

Chem 111**10:10a section****Evening Exam #3v2**

This exam is composed of 25 questions. Go initially through the exam and answer the questions you can answer *quickly*. Then go back and try the ones that are more challenging to you and/or that require calculations.

As discussed on the course syllabus, honesty and integrity are absolute essentials for this class. In fairness to others, dishonest behavior will be dealt with to the full extent of University regulations.

$$E = h\nu = \frac{hc}{\lambda}$$

$$1 \text{ mL} = 1 \text{ cm}^3$$

$$h = 6.626 \times 10^{-34} \text{ J s}$$

$$c = 2.998 \times 10^8 \text{ m s}^{-1}$$

$$N = 6.022 \times 10^{23} \text{ mol}^{-1}$$

1. Which of the following has the longest bond length?

- 1) HF 2) HCl 3) HBr 4) HI

2. Which of the following has the highest bond energy?

- 1) HF 2) HCl 3) HBr 4) HI

3. Which of the following has the shortest bond length?

- 1) F₂ 2) O₂ 3) N₂ 4) C₂ 5) B₂

4. The CO bond in the molecule **CH₂O** is best described as a:

- 1) ionic bond 2) single bond
3) double bond 4) triple bond
5) the molecule doesn't exist

5. Draw the Lewis structure for NO^+ . Draw a stable resonance structure that provides a full octet to each of N and O. In this resonance structure, what is the bond order for the NO bond?

1) single 2) double 3) triple

6. Using the simplified molecular orbital diagram at right, predict the true bond order in NO^+ .

1) single 2) double 3) triple
4) 1.5 5) 2.5



7. Draw a stable resonance structure for NO_2^- . (one that provides a full octet to each atom). In this resonance structure, what are the bond orders for the NO bonds?

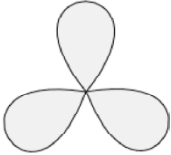
1) two single 2) two double 3) two triple
4) one single, one double 5) one double, one triple

8. In the molecule NO_2^- , the actual bond order for each NO bond is:

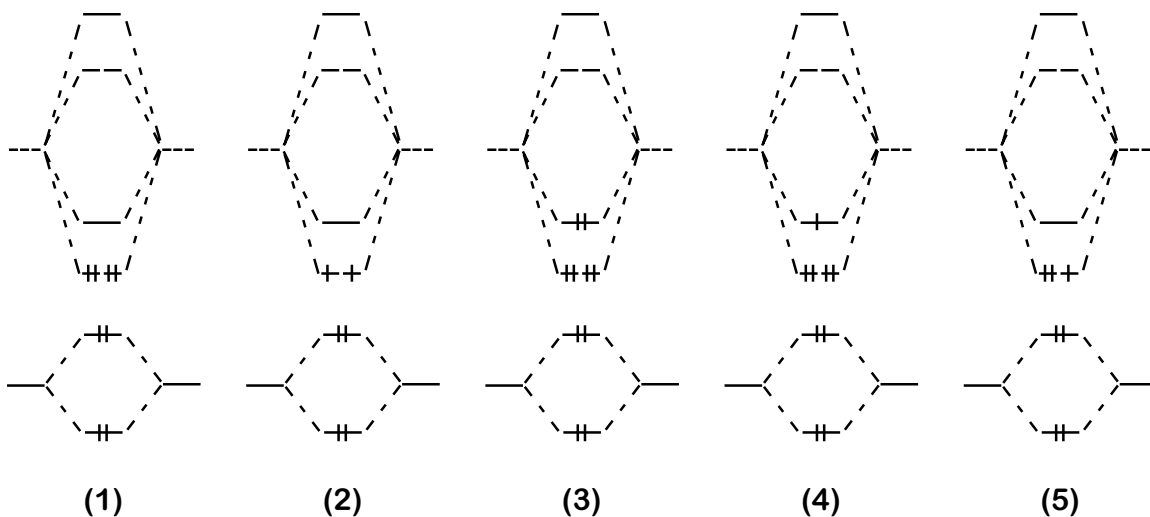
1) 1 2) 2 3) 3 4) 1.5
5) 1 for one bond and 2 for the other

