symmetrical so the bond dipoles cancel out. Therefore [molecule] is non-polar.

OR

4. State for a non-polar molecule (with non-polar bonds): [molecule] has [x-x] non-polar bonds. Since there is no electronegativity difference between the 2 atoms in the bonds it does not form bond dipoles. Therefore [molecule] is non-polar.

Sample NCEA Style Questions:

1. Elements M and X form a compound MX_2. Atoms of element X have a higher electronegativity value than atoms of element M, therefore the M–X bonds are polar.

Depending on what elements M and X are, molecules of the compound formed will be **polar** or **non-polar**.
State the most likely shape(s) of the molecule if it is: Polar/non-polar
Justify your answer and draw diagrams of the possible molecules with dipoles labelled.

2. Molecules can be described as being polar or non-polar.

The following diagrams show the Lewis structures for two molecules, **SO_2** and **CO_2**.

O = C = O O = Š - O

Circle the term that describes the **polarity** of each of the molecules. Polar or non-polar
For each molecule, justify your choice.