SCH4U1 Name:
SP08 Date:

Bond Dipoles and Molecular Dipoles

Bond Dipoles

Recall that molecular compounds contain covalent bonds. Covalent bonds can be classified as covalent or polar covalent based on the electronegativity (EN) of the bonded atoms. **Electronegativity** is a relative measure of an atom's electron attracting ability in a bond. By calculating the electronegativity difference (∆EN), bonds can be classified.

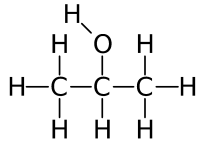
$\Delta EN = EN_2 - EN_1$
where: EN_2 is the electronegativity of element with higher EN
EN_1 is the electronegativity of element with lower EN

Although every bond is distinct, the following guidelines are used to classify bonding:

e.g. N_2 NH_3 K_3N

Recall that a polar covalent bond exists if the two bonding electrons are not equally shared between the two atoms. A **bond dipole** exists if the two atoms have different electronegativities (i.e. ∆EN > 0). Since the electrons are attracted towards one atom, that atom has a partial negative charge (δ^-) and the other atom has a partial positive charge (δ^+).

e.g. 2-Propanol (isopropyl alcohol or rubbing alcohol) has the following structure:



Identify the types of bonds in 2-propanol and rank them according to increasing polarity. Indicate the bond dipole in each bond.

Predicting Molecular Polarity

Bond polarity refers to the unequal distribution of charge in a bond. Similarly, molecular polarity refers to the asymmetrical distribution of charge in a molecule.
Both <u>bond polarity</u> and <u>molecular shape</u> must be considered to determine if a molecule is polar. Overall, molecular polarity can be determined with the vector addition of all bond dipoles in a molecule.

1) Diatomic Molecules
With a diatomic molecule, there is only one bond so a bond dipole always results in a molecular dipole.

e.g. H – Cl

e.g. F – F

2) Polyatomic Molecules
With larger molecules, there are two or more bonds to consider and thus one has to consider the number and orientation of several bond dipoles. With these molecules, a molecular dipole only exists if the bond dipoles do not cancel each other out.

e.g. BeF_2

e.g. F_2O

Double and Triple Bonds
e.g. CO_2

e.g. C_2F_4