

## Activity 14: Bond Polarity

### *Learning Objectives*

*Predict bond polarity based on electronegativity*

*Predict molecular polarity*

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**Estimated Completion Time**      20–30 Minutes

### **Instructor Information**

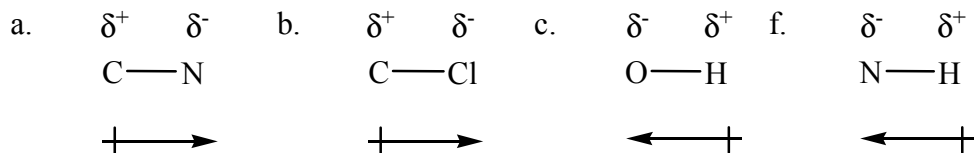
It is useful to use electronegativity values to estimate bond polarity; however, students should be able to predict polarity without having access to electronegativity values.

### **ANSWERS TO QUESTIONS**

#### Bond Polarity

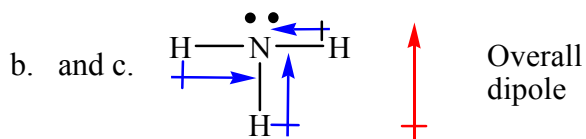
1.
  - a. Polar covalent; C and N have different electronegativities.
  - b. Polar covalent; C and Cl have different electronegativities.
  - c. Polar covalent; O and H have different electronegativities.
  - d. Nonpolar covalent; both hydrogens have identical electronegativities.
  - e. Nonpolar covalent; this is the exception—a C—H bond is considered nonpolar.
  - f. Polar covalent; N and H have different electronegativities.

2.

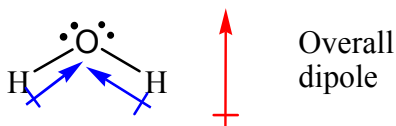


### Molecule Polarity

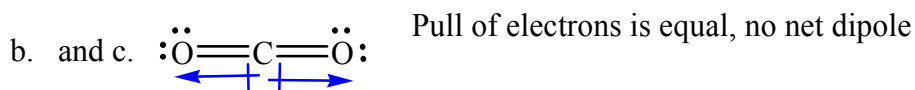
3. a. The shape is pyramidal. It follows the VSEPR form  $AB_3N$ .



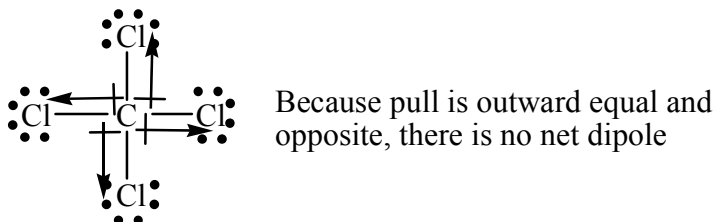
4. One side of the molecule is negative (in this model, the top), so the molecule does have a dipole. The geometry is bent.



5. a. Carbon dioxide is a linear molecule.

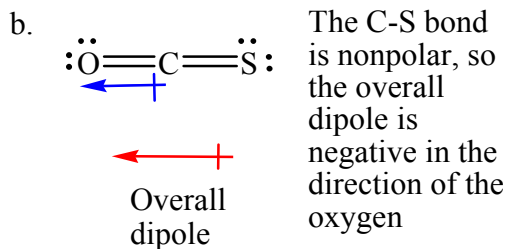
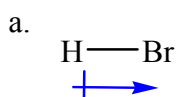


