

will not have the same shape as CH_4 . Molecular shape describes the arrangement of **atoms** about the central atom. When determining the molecular shape, you must consider the electron group geometry and the number of **lone pairs** bonded to the central atom. The possible combinations of electron groups and lone pair electrons are summarized in the chart I gave you.

Using our chart, we can predict that CH_4 has a tetrahedral molecular shape while NH_3 has a trigonal pyramidal molecular shape.

After the geometries have been assigned to a molecule, we decide if there is more than one correct structure for it. These correct structures are called resonance structures. Lastly, we can use the molecular shape to determine if electron density is evenly distributed across the molecule. If electron density is unevenly distributed across the molecule, the molecule is said to be polar. A molecule with a uniform charge distribution is nonpolar. But first you must learn how to draw Lewis dot structures...

The Assignment

You are to determine the Lewis structure, electron pair geometry, molecular geometry, expected bond angle and the polarity for a series of molecules given on the worksheet. Feel free to work on this exercise in a group to help you learn the procedure. Carbon tetrachloride is worked out for you as an example.

	CCl_4	BF_3	SO_3	CO_2
Lewis Structure				
Resonance structures (if any)				
Molecular Geometry	tetrahedral	trigonal planar	trigonal planar	linear
Expected Bond Angle	109.5	120°	120°	180°
Polar or nonpolar	Nonpolar	non polar	non polar	non polar
IMFs present	LDF	LDF	LDF	LDF

Names: _____

Date: _____

$$5 + (6 \times 2) - 1 = 16$$

$$5 + (6 \times 4) + 3 = 32$$

	H ₂ O	SO ₄ ²⁻	NO ₂ ⁺	PO ₄ ³⁻
Lewis Structure				
Resonance structures (if any)				
Molecular Geometry	bent	tetrahedral	linear	tetrahedral
Expected Bond Angle	less than 109.5°	109.5°	180°	109.5°
Polar or nonpolar	polar	nonpolar	nonpolar	nonpolar
IMFs present	LDF H Bonding	LDF	LDF	LDF

	$4 + 6(3) + 2 = 24$ CO ₃ ²⁻	SO ₂	NO ₂ ⁻	$5 + 7(3) = 26$ PF ₃
Lewis Structure				
Resonance structures (if any)				
Molecular Geometry	trigonal planar	bent	bent	trigonal pyramidal
Expected Bond Angle	120°	less than 120°	less than 120°	less than 109.5°
Polar or nonpolar	nonpolar	polar	polar	polar
IMFs present	LDF	LDF Dipole-Dipole	LDF Dipole-Dipole	LDF Dipole-Dipole

	NH ₃	H ₃ O ⁺	NH ₄ ⁺	SO ₃ ²⁻
Lewis Structure	$\begin{array}{c} \text{H} - \ddot{\text{N}} - \text{H} \\ \\ \text{H} \end{array}$	$\begin{array}{c} \text{H} - \ddot{\text{O}} - \text{H} \\ \\ \text{H} \end{array}$	$\begin{array}{c} \text{H} \\ \\ \text{H} - \text{N} - \text{H} \\ \\ \text{H} \end{array}$	$\begin{array}{c} \text{:}\ddot{\text{O}}\text{:} - \ddot{\text{S}} - \text{:}\ddot{\text{O}}\text{:} \\ \\ \text{:}\ddot{\text{O}}\text{:} \end{array}$
Resonance structures (if any)				
Molecular Geometry	trigonal pyramidal	trigonal pyramidal	tetrahedral	trigonal pyramidal
Expected Bond Angle	less than 109.5	less than 109.5	109.5	less than 109.5
Polar or nonpolar	polar	polar	nonpolar	polar
IMFs present	LDF H Bonding	LDF H Bonding	LDF	LDF Dipole-Dipole

	SiI ₄	CHCl ₃	NO ₃ ⁻	ClO ₂ ⁻
Lewis Structure				
Resonance structures (if any)				
Molecular Geometry	tetrahedral	tetrahedral	trigonal planar	bent
Expected Bond Angle	109.5°	109.5°	120°	less than 109.5°
Polar or nonpolar	nonpolar	polar	nonpolar	polar
IMFs present	LDF	LDF Dipole-Dipole	LDF	LDF Dipole-Dipole