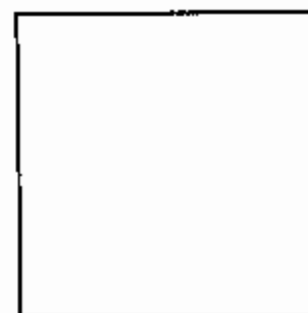


# Exam 2B

Chem 960  
Fall 2009  
Maleckar  
100 points



Initial of last name

NAME KEY

Which is Greatest? \_\_\_\_\_ (30)

Problems 2&3 \_\_\_\_\_ (29)

Problem 4 \_\_\_\_\_ (17)

Problem 5 \_\_\_\_\_ (14)

Problem 6 \_\_\_\_\_ (10)

TOTAL \_\_\_\_\_

# Which is Greatest?

Compare the answers for every question and circle the one that is the greatest or largest in number OR IN MAGNITUDE if a negative number.

a. the electronegativity of  
*N is the one furthest to the right and highest up*

P                      C                      **N**

b. the lattice energy in  
*Rb is smaller than Cs  
Cl is smaller than Br*

**RbCl**                      RbBr                      CsBr

c. the IE<sub>1</sub> of  
*Sb has a half-filled p subshell*

Sr                      Sn                      **Sb**                      Te

d. the atomic radius of  
*Zn is smaller bec. furthest to the right  
the others: the lower # p, the bigger the ion*

**Mn**                      Fe<sup>+</sup>                      Co<sup>2+</sup>                      Zn<sup>+</sup>  
*25 p 25e<sup>-</sup>*                      *26 p 25e<sup>-</sup>*                      *27 p 25e<sup>-</sup>*                      *30 p 29e<sup>-</sup>*

e. the polarity of  
*C + O are furthest away + C-H is nonpolar*

a C-H bond                      a C-S bond                      **a C-O bond**                      a C-N bond

*3 pts. each*

f. the lattice energy in  
*Mg is smaller than Ba  
Cl is smaller than NO<sub>3</sub><sup>-</sup> (atoms)*

BaCl<sub>2</sub>                      Ba(NO<sub>3</sub>)<sub>2</sub>                      **MgCl<sub>2</sub>**                      Mg(NO<sub>3</sub>)<sub>2</sub>

g. the atomic radius of  
*Ca is furthest left*

**Ca**                      Mg                      Si                      Cl

h. the IE<sub>1</sub> of  
*P has a half-filled p subshell*

Bi                      Sb                      **P**                      As

i. the atomic radius of  
*Cs is furthest left and lowest*

Sr                      Rb                      **Cs**                      Ba

j. the attraction of \_\_\_\_\_ to a magnetic field

**NO<sup>•</sup>**                      CO                      BF<sub>3</sub>  
*2 unpaired e<sup>-</sup>*                      *0 unpaired e<sup>-</sup>*                      *1 unpaired e<sup>-</sup>*

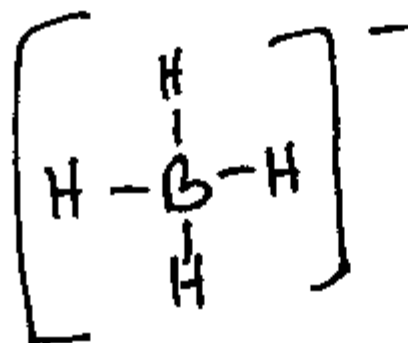
Draw each Lewis Dot structure and provide the following information for each.

