

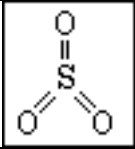
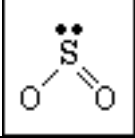
Molecular Polarity for Simple Chemical Species

The general factors to consider in predicting molecular polarity are:

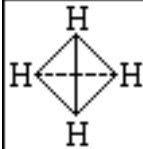
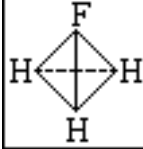
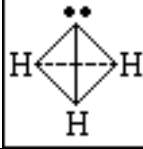
1. Does the molecule have polar bonds?
2. Are the electron regions around the central atom, or around a more complex molecule, symmetrically arranged?
3. Are the species present at the electron regions the same?

Geometry	Similar Regions
Linear	Ends
Trigonal Planar	Corners of the triangle
Tetrahedral	corners of the tetrahedron
Trigonal Bipyramidal	two axial positions as a set, three equatorial positions as a set
Octahedral	Corners of the octahedron

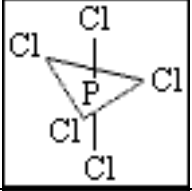
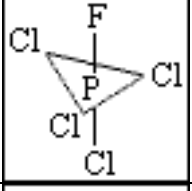
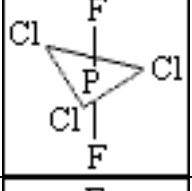
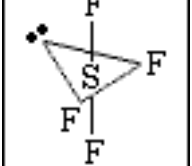
Trigonal Planar Examples

SO ₃		all triangle corners are the same. Nonpolar.
SO ₂		all triangle corners are not the same. Polar.

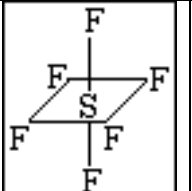
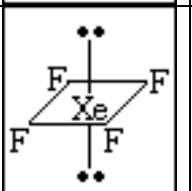
Tetrahedral Examples

CH ₄		all tetrahedron corners are the same. Nonpolar.
CH ₃ F		all tetrahedron corners are not the same. Polar.
NH ₃		all tetrahedron corners are not the same. Polar.

Trigonal Bipyramidal Examples

PCl ₅		two axial positions are the same, and three equatorial positions are the same. Nonpolar
PCl ₄ F		two axial positions are not the same. three equatorial positions are the same. Polar. Since the three equatorial positions cancel each other for polarity, the polarity direction would be toward the axial F.
PCl ₃ F ₂		the two axial positions are the same the three equatorial positions are the same. Nonpolar.
SF ₄		the two axial positions are the same the three equatorial positions are not the same. Polar. Polarity direction would be quite difficult to predict with two F versus a lone pair.

Octahedral Examples

SF ₆		all octahedron corners are the same. Nonpolar.
XeF ₄		all octahedron corners are not the same. All opposite corners are the same; symmetry takes precedence. Thus, there is no preferred polarity direction. Nonpolar.

Organic Molecules

Hydrocarbons	C - H bonds slightly polar, but regions distributed symmetrically. Non-polar
Organic Halides	C - halogen bonds are polar, symmetry of bond locations determines polarity
Amines, alcohols	O and N have high electronegativities and polar bonds, geometry is asymmetric, will result in partial negative regions on molecule and some polarity (hydrogen bonding?)
Carbonyl compounds	C = O bond is polar and geometry is asymmetric, partial negative region and polarity depend on location (hydrogen bonding?)