Name _____ Block: _____ Date: _____

Chemistry 11

VSEPR Theory & Molecular Shapes

V_____S_____ E_____P_____ R_____

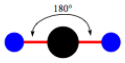
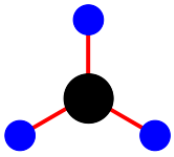
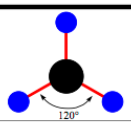
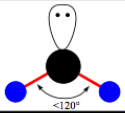
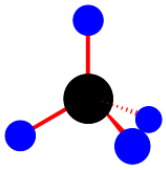
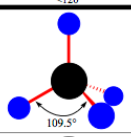
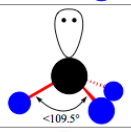
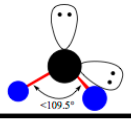
= _____

_____

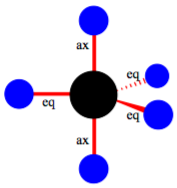
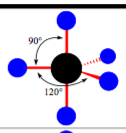
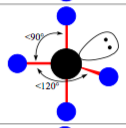
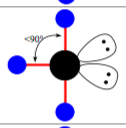
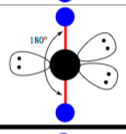
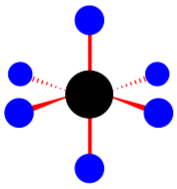
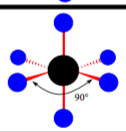
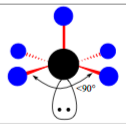
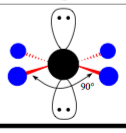
_____

- lone pairs occupy _____ space than bonded electrons

Using VSEPR to Predict the Shapes of Molecules

Electron Groups on central atom[1]	Electron-Group Shape	Bonds[2]	Lone Pairs	AX_mE_n[3]	Molecular Shape	Bond angles	Polarity	Hybrid-ization	Appearance
2	 Linear	2	0	AX_2	linear	180°	nonpolar[4]	sp	
3	 Trigonal Planar	3	0	AX_3	trigonal planar	120°	nonpolar[4]	sp^2	
		2	1	AX_2E	bent	<120°[5]	polar	sp^2	
4	 Tetrahedral	4	0	AX_4	tetrahedral	109.5°	nonpolar[4]	sp^3	
		3	1	AX_3E	trigonal pyramidal	<109.5°	polar	sp^3	
		2	2	AX_2E_2	bent	<109.5°	polar	sp^3	

[1] "Electron groups" include bonds, lone pairs, and odd (unpaired) electrons. A multiple bond (double bond or triple bond) counts as one electron group.
[2] A multiple bond (double bond or triple bond) counts as one bond in the VSEPR model.
[3] A = central atom, X = surrounding atoms, E = lone pairs
[4] Molecules with this shape are nonpolar when all of the atoms connected to the central atom are the *same*. If the atoms connected to the central atom are *different* from each other, the molecular polarity needs to be considered on a case-by-case basis.
[5] Since electrons in lone pairs take up more room than electrons in covalent bonds, when lone pairs are present the bond angles are "squashed" slightly compared to the basic structure without lone pairs.

Electron Groups on central atom[1]	Electron-Group Shape	Bonds[2]	Lone Pairs	AX_mE_n[3]	Molecular Shape	Bond angles	Polarity	Hybrid-ization	Appearance
5	 eq = equatorial ax = axial Trigonal Bipyramidal	5	0	AX_5	trigonal bipyramidal	120° eq 90° ax	nonpolar[4]	sp^3d	
		4	1	AX_4E	seesaw	<120° eq <90° ax	polar	sp^3d	
		3	2	AX_3E_2	T-shaped	<90°	polar	sp^3d	
		2	3	AX_2E_3	linear	180°	nonpolar[4]	sp^3d	
6	 Octahedral	6	0	AX_6	octahedral	90°	nonpolar[4]	sp^3d^2	
		5	1	AX_5E	square pyramidal	<90°	polar	sp^3d^2	
		4	2	AX_4E_2	square planar	90°	nonpolar[4]	sp^3d^2	

1. Draw the Lewis structure for water, H_2O.

bonds = _____ lone pairs = _____

e-group shape = _____ molecular shape = _____

bond angle = _____ polarity = _____

2. Draw the Lewis structure for NO_2^-.

bonds = _____ lone pairs = _____

e-group shape = _____ molecular shape = _____

bond angle = _____ polarity = _____

3. For each of the following, draw the Lewis structure, determine the bond angles, polarity and molecular shape.

a. carbon tetrachloride

b. silicon disulphide

c. C_2H_2

d. SO_3

e. carbon dioxide

f. NH_3