9. In the molecule NO_2^- , the actual charge on each O is:

1) 0 2) +1 3) -1 4) -0.5
5) -1 for one O and 0 for the other O

10. Draw the Lewis structure for XeF_2 . The molecular geometry is:
 1) bent 2) linear 3) trigonal bipyramidal 4) octahedral
 5) none of the above
11. The molecule XeF_2 is:
 1) nonpolar 2) npolar 3) can't tell
12. Draw the Lewis structure for XeOF_4 (Xe is the central atom). What is the hybridization on **Xe**?
 1) sp^2 2) sp^3 3) sp^3d 4) sp^3d^2 5) sp^3d^3
13. The picture at right depicts which type of orbital hybridization?
 1) sp^4 2) sp^3 3) sp^2 4) sp
 5) none of the above
- 
14. In the orbital hybridization *above*, how many atomic orbitals were used to create the resulting molecular orbitals?
 1) 1 2) 2 3) 3 4) 4 5) 5
15. A molecule has sp^3d^2 hybridization with one lone pair. The **molecular geometry** of this molecule is:
 1) tetrahedral 2) octahedral 3) linear
 4) square pyramidal 5) trigonal bipyramidal
16. What hybrid orbitals make up the sigma bond between **C2** and **C3** in propylene, CH_2CHCH_3 ?
 1) sp & sp^3 2) sp & sp^2 3) sp^2 & sp^3 4) sp^2 & sp^2 5) sp^3 & sp^3

17. Which of the following molecular orbital representations correctly describes C_2^+ ?



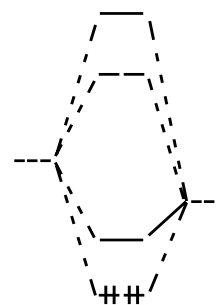
18. From molecular orbital theory, the bond order in C_2^+ is:

- 1) single 2) double 3) 0.5 4) 1.5 5) 3.5

19. Consider the molecular orbital diagram shown at right:

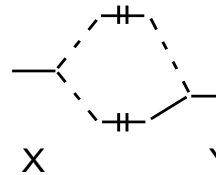
This energy diagram best describes:

- 1) C_2 2) CN^- 3) CN^+ 4) N_2



20. In the diagram at right, the π bonding orbitals are best described as:

- 1) all C 2) all N
 3) more C than N 4) more N than C
 5) equal mixture of C and N



21. Using molecular orbital theory, what is the bond order in the anion O_2^- ?

- 1) 1 2) 1.5 3) 2 4) 2.5 5) 3

Solubility Rules for some ionic compounds in water

Soluble Ionic Compounds

1. All sodium (Na^+), potassium (K^+), and ammonium (NH_4^+) salts are SOLUBLE.
2. All nitrate (NO_3^-), acetate (CH_3CO_2^-), chlorate (ClO_3^-), and perchlorate (ClO_4^-) salts are SOLUBLE.
3. All chloride (Cl^-), bromide (Br^-), and iodide (I^-) salts are SOLUBLE -- EXCEPT those also containing: lead, silver, or mercury (I) (Pb^{2+} , Ag^+ , Hg_2^{2+}) which are NOT soluble.
4. All sulfate (SO_4^{2-}) salts are SOLUBLE -- EXCEPT those also containing: calcium, silver, mercury (I), strontium, barium, or lead (Ca^{2+} , Ag^+ , Hg_2^{2+} , Sr^{2+} , Ba^{2+} , Pb^{2+}) which are NOT soluble.

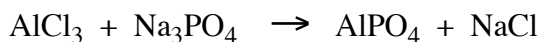
Not Soluble Ionic Compounds

5. Hydroxide (OH^-) and oxide (O^{2-}) compounds are NOT SOLUBLE -- EXCEPT those also containing: sodium, potassium, or barium (Na^+ , K^+ , Ba^{2+}) which are soluble.
6. Sulfide (S^{2-}) salts are NOT SOLUBLE -- EXCEPT those also containing: sodium, potassium, ammonium, or barium (Na^+ , K^+ , NH_4^+ , Ba^{2+}) which are soluble.
7. Carbonate (CO_3^{2-}) and phosphate (PO_4^{3-}) salts are NOT SOLUBLE -- EXCEPT those also containing: sodium, potassium, or ammonium (Na^+ , K^+ , NH_4^+), which are soluble.

22. Mixing Na_2CO_3 with CaCl_2 in water leads to precipitation of:

- 1) a CO_3^{2-} salt 2) a Na^+ salt 3) a Cl^- salt
 4) everything precipitates 5) no precipitation

23. Write the balanced, *net ionic equation* corresponding to the unbalanced equation:



The coefficient in front of Na^+ (aq) is:

- 1) 1 2) 2 3) 3 4) 4
 5) 0 (Na^+ doesn't occur in the net ionic equation)

