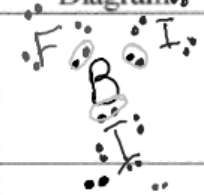
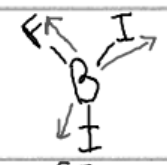
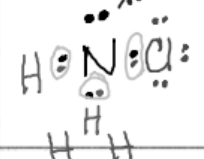
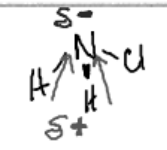
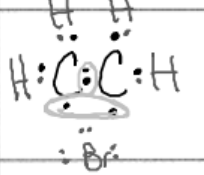
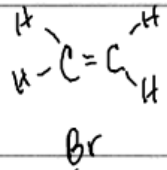
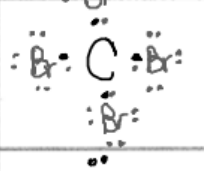
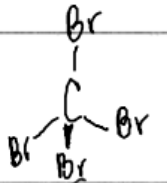
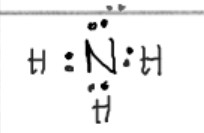
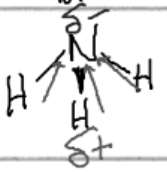
Homework: Molecular Shapes

1-5. Draw the Lewis Dot Diagram, illustrate and indentify the molecular shape of the following, and then indicate if it is a polar or non-polar molecule. Molecule

≥2 = I
0.5-1.9 = PC
≤0.49 = NPC

	Lewis Dot Diagram	Illustrate	Shape	Polar/Non-polar
1. BFI_2 F 4.0 I 2.5 B 2.0 B 2.0 2.0 (I) 0.5 (PC)			trigonal planar	non-polar molecule Equal & Opposite
2. NH_2Cl N 3.0 N 3.0 H 2.1 Cl 3.0 0.9 (PC) (NPC)			trigonal pyramidal	polar molecule Same direction
3. C_2H_4 C C 2.5 C H 2.1 0 0.4 (NPC) (NPC)				non-polar molecule
4. CBr_4 Br 2.8 C 2.5 0.3 (NPC)			tetrahedral	non-polar molecule
5. NH_3 N 3.0 H 2.1 0.9 (PC)			trigonal pyramidal	polar molecule Same direction

S

Determining Molecular Polarity VSEPR

Step 1 Determine the Type of Bond (Math)

Non-Polar Covalent (EN diff ≤0.49) → ✓Non Polar Molecule

Polar Covalent (EN diff 0.5 to 1.9) or Ionic (EN diff ≥2.0)

Step 2 Draw an arrow at each bond pointing toward the element w↑EN

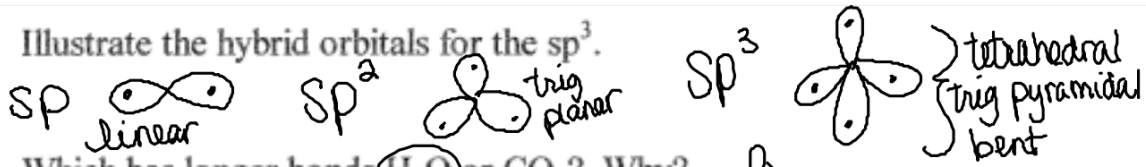
Equal & Opposite (Tug-o-war) → Non-Polar Molecules

Single Direction → Polar Molecules

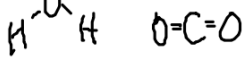
New Symbols $\delta+$ partial ⊕ $\delta-$ partial ⊖ Charged regions caused by uneven sharing of e^-

	I A	II A	Group B	III A	IV A	V A	VI A	VII A	VIII A
# of Valence Electrons	1	2	2	3	4	5	6	7	8
Charge	1+	2+	vary	3+	4+ 4−	3-	2-	1−	
Bonding Capacity	1	2		3	4	3	2	1	N/A
Shape – if central atom	N/A	linear ·X·		trigonal planar ·X·	tetrahedral ·X·	pyramidal ·X·	Bent ·X·	N/A	N/A
Resulting Bond Angle	/	180°		120°	109.5°	107°	105°	/	/

6. Illustrate the hybrid orbitals for the sp^3.



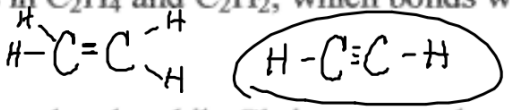
7. Which has longer bonds H_2O or CO_2? Why?



8. In a polar bond, electrons are shared (equally/unequally) between two atoms.

9. A molecule that is composed of only one kind of atom is a(n) monatomic.

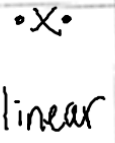
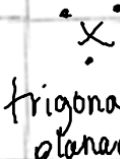
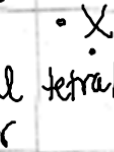
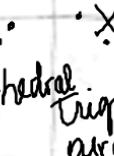
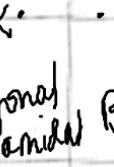
10. Compare the bonds in C_2H_4 and C_2H_2, which bonds would require more energy to break?



11. Why is HCl a polar molecule while Cl_2 is a non-polar molecule?

PC NPC

12. The polarity of a large molecule helps determine its shape.

	I A	II A	Group B	III A	IV A	V A	VI A	VII A	VIII A
# of Valence Electrons	1	2	2 **	3	4	5	6	7	8
Charge	1+	2+	follow directions based on charge	3+	4+ 4-	3-	2-	1-	
Bonding Capacity	1	2		3	4	3	2	1	0
Shape – if central atom		 linear		 trigonal planar	 tetrahedral	 Trigonal pyramidal	 Bent		
Resulting Bond Angle		180°		120°	109.5°	107°	105°		

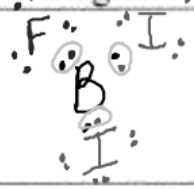
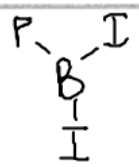
sp 2 bonds linear

sp^2 trigonal planar

sp^3 } tetrahedral, trig. pyramidal, Bent

Homework: Molecular Shapes 2.0 or > (I) 0.5-1.9 (PC) 0.49 or < (NPC)

1-5. Draw the Lewis Dot Diagram, illustrate and indentify the molecular shape of the following, and then indicate if it is a polar or non-polar molecule.

Type of Bond	Lewis Dot Diagram	Illustrate	Shape	Polar/Non-polar
1. BFI_2 F 4.0 I 2.5 B 2.0 — 2.0 = 0 (NPC); B 2.0 — 0.5 (PC)			trigonal planar	
2. NH_2Cl				
3. C_2H_4				
4. CBr_4				
5. NH_3				

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