Molecular Polarity Practice

A polar molecule has an overall permanent dipole, meaning it has an uneven distribution of electronegativity. Several factors, such as bond polarity and molecular shape, help determine a molecule's polarity.

1. Start by considering if the molecule has polar bonds.
    a. A bond is generally considered polar when there is a difference in electronegativity between the two atoms. Recall electronegativity trends.

2. Next, determine if the molecule is symmetrical based on its geometry
    a. Typically Symmetric: trigonal planar, tetrahedral, linear (triatomic)
    b. Typically Asymmetric: bent, pyramidal, diatomic (different atoms)

3. Lastly, consider if the exterior atoms are the same or different
    a. Same: bond polarities will cancel
    b. Different: an electronegativity difference will exist, and bond polarities will not cancel

Think of dipole arrows as vectors with magnitude and direction pointing towards the more electronegative atom.

Use these steps to determine whether the following molecules are polar or nonpolar. Explain.

1. CO_2
2. H_2O
3. BF_3
4. NH_3
5. CCl_4
6. SO_2
7. CH_4
8. HCN
9. SF_4
10. XeF_2
11. CH_2Cl_2
12. $BeCl_2$
13. ClF_3
14. CF_4

Answer Key

1. Nonpolar: symmetric with consistent exterior atoms -> dipoles cancel
2. Polar: asymmetric -> dipoles don't cancel
3. Nonpolar: symmetric with consistent exterior atoms -> dipoles cancel
4. Polar: asymmetric -> dipoles don't cancel
5. Nonpolar: symmetric with consistent exterior atoms -> dipoles cancel
6. Polar: asymmetric -> dipoles don't cancel
7. Nonpolar: symmetric with consistent exterior atoms -> dipoles cancel
8. Polar: symmetric but inconsistent exterior atoms -> dipoles don't cancel
9. Polar: asymmetric -> dipoles don't cancel
10. Nonpolar: symmetric with consistent exterior atoms -> dipoles cancel
11. Polar: symmetric but inconsistent exterior atoms -> dipoles don't cancel
12. Nonpolar: symmetric with consistent exterior atoms -> dipoles cancel
13. Polar: asymmetric -> dipoles don't cancel
14. Nonpolar: symmetric with consistent exterior atoms -> dipoles cancel