

Announcements – Lecture XIV – Tuesday, June 10th

1. Fourth Lab: Today, 1:30-4:30, ISB 155 (A-C)
2. Exam II: Friday, June 13th, In Class

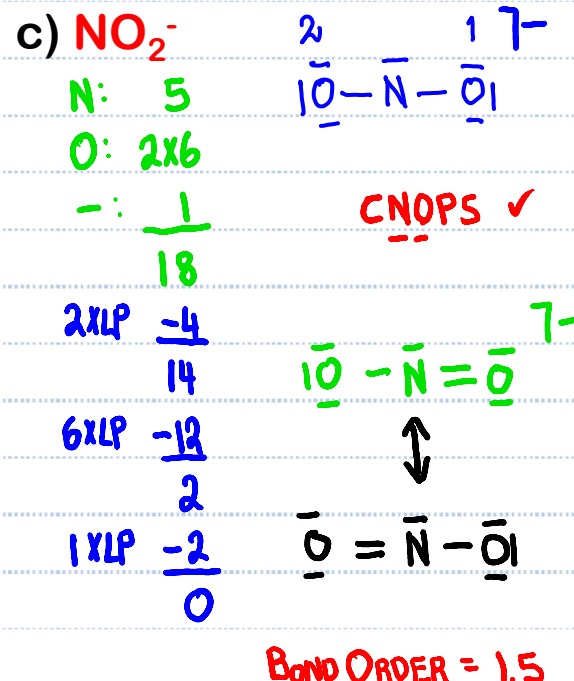
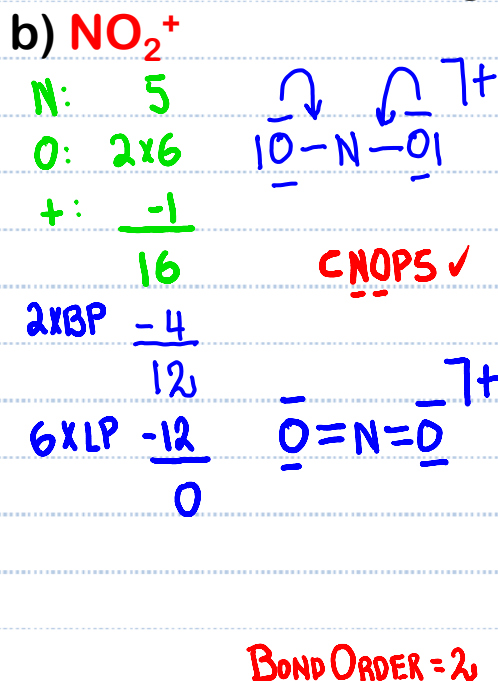
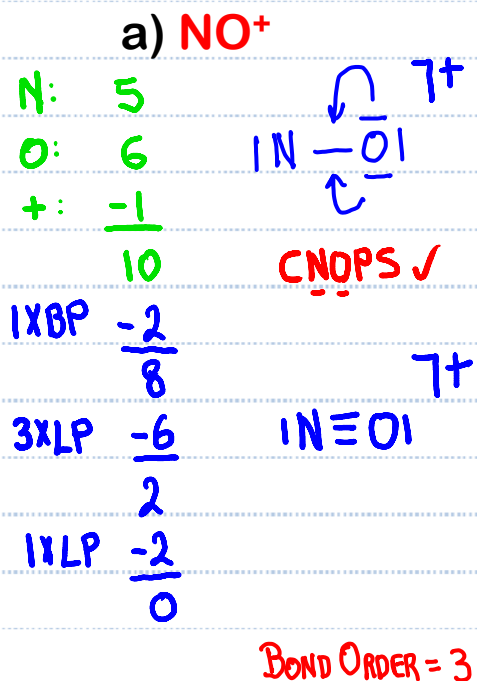


Quiz 11

Class #: _____

Last Name: _____

1. Draw the Lewis structure for the following molecules:



Average Single Bond Lengths (Picometers)

	H	C	N	O	F	Si	P	S	Cl	Br	I
H	74	110	98	94	92	145	138	132	127	142	161
C		154	147	143	141	194	187	181	176	191	210
N			140	136	134	187	180	174	169	184	203

2. Which of the above molecules would have a bond length > 115 pm C

Average Multiple Bond Lengths (Picometers)

C = O	122	C ≡ O	113
N = O	115	N ≡ O	108

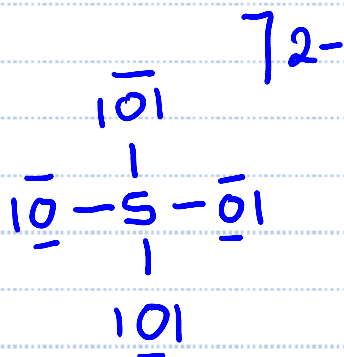


8.4 Electron Distribution in Molecules

C: Resonance Structures, Formal Charge – Refining Structures

SO_4^{2-} (Octet Rule)

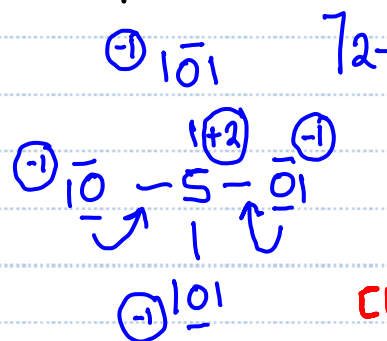
$$\begin{array}{r}
 \text{S: } 6 \\
 \text{O: } 4 \times 6 \\
 2^-: \quad 2 \\
 \hline
 32 \\
 4 \text{ xBP} \quad -8 \\
 \hline
 24
 \end{array}$$



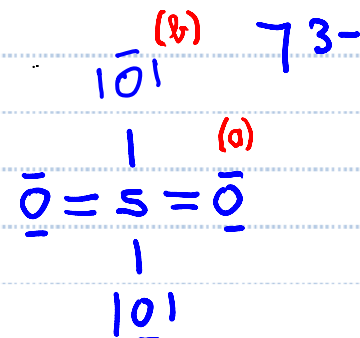
FORMAL CHARGE CHECK

$$\begin{array}{l}
 \text{S: } 6 - 0 - \frac{1}{2}(8) = +2 \\
 \text{O: } 6 - 6 - \frac{1}{2}(2) = -1
 \end{array}$$

SO_4^{2-} (Minimal Formal Charge)



ENOPS ✓



FORMAL CHARGE CHECK

$$\begin{array}{l}
 \text{O}(a): 6 - 4 - \frac{1}{2}(4) = 0 \\
 \text{O}(b): 6 - 6 - \frac{1}{2}(2) = -1 \\
 \text{S}: 6 - 0 - \frac{1}{2}(12) = 0
 \end{array}$$

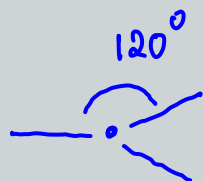
How about Resonance Structures? ✓

8.5 Valence-Shell Electron-Pair Repulsion and Molecular Shape

A: VSEPR and Electron-Pair Geometry



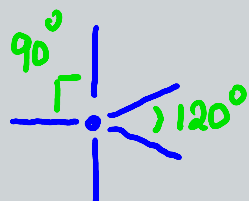
Linear



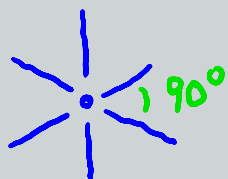
Trigonal planar



Tetrahedron



Trigonal bipyramid



Octahedron

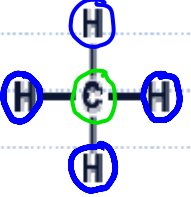
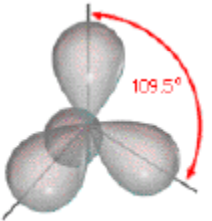
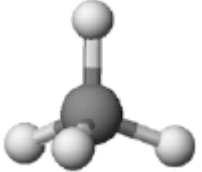
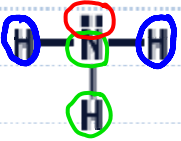
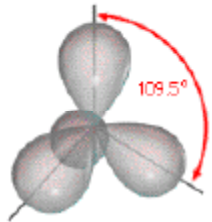


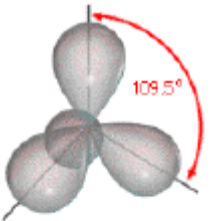
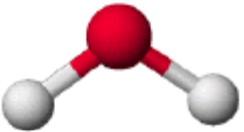


8.5 Valence-Shell Electron-Pair Repulsion and Molecular Shape

B: Electron Pair Geometries – Molecular Geometries

Tetrahedron

$$\lambda + E = 4$$

Lewis Structure	Class	Electron Pair Geometry	Molecular Geometry	Bond Angles
CH_4 	AX_4E_0	 TETRAHEDRON	 TETRAHEDRON	$\sim 109^\circ$
NH_3 	AX_3E_1	 TETRAHEDRON	 TRIGONAL PYRAMID	$\sim 109^\circ$
H_2O 	AX_2E_2	 TETRAHEDRON	 BENT/ANGULAR (109°)	$\sim 109^\circ$

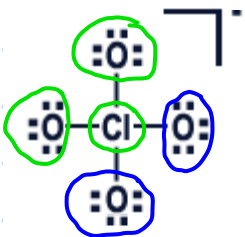
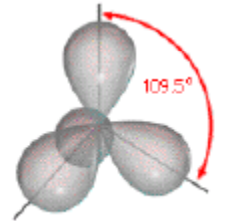
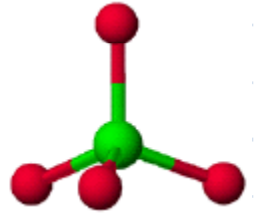
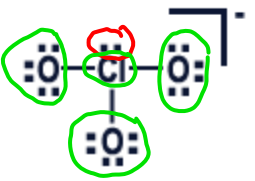
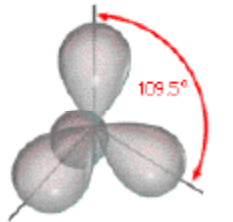
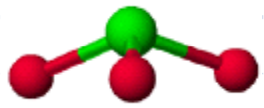


8.5 Valence-Shell Electron-Pair Repulsion and Molecular Shape

B: Electron Pair Geometries – Molecular Geometries

Tetrahedron

$$X + E = 4$$

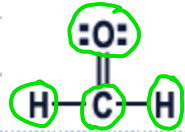
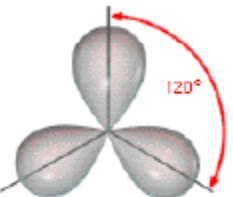
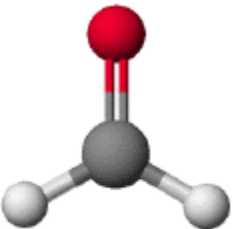
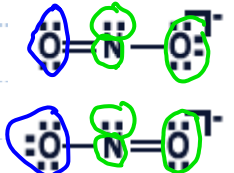
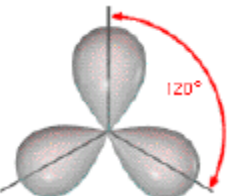
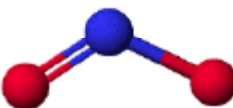
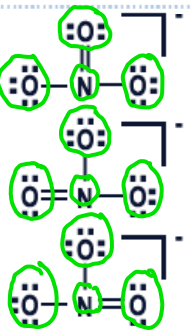
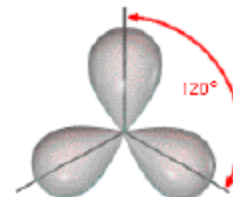
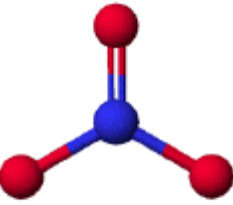
Lewis Structure	Class	Electron Pair Geometry	Molecular Geometry	Bond Angles
ClO_4^- 	AX_4E_0	 TETRAHEDRON	 TETRAHEDRON	$\sim 109^\circ$
ClO_3^- 	AX_3E_1	 TETRAHEDRON	 TRIGONAL PYRAMID	$\sim 109^\circ$

8.5 Valence-Shell Electron-Pair Repulsion and Molecular Shape

B: Electron Pair Geometries – Molecular Geometries

Trigonal Planar

$$X+E=3$$

Lewis Structure	Class	Electron Pair Geometry	Molecular Geometry	Bond Angles
H_2CO 	AX_3E_0	 TRIGONAL PLANAR	 TRIGONAL PLANAR	120°
NO_2^- 	AX_2E_1 AX_2E_1	 TRIGONAL PLANAR	 BENT/ANGULAR (120°)	120°
NO_3^- 	AX_3E_0 AX_3E_0 AX_3E_0	 TRIGONAL PLANAR	 TRIGONAL PLANAR	120°

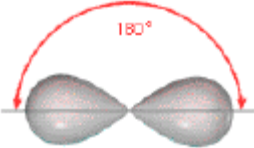



8.5 Valence-Shell Electron-Pair Repulsion and Molecular Shape

B: Electron Pair Geometries – Molecular Geometries

Linear

$$X + E = 2$$

Lewis Structure	Class	Electron Pair Geometry	Molecular Geometry	Bond Angles
<p>HCN</p> <p>$\text{H}-\text{C}\equiv\text{N}:$</p>	<p>AX_2E_0</p>	 <p>LINEAR</p>	 <p>LINEAR</p>	<p>180°</p>

