

Name:

Period:

Title: MODELS OF MOLECULAR COMPOUNDS

Background: The way compounds (chemically bonded atoms) act depends not only on what the atoms are, but also how the whole compound, or molecule, is shaped. Molecular shape determines a compound's boiling point, freezing point, viscosity (thickness or stickiness), and the nature of its reactions.

The geometry (or shape) of a small molecule can be determined by looking at the atom in the middle and figuring out how many atoms are bonded to it and whether or not there are any unshared electrons. The VSEPR rule states that electron pairs will arrange themselves as far apart from each other as possible.

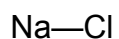
The type of bond between two atoms can be determined by comparing the electronegativities of the two atoms. If the electronegativity difference is 2.0 or greater, the bond is ionic. If the difference is between 0.5 and 1.9, it is a polar covalent bond. If the difference is below 0.5, the bond is a nonpolar covalent bond. Once the polarity of each bond has been determined, you can determine whether or not the entire molecule is polar.

In this lab, you'll be using ball-and-stick models to "look" at molecule shapes and predict whether or not they are polar.

Pre-Lab Questions:

1. What is a covalent bond? Describe electronegativity differences and what's going on with electrons.
2. What is an ionic bond? Describe electronegativity differences and what's going on with electrons.
3. How can you predict, very basically, whether a bond will be ionic or covalent, using the periodic table?
4. What does it mean if a molecule is "polar"? Answer as completely as possible.
5. List five different molecular geometries. Refer to your notes and/or the book.

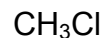
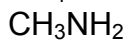
6. Calculate the electronegativity difference **and** bond type for the following examples. (Figure 6-18 on page 169 in your book lists electronegativities for various atoms.)



Problem: How can the polarity of molecules be predicted from their geometry and the types of bonds they contain?

Procedure:

1. Construct ball-and-stick models of the following compounds:



2. Fill in Data Table 1. The first line has been filled in for you as an example.
3. Finish with the analysis questions.

Data Table 1: Structure and Polarity of Molecules

Chemical Formula	Count Atoms	Structural Formula (Draw using molecular model kit)	Lewis Structure for each atom & # valence electrons	Lewis Structure for Molecule	Shape of Molecule	Polar or Nonpolar?
H₂	2	H-H	H· 1 V.E.	H : H	Linear	Nonpolar
PH₃						
N₂						
H₂CO						
HCOOH						
HBr						
CH₄						

Chemical Formula	Count Atoms	Structural Formula (Draw using molecular model kit)	Lewis Structure for each atom & # valence electrons	Lewis Structure for Molecule	Shape of Molecule	Polar or Nonpolar?
CH₃NH₂						
C₂H₂						
HCN						
H₂O						
HClO						
NH₃						
I₂						

Analysis Questions:

1. How were you able to use the molecular shapes to predict whether or not the molecule was polar? Explain and give at least two examples from the lab.
2. What two factors determine whether or not a molecule is polar?
3. The polarity of a substance can have a great effect on its reactivity and solubility. A rough rule of thumb for solubility is “like dissolves like”, which means that polar substances dissolve in polar substances, and nonpolar substances dissolve in other nonpolar substances. What can you predict about the polarity of alcohol if you know that alcohol dissolves in water?
4. Why do you think that water is not used to dissolve greasy stains and dirt at dry cleaners? (What must be true about grease and dirt?)