

Refresher on Polarity

One of the very first topics covered in Gen Chem II is understanding how molecules interact with each other. A lot of these interactions are governed by whether a molecule is polar or not, so we need to be able to quickly determine if a molecule is polar or nonpolar. Whether you remember this perfectly, or it's been a little while (that's ok!), work with your group on the following exercises:

First, identify if the substance is an ionic compound or a molecule:



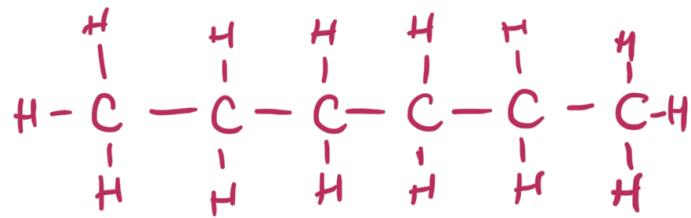
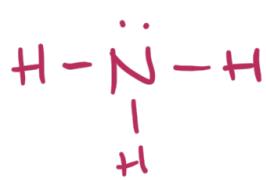
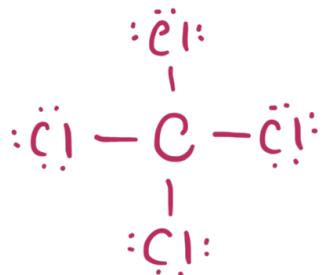
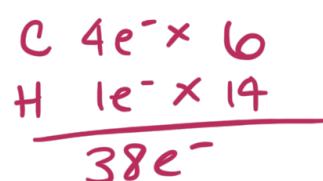
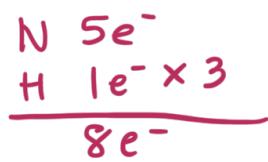
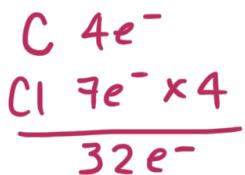
Explain how you differentiated between the ionic compounds and the molecules.

Ionic compounds are formed from a cation & an anion, usually a metal & a nonmetal

Molecular compounds are nonmetal + nonmetal.

Now, take the molecules and draw the Lewis dot diagram for each.

valence electrons!



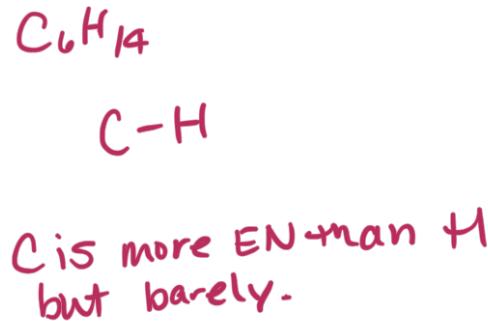
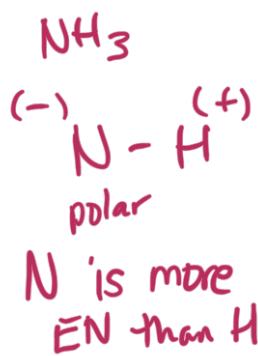
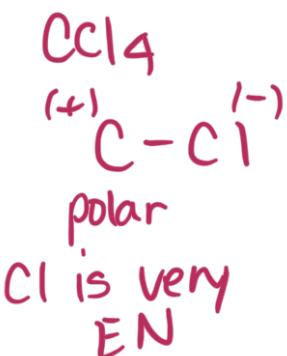
Once we have the Lewis Dot Diagram we now need to determine two things:

- (1) Does the molecule contain any polar bonds?
- (2) What is the shape of the molecule?

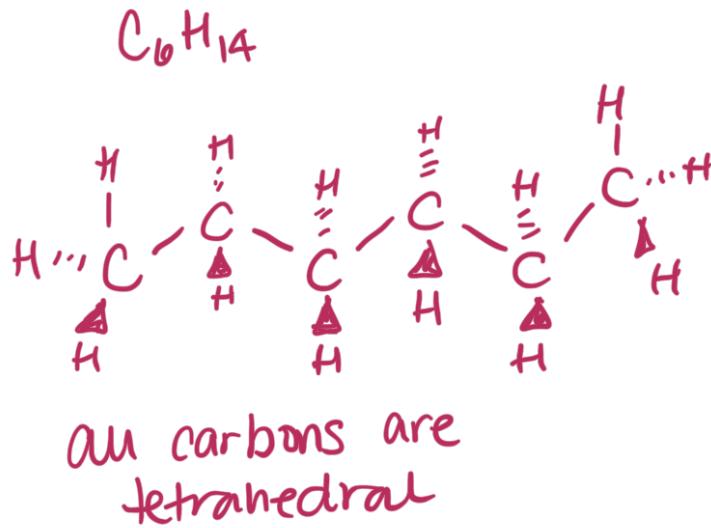
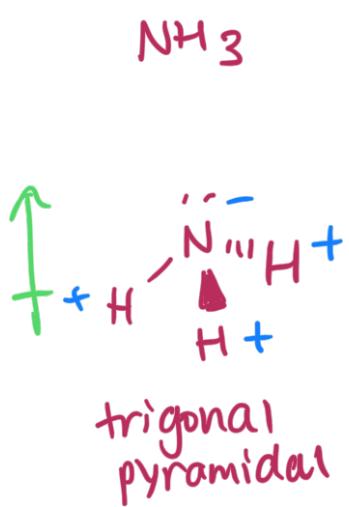
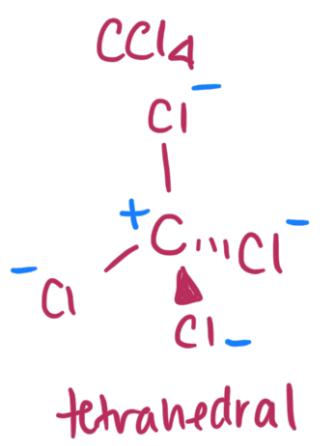
How do we determine if a bond is polar? Determine within your group how you would do this. Explain below:

Compare the electronegativity between the two elements in the bond. EN is how badly an atom wants an electron.

For your molecules, identify any polar bonds. Label which side of the bond is (+) and which side is negative (-).



Now that we know if there are polar bonds we need to know what the molecule looks like. For each molecule, determine the shapes with VSEPR theory. Remember each central atom will have a shape. Draw the molecule in "3D".



Label any polar bonds on top of the 3D molecules. Label (+) and (-).

Labeled w/ Blue

For a molecule to be polar there needs to be an overall positive side of the molecule and an overall negative side, what we call a dipole (two poles). Look at your molecules and identify if there is a dipole (look for clusters of one type of charge on one side of the molecule). If there is a dipole, draw an arrow (\longleftrightarrow) where the arrow points towards the negative side of the molecule.

Labeled in green

Based on your drawings, which molecules are polar?

Only NH_3 is polar! It's the only one with a clear (+) & (-) side to the molecule.

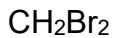
Can you have a molecule which contains polar bonds, but is not polar? Explain.

Yes! CCl_4 has 4 polar bonds but because they all point out away from carbon, there is no negative side to the molecule.

Why did we only look at molecules for polarity? Why not consider the ionic compounds?

Because polar bonds only exist in covalent bonds, which occur in molecules. Ionic compounds are held together by attraction between ions!

Using the workflow from above practice determining if the molecules below are polar or nonpolar...



nonpolar

polar

polar

nonpolar

polar