Name: _____

Molecule Polarity PhET Lab

Search Google for "PhET". Click on the link and search for the Polarity Lab. Open the simulation by clicking the "Run Now" Icon.

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

1) From what you've already learned about trends of the periodic table, what would cause an atom to have a **high electronegativity value**?

2) How do additional energy levels affect an atoms' electronegativity value?

Procedure: Two Atoms

1) Turn on (check) all view options on the right. In the surface category, click Electrostatic Potential

Create the following situations by dragging the slider above each atom changing the electronegativity values: Describe in detail the bond character, charges, dipoles, and any other characteristics of the situations following:

2) Atom A: High electronegativity, Atom B: Low electronegativity:
a) Specifically, where are the charges found in this molecule? (Electrostatic Potential– who is +? and who is -?)

b) Where does the dipole point to?

c) Describe the polarity of the bond: (Polar Covalent/Nonpolar Covalent/Ionic)

3) Atom A: Low electronegativity, Atom B with an average (middle position) electronegativity:
a) Specifically, where are the charges found in this molecule? (Electrostatic Potential– who is +? and who is -?)

b) Where does the dipole point to?

c) Describe the polarity of the bond: (Polar Covalent/Nonpolar Covalent/Ionic)

4) Atom A: High electronegativity, Atom B: High electronegativity:
a) Specifically, where are the charges found in this molecule? (Electrostatic Potential– who is +? and who is -?)

b) Where does the dipole point to?

c) Describe the polarity of the bond: (Polar Covalent/Nonpolar Covalent/Ionic)

7) Describe (in your own words) what is meant by each the dipoles, **δ-** and **δ+**.

In the surface box to the right, switch the view to electron density: Experiment with different situations.

8) Describe the density of electrons around positively charged atoms compared to the density of electrons around negatively charged atoms.

9) 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. (Don't write numbers)

10) Describe a covalent bond in terms of the atoms' electronegativity values. (Don't write numbers)

11) Additionally, we further separate covalent bonds into ***polar*** *covalent* and ***nonpolar*** *covalent*. What is true about the electronegativity difference for a *nonpolar covalent bond*? (Don't write numbers)

Three Atoms Switch the tab at the top to three atoms: **In the view category, click on all items!** In this simulation realize that in addition to changing the electonegativities, **you may also move individual atoms by dragging them with the mouse.**

12) Describe how a molecule with strong polar bonds could have no molecular dipole at all?

13) Experiment with the three atoms simulation. Choose **two** situations where the atoms have different electronegativites, and different angles between each atom. Illustrate those situations below including each atom's electronegativity, draw the bond polarities (bond dipoles), and draw the molecule's polarity (molecular dipole).

Atom A Electroneg. | Atom B Electroneg. | Atom C Electroneg.

Atom A Electroneg. | Atom B Electroneg. | Atom C Electroneg.

Real Molecules Switch tabs to Real Molecules: View all items and switch surface to Electrostatic Potential. ***Using the simulation***, examine each molecule and indicate **P for Polar and NP for nonpolar** in the table below:
******Notice that some molecules have been omitted and you will need to skip them!!!********

Molecule	H_2	N_2	O_2	F_2	HF	H_2O	CO_2	HCN	O_3	NH_3	CH_2O	CH_4	CH_3F	CH_2F_2	CHF_3	CF_4	$CHCl_3$
Bond Polarity (Between Atoms)																	
Molecule Polarity (Symmetry)																	