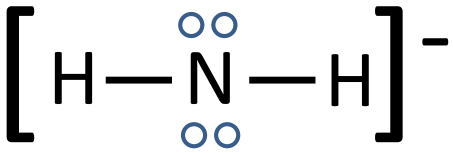
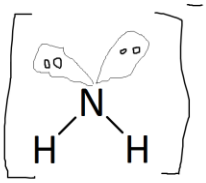
Name_____

Shapes of Molecules – Honors Chemistry I Study Guide

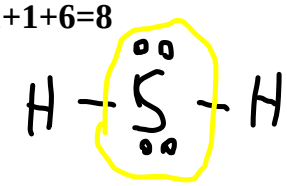
Part I: Shapes of Molecules (4 points each)
Draw a Lewis structure of each molecule or ion – if there are multiple resonance structures, show them all. The central atom of each molecule or ion will be underlined as a hint. Use the Lewis structure (and sketch, if necessary) to classify the geometry of each molecule as one of the following: Linear, Bent, Triangular, Pyramidal, Tetrahedral.

EXAMPLE: $\underline{N}H_2^-$ Geometry: BENT



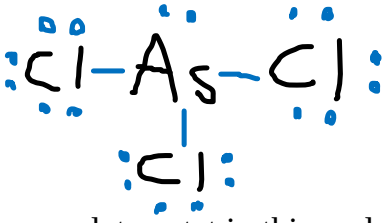


$H_2\underline{S}$: 1+1+6=8



2B 2LP bent 109.5

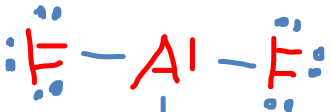
$\underline{As}Cl_3$: 5 + 3·7 = 26



trig pyramidal

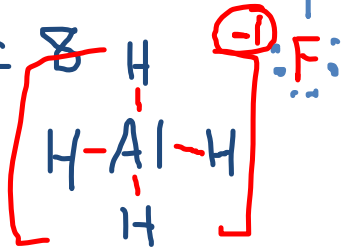
$\underline{Al}F_3$(Note: aluminum has an incomplete octet in this molecule)

3 + 3·7 = 24



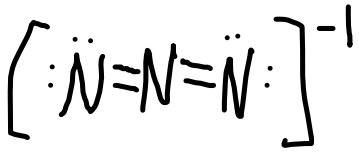
trigonal planar

$\underline{Al}H_4^-$: 3 + 4 + 1 = ~~8~~



4B 0LP tetrahedral

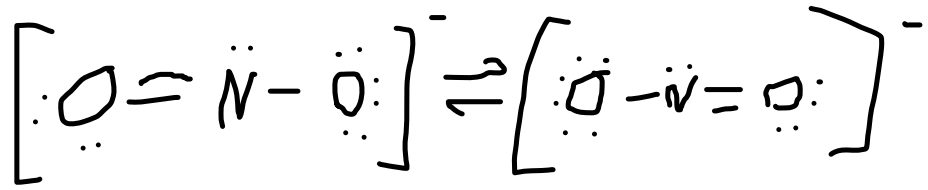
N_3^-(N-N-N): 16



2B 0LP linear

NO_2^- (Note: there are 2 resonance structures. The 'real' structure of the ion is an average between them) 18

2B 1LP bent 120



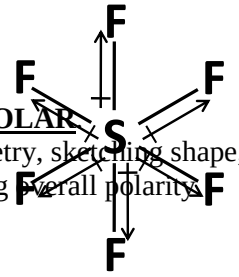
Name_____

H 2.1									
Li 1.0	Be 1.5				B 2.0	C 2.5	N 3.0	O 3.5	F 4.0
Na 0.9	Mg 1.2				Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0

Part II: Polar vs Nonpolar Molecules (8 points each)

Sketch each molecule's shape and NAME the bonding geometry. Use the electronegativity chart above to draw dipole vectors for all polar bonds in the molecule, whenever the electronegative difference ≥ 0.5. Determine whether the dipoles all cancel out due to symmetry, making the molecule NONPOLAR, *or whether there is a net dipole that makes the molecule* POLAR.

EXAMPLE: SF_6

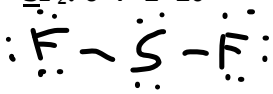


Octahedral geometry – the S-F dipoles cancel out in pairs.

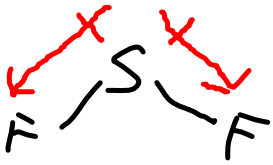
The SF_6 molecule is **NONPOLAR**

2 pts each for naming geometry, sketching shape, drawing dipoles, determining overall polarity

SF_2: 6+7*2=20



bent



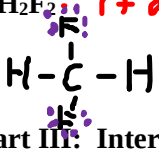
Polar

C_2H_2: 10

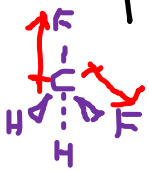
Linear

Nonpolar

CH_2F_2: 4+2+14=20



tetrahedral

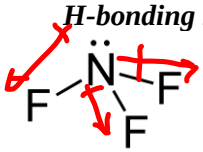


Polar

Part III: Intermolecular Forces

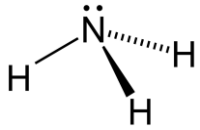
Check off all intermolecular forces found in a sample of each substance (12 points):

H-bonding requires O-H, N-H, or F-H. Remember "Hey pick up the FON"



Dipole-Dipole (Yes/No) **Hydrogen Bonding (Yes/No)** **London Dispersion (Yes/No)**

N-H, O-H, F-H



Dipole-Dipole (Yes/No) **Hydrogen Bonding (Yes/No)** **London Dispersion (Yes/No)**

$N \equiv N$

Dipole-Dipole (Yes/No) **Hydrogen Bonding (Yes/No)** **London Dispersion (Yes/No)**

$H-H$

Dipole-Dipole (Yes/No) **Hydrogen Bonding (Yes/No)** **London Dispersion (Yes/No)**

Please rank the above substances, NF_3, NH_3, N_2, and H_2 in order of increasing boiling point. (2 points)

Higher attractive forces mean higher boiling point.

H-Bonding is stronger than Dipole which is stronger than London

Bigger molecules/atoms have stronger London than smaller atoms/molecules.

$NH_3 > NF_3 > N_2 > H_2$