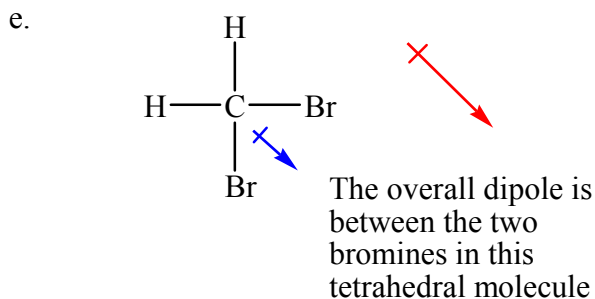
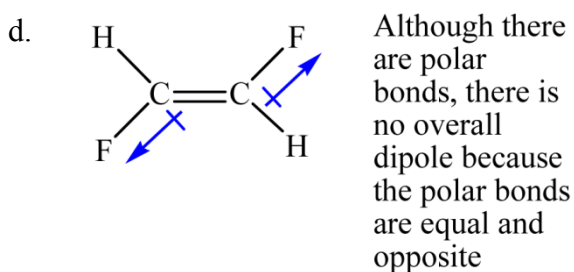
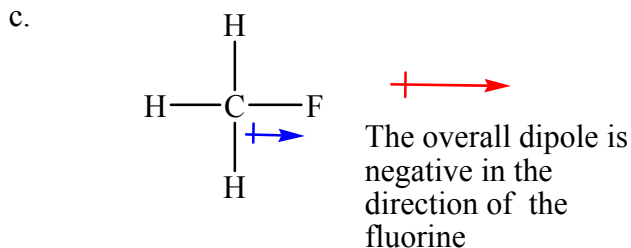
6. a. The geometry is tetrahedral.



7. If the polar bonds are distributed equally and no area of a molecule is more positive or negative than another area, then there is no net dipole and the molecule is nonpolar.

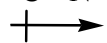
8.

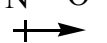


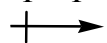


### Activity 14: Skill Development

1.

- $\delta^+ \quad \delta^-$   
 $\text{C}-\text{N}$   


On the periodic table, nitrogen is closer to fluorine than carbon is, so nitrogen is more electronegative and attracts the bonding electrons more strongly, giving it a partial negative charge.
- $\delta^+ \quad \delta^-$   
 $\text{N}-\text{O}$   


Oxygen is closer to fluorine than carbon, so oxygen is more electronegative and attracts the bonding electrons more strongly, giving it a partial negative charge.
- $\delta^+ \quad \delta^-$   
 $\text{P}-\text{F}$   


Fluorine is the most electronegative of all elements, so it attracts the electrons in this bond more strongly, giving it a partial negative charge.

2. In general, the farther apart two atoms are on the periodic table, the greater the difference in their electronegativities and, therefore, the more polar the bond between them.

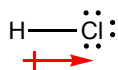
a. C–Cl is the more polar bond.

b. N–Cl is the more polar bond.

c. Si–F is the more polar bond.

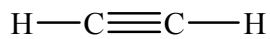
3.

a. Polar



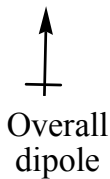
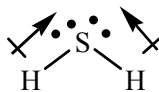
Because this molecule contains one bond, the bond and molecular dipoles are the same.

b. Nonpolar



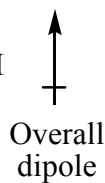
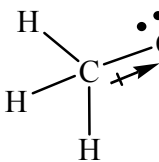
C–H bonds are nonpolar.

c. Polar



Overall  
dipole

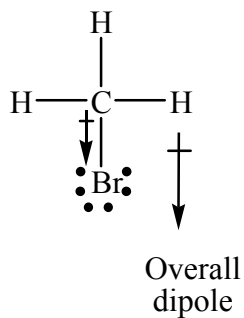
d. Polar



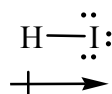
Overall  
dipole

4.

a. Polar

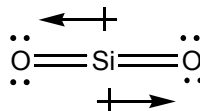


b. Polar



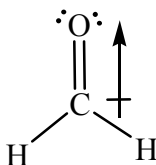
Because this molecule contains one bond, the bond and molecular dipoles are the same.

c. Nonpolar



The Si-O double bonds are polar. This molecule has a linear shape, so the dipoles cancel each other.

d. Polar



Because this molecule contains one polar bond, the bond and molecular dipoles are the same.