 Name: _____

Chem 111 10:10a section Evening Exam #3v1

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 mL = 1 cm^3

$h = 6.626x10^{-34}\ J\ s$

$c = 2.998x10^{8}\ m\ s^{-1}$

$N = 6.022x10^{23}\ mol^{-1}$

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

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

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

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

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

   1) B_2 2) C_2 3) N_2 4) O_2 5) F_2

4. The CO bond in the molecule **CH_2O** is best described as a:

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

 Name: _____

5. Draw the Lewis structure for $\mathbf{NO^-}$. 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 $\mathbf{NO^-}$.

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

7. Draw a stable resonance structure for $\mathbf{NO_2^+}$. (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 $\mathbf{NO_2^+}$, 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 $\mathbf{NO_2^+}$, 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

 Name: _____

10. Draw the Lewis structure for **XeF_4**. The molecular geometry is:

    1) square planar 2) square pyramidal 3) trigonal bipyramidal
    4) octahedral 5) none of the above

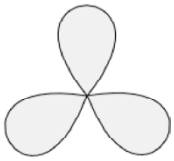
11. The molecule **XeF_4** is:

    1) polar 2) nonpolar 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^3d^3 2) sp^3d^2 3) sp^3d 4) sp^3 5) sp^2

13. The picture at right depicts which type of orbital hybridization?



    1) sp 2) sp^2 3) sp^3 4) sp^4
    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 **electron pair geometry** of this molecule is:

