

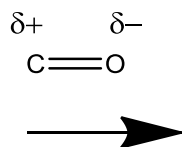
Answer on Question #57493 - Chemistry - Organic Chemistry

Question:

Why bond polarity and molecular geometry determine molecular polarity?

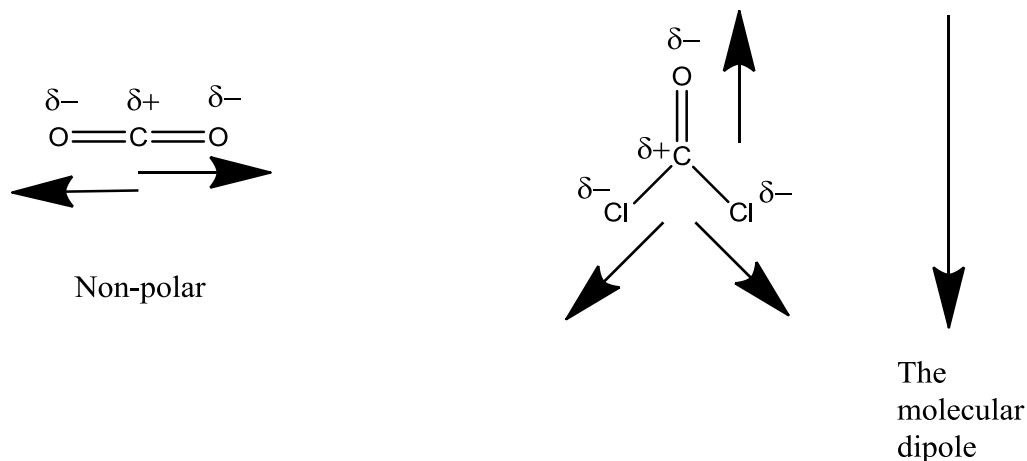
Answer:

In short, each heteroatomic bond is polar because of the different electronegativities of these atoms. This leads to the formation of the opposite charges on the atoms, so-called dipole, and can be represented by an arrow:



The dipole has a definite orientation and magnitude which equals the charge multiplied by the distance between atoms.

Since the dipole is a vector, the polarity of the molecule is defined by the vector sum of all bond dipoles presented in its structure. This is an answer why bond polarity and orientation of the bond determine the molecular polarity. For instance,



Despite the CO₂ has two polar bonds (two bond dipoles) it remains non-polar, because these dipoles are oriented to opposite sides so that their vector sum is zero. (See the first figure above)

In COCl₂ there are three polar bonds forming three different dipoles and their vector sum has non-zero value which provides the polarity to the entire molecule.