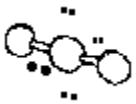
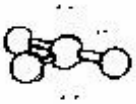
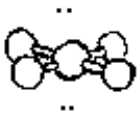
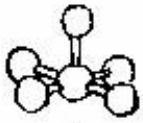
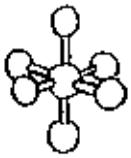
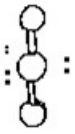
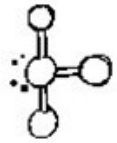
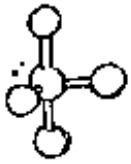
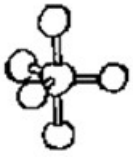
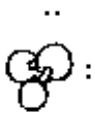
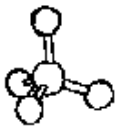
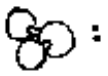
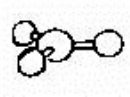
Molecular Shapes and the VSEPR Model

*Symmetrical molecular shapes are **boldfaced and italicized red***

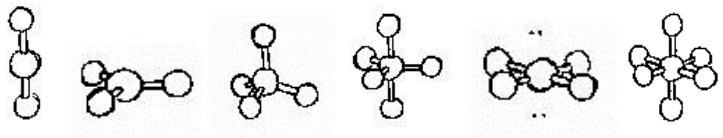
Steric number SN=6 6 Electron Domains[1] 180° & 90°					
Bonding Pair	2	3	4	5	6
Lone Pair	4	3	2	1	0
Name	***Linear***	T-shaped	***Square Planar***	Square Pyramidal	***Octahedral***
SN=5 5 Electron Domains 180°, 120°, 90°					
Bonding Pair	2	3	4	5	
Lone Pair	3	2	1	0	
Name	***Linear***	T-shaped	Distorted Tetrahedron (Seesaw)	***Trigonal Bipyramidal***	
SN=4 4 Electron Domains 109°				***sp*³ hybrid orbitals**	
Bonding Pair	2	3	4		
Lone Pair	2	1	0		
Name	Nonlinear (Bent)	Trigonal Pyramidal	***Tetrahedral***		
SN=3 3 Electron Domains 120°			***sp*² hybrid orbitals**		
Bonding Pair	2	3			
Lone Pair	1	0			
Name	Nonlinear (Bent)	***Trigonal Planar***			
SN=2 2 Electron Domains 180°		***sp* hybrid orbitals**			
Bonding Pair	2				
Lone Pair	0 ***Linear***				

[1] The electron domain count is the number of pairs of electrons and bonds (single, double and triple bonds count as single domains.)

These symmetrical molecules with identical attached atoms will not produce a dipole moment.

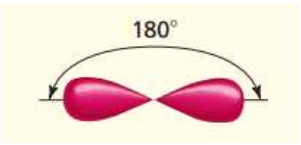
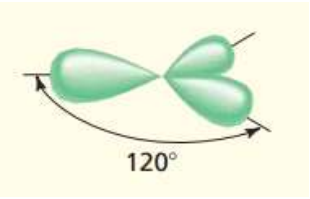
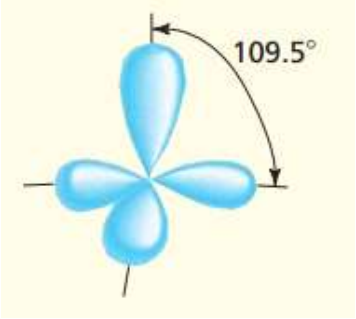
Dipole moment, a measure of polarity of a molecule is measured in debyes, D.

Symmetrical molecules, D = 0 debyes



Symmetrical molecular structure can produce nonpolar molecules despite having polar bonds.

Hybrid[2] orbitals are used to explain molecular geometry.
This table lists the hybrids you are expected to recognize.

Hybrid Orbital	# Electron Domains	Shape Names	Angles
sp	2	2 σ bonds = Linear	 *sp*, *sp*
***sp*^{2}**	3	3 σ bonds = Trigonal Planar or 2 σ bonds + 1 unshared = Nonlinear 120°	 *sp*^{2}, *sp*^{2}, *sp*^{2}
***sp*^{3}**	4	4 σ bonds = Tetrahedral or 3 σ bonds + 1 unshared = Trigonal pyramidal or 2 σ bonds + 2 unshared = Nonlinear 109°	 *sp*^{3}, *sp*^{3}, *sp*^{3}, *sp*^{3}

[2] Hybrids are losing favor in their use outside of organic chemistry. The College Board has decided to no longer consider *d* orbitals as being involved in hybridizing. Chang and every other text book still includes *d* orbitals in hybrids and so do many college classes.