1-5: Molecule Polarity Lab

A study of electronegativity, bond polarity, and molecular polarity

Instructions: Click on the link provided on the assignment page or go to: http://phet.colorado.edu/en/simulation/molecule-polarity and click run.

Introduction:

In this atomic-level simulation, you will investigate how atoms' ***electronegativity*** value affects the bonds they produce. When two atoms bond, a pair of electrons is shared between atoms. Electronegativity is a measure of a single atom's ability to hoard electrons shared in that bond.

Part 1 - Procedure:

- Begin with the 2 atoms tab on the top
- Turn on (check) all view options and electron density.
- Take your time and investigate how the compound's bond behaves when the atom's electronegativity and orientation are changed. Do not rush through this step.

1. Describe the bond formed between two atoms with **similar, low** electronegativities.

2. Describe the bond formed between two atoms with **similar, high** electronegativities.

3. Describe the bond formed between two atoms with **very different** electronegativities.

4. δ- represents:

5. δ+ represents:

6. What happens when the electric field is applied to a very polar molecule?

7. Why do you think this is?

8. What is **electron density**?

9. How does the density around a partial positive compare to the density of a partial negative?

10. What would bring about a higher electron density around an atom?

11. A bond is characterized as ionic or covalent by comparing the differences between two atoms' electronegativities. Describe an ionic bond in terms of the atoms' electronegativity values.

12. Describe a covalent bond in terms of the atoms' electronegativity values.

13. Additionally, we further separate covalent bonds into ***polar*** *covalent* and ***nonpolar*** *covalent*. What would have to be the case for a bond to be *nonpolar covalent*?

Part 2 - Procedure:

- Click on the "Three Atoms" tab at the top of the simulator
- Check all the view options

In this simulation realize that in addition to changing the electonegativities, you may also move individual atoms by dragging them with the mouse. Here, in addition to bond polarity (represented by the ***bond dipole***), the ***entire molecule may be polar*** (represented by the ***molecular dipole***). It is this molecular dipole that determines the polarity of the molecule and how it interacts with other molecules and its environment.

❖ Take some time and adjust each of the atom's locations and electronegativity values several times. Observe how the bond dipoles (between A-B and B-C) add to produce a molecular dipole.

1. How might a molecule with two strong bond dipoles have no molecular dipole at all?

2. How might a molecule have a very strong molecular dipole.