Structure

Hybridization

Molecular Shape

2a.  $BH_4^-$

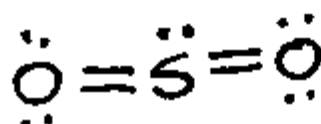


$sp^3$

tetrahedral

2b.  $SO_2$

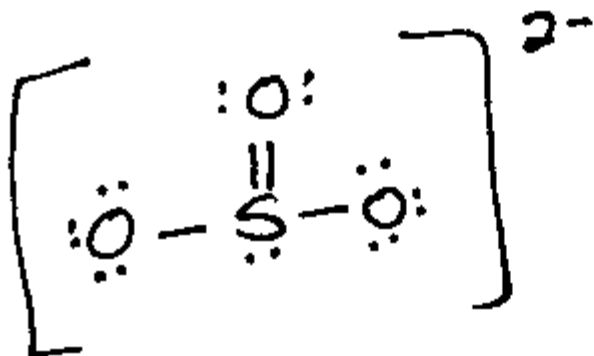
18e<sup>-</sup>



$sp^2$

bent

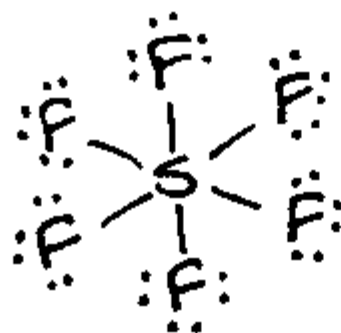
2c.  $SO_3^{2-}$



$sp^3$

trigonal pyramidal

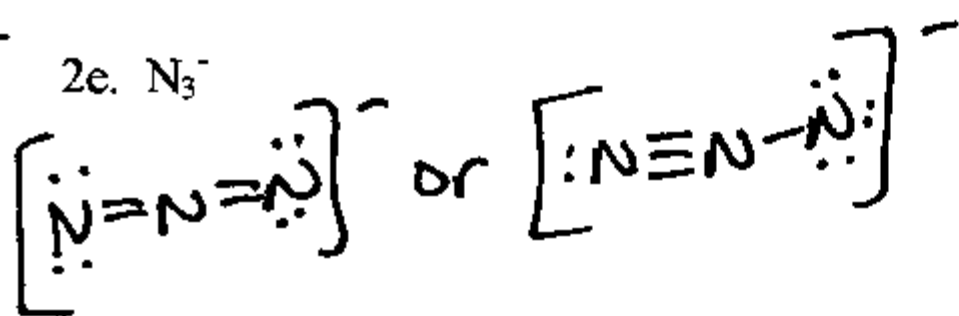
2d.  $SF_6$



$sp^3d^2$

not required

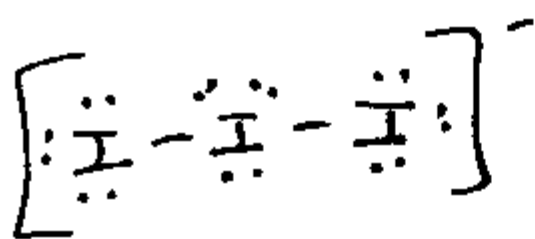
16e<sup>-</sup> 2e.  $N_3^-$



$sp$

linear

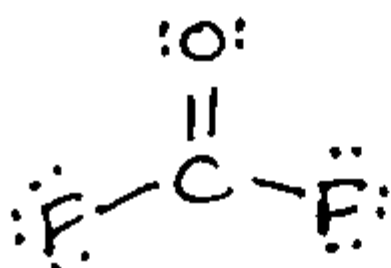
22e<sup>-</sup> 2f.  $I_3^-$



$sp^3d$

not required

2g.  $CF_2O$

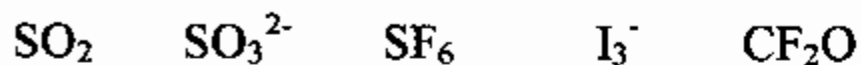


$sp^2$

trigonal planar

lot each  
C19 to/re

2h. Based on the structures from the previous page, determine to the best of your ability if the following compounds would be soluble in water or not by writing the formulas (only) in the appropriate boxes.



**Soluble in Water**

SO<sub>3</sub><sup>2-</sup>    I<sub>3</sub><sup>-</sup>    SO<sub>2</sub>    CF<sub>2</sub>O

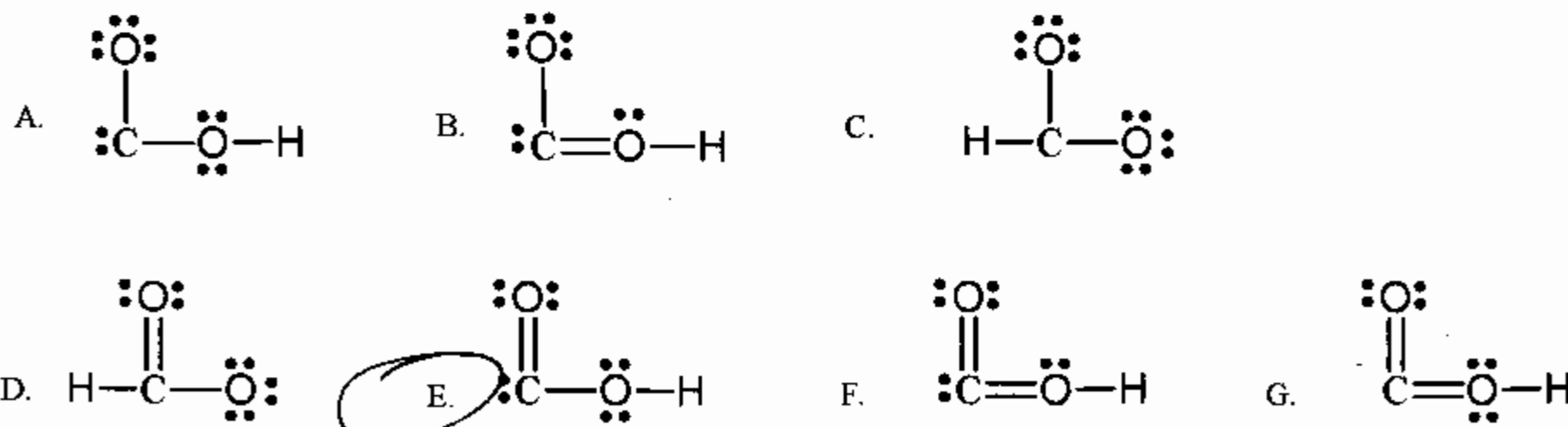
**Insoluble in Water**

SF<sub>6</sub>

1 PT each

3. Circle the **BEST** possible structure for ClO<sub>2</sub><sup>-</sup>.

5 pts.

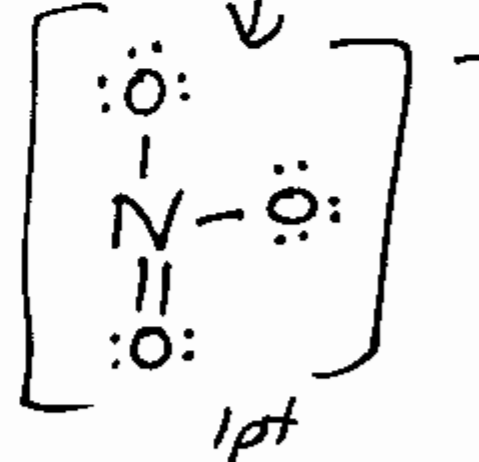
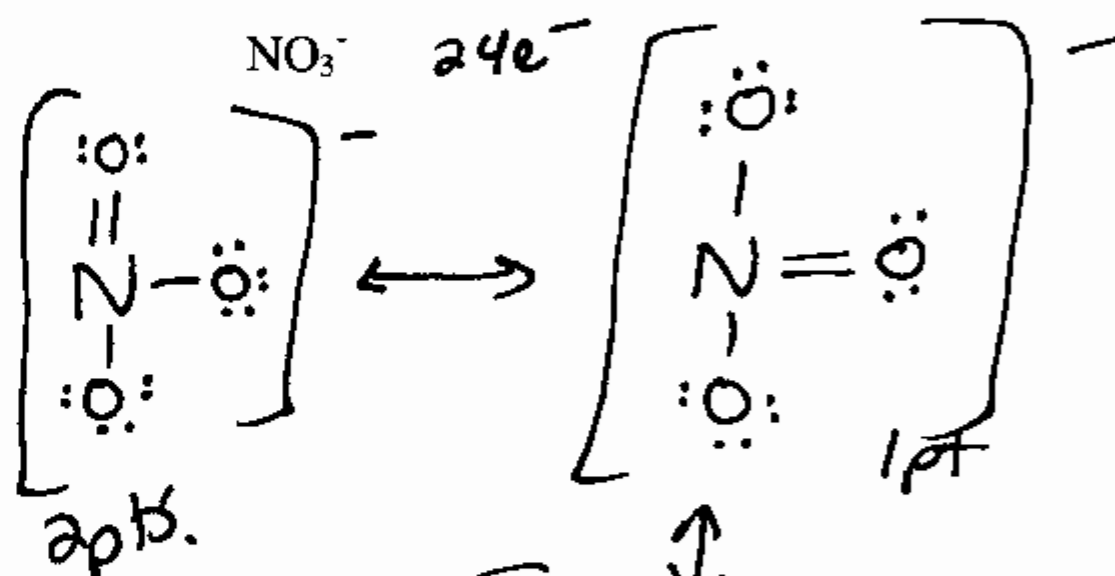
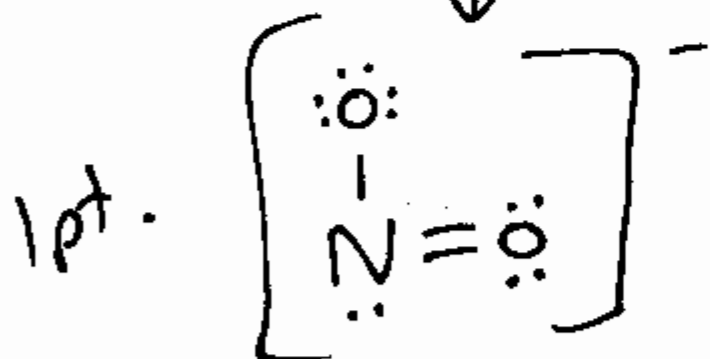
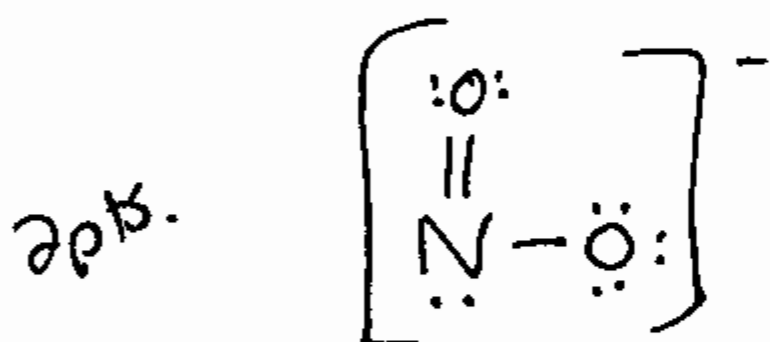
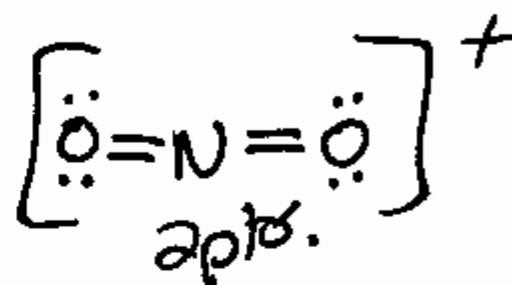
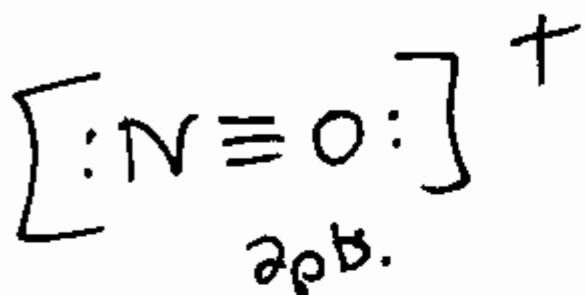
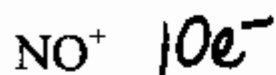


A: C has 6e<sup>-</sup>  
 B: bad formal charges  
 C: C has 6e<sup>-</sup>  
 D: H isn't acidic

$\begin{array}{c} \text{O}^- \\ | \\ \text{:C}=\text{O}-\text{H} \\ +1 \end{array}$

F: C has 10e<sup>-</sup> ;  
 G: O has 10e<sup>-</sup> ;

4. Draw the Lewis Dot structures for the following compounds along with ANY AND ALL equivalent resonance structures that they have. (note: not all of the compounds have equivalent resonance structures....only draw equivalent structures if there are any) Then answer the following questions about these compounds.



What is the N-O bond order in each structure?

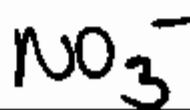
$\frac{3}{\text{NO}^+}$

$\frac{2}{\text{NO}_2^+}$

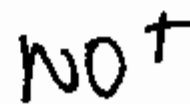
$\frac{1\frac{1}{2}}{\text{NO}_2^-}$

$\frac{1\frac{1}{3}}{\text{NO}_3^-}$

Which compound has the weakest N-O bond?

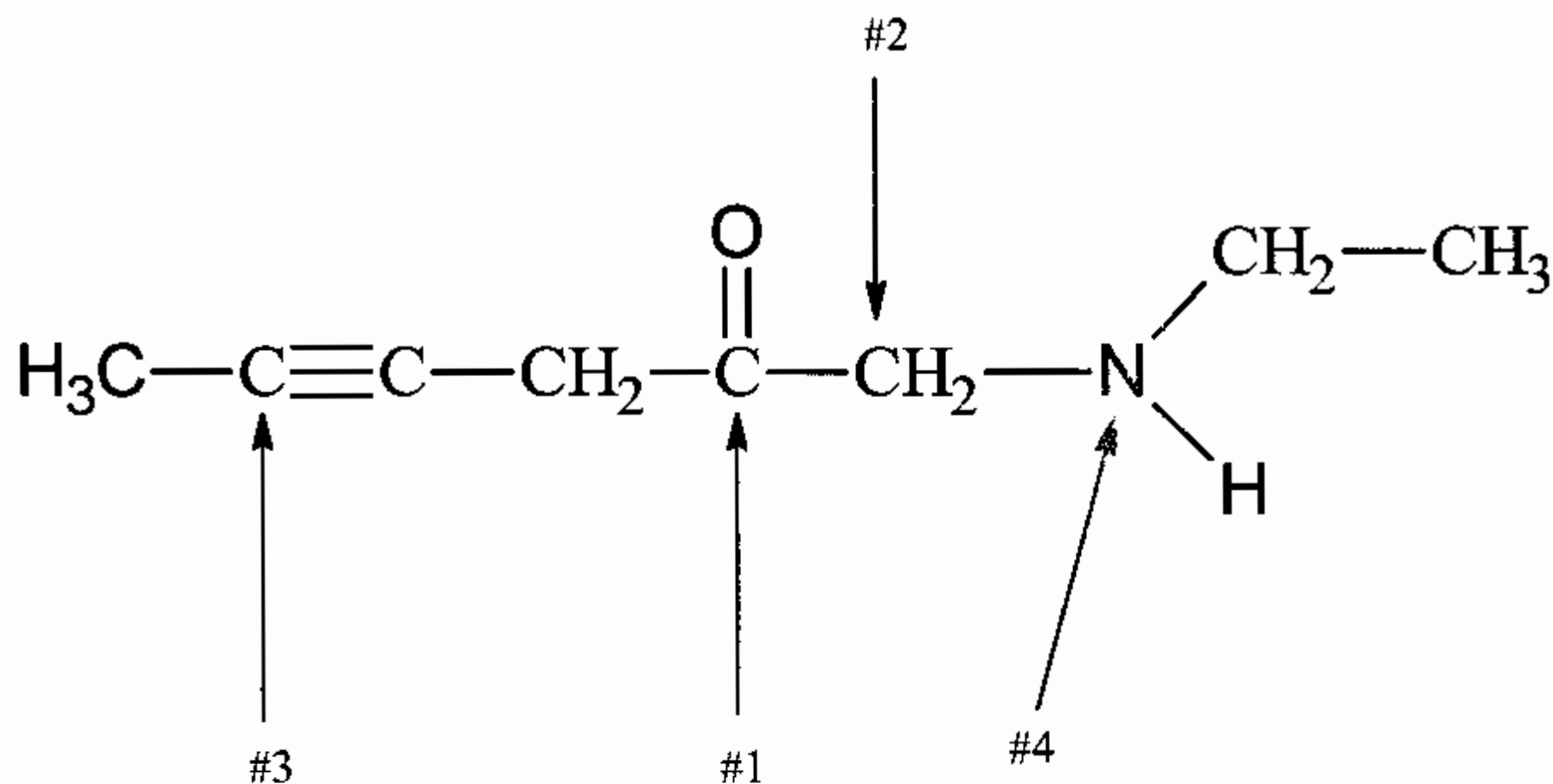


Which compound has the shortest N-O bond?



1pt each

5. For the following compound, give the hybridizations, approximate bond angles, and molecular shape for each of the numbered atoms. **CAUTION:** Not all of the bonds and lone pairs are drawn out in this structure.



	<u>Hybridization</u>	<u>App. Bond Angle</u>	<u>Molecular Shape</u>
#1	$sp^2$	$120^\circ$	trigonal planar
#2	$sp^3$	$109.5^\circ$	tetrahedral
#3	$sp$	$180^\circ$	linear
#4	$sp^3$	$109.5^\circ$	trigonal pyramidal

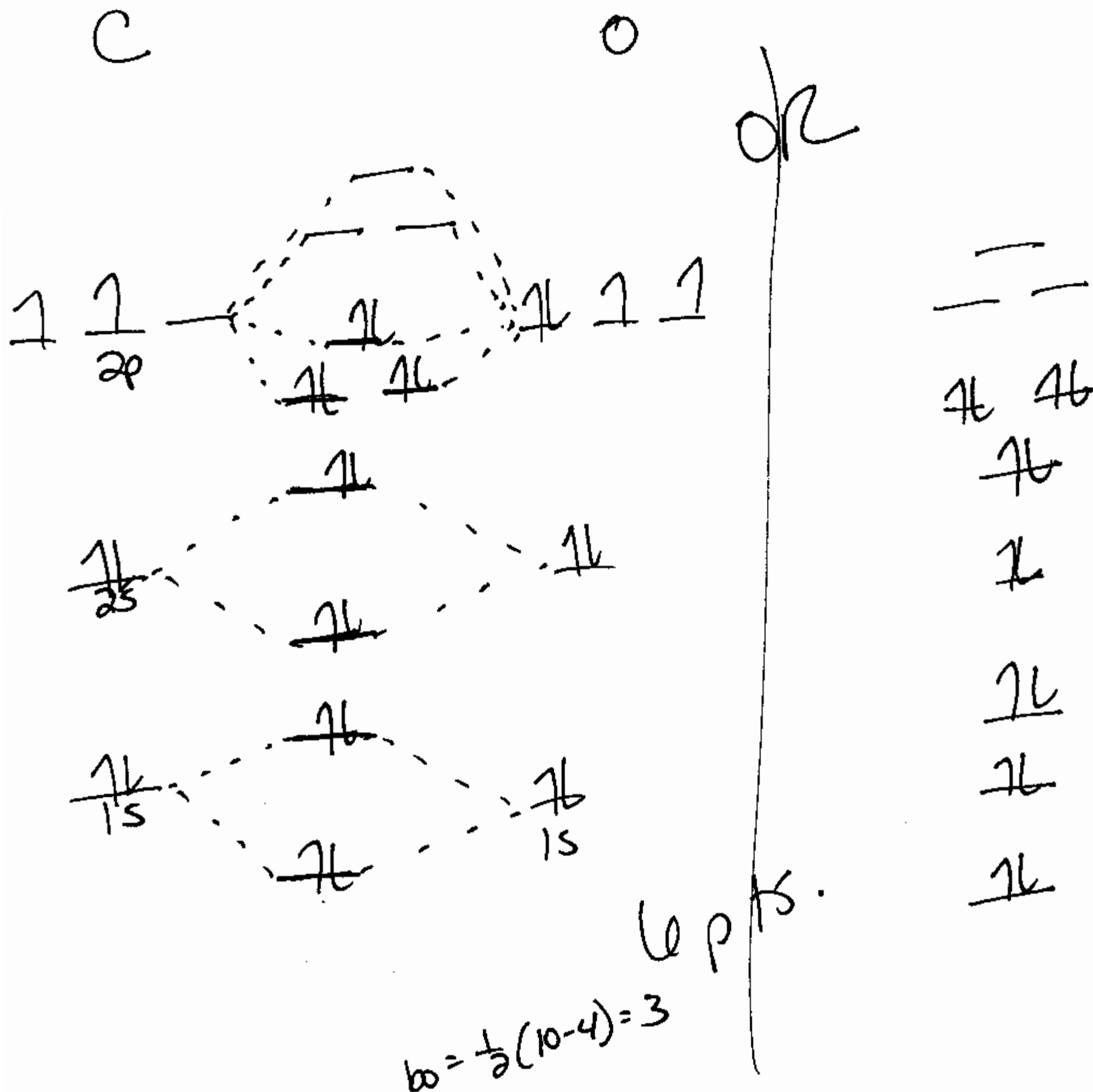
How many total  $\sigma$  bonds are in this structure? 22

How many total  $\pi$  bonds are in this structure? 3

107. each

### Molecular Orbital Diagram

6. Draw the molecular orbital diagram of carbon monoxide, CO. Show all of the electrons, not just the valence electrons. Either p orbital splitting pattern is acceptable.



6 p's.

$$b.o. = \frac{1}{2}(10 - 4) = 3$$

What is the bond order of CO? 3

Is CO paramagnetic or diamagnetic? diamagnetic

2 pts. each.