1. Go to <https://phet.colorado.edu/en/simulation/molecule-polarity>. Click on the picture of the simulation to launch it.

**Part 1** (\*Make sure to take at least one screenshot of this part!)

1. Choose Two Atoms.
2. Under View, click the box to show Partial Charges.
3. Without changing anything else, answer the following questions:
   1. Which atom is more electronegative?
   2. Which atom has the partial negative charge?
   3. Which atom has the partial positive charge?
   4. Which atom does the bond dipole point toward?
   5. Spin the molecule by clicking and moving one of the atoms. What happens to the bond dipole as you spin the molecule?
4. Change the electronegativity of Atom A so that it is all the way to the right under “more.” Do not change Atom B. What happened to the bond dipole and the partial charges?
5. Change the electronegativity of Atom B so that it is all the way to the left under “less.” Keep the slider for Atom A all the way under “more.” What happened to the bond dipole and the partial charges?
6. Change the electronegativity of Atom B so that it is all the way to the left under “less.” Keep the slider for Atom A all the way under “more.” What happened to the bond dipole and the partial charges?
7. Change the electronegativities of Atom A and Atom B so that they are the same. What happens to the bond dipole and the partial charges?

**Part 2** (\*Make sure to take at least one screenshot of this part!)

1. At the bottom of the screen, choose Three Atoms.
2. Under View, click the boxes so that Bond Dipoles, Moleular Dipole, and Partial Charges are all showing.
3. Without changing anything else, answer the following questions:
   1. What is the molecular shape of the molecule shown?
   2. Which atom(s) is more electronegative?
   3. Which atom(s) has the partial negative charge(s)?
   4. Which atom(s) has the partial positive charge(s)?
   5. In the space below, sketch the diagram that’s on the screen, including the bond dipoles, molecular dipole, and partial charges.
   6. How is the molecular dipole related to the bond dipoles?
4. Change the electronegativities of Atom A and Atom C all so that they are both all the way to the right under “more.” What happened to the bond dipoles, molecular dipole, and partial charges?
5. Click on Atom C and drag it until you make a linear molecule. What happens to the bond dipoles, molecular dipole, and partial charges?
6. Change the electronegativity of Atom C all so that it is all the way to the left under “less.” What happened to the bond dipoles, molecular dipole, and partial charges?

**Review Questions**

1. How can you determine which way to draw a bond dipole?
2. How can you determine which element will have a partial negative charge and which will have a partial positive charge in a polar bond?
3. How does the difference in electronegativity of the two atoms in a bond affect the polarity of the bond?
4. Why is it important to take both the polarity of the bonds and the VSEPR shape of the molecule into consideration when determining the polarity of the molecule?
5. For each molecule below,
   1. Draw the Lewis structure, using wedges and dashes to indicate the VSEPR shape as necessary.
   2. Draw the bond dipole for all polar bonds.
   3. Determine if the overall molecule is polar or nonpolar.

HCN O2 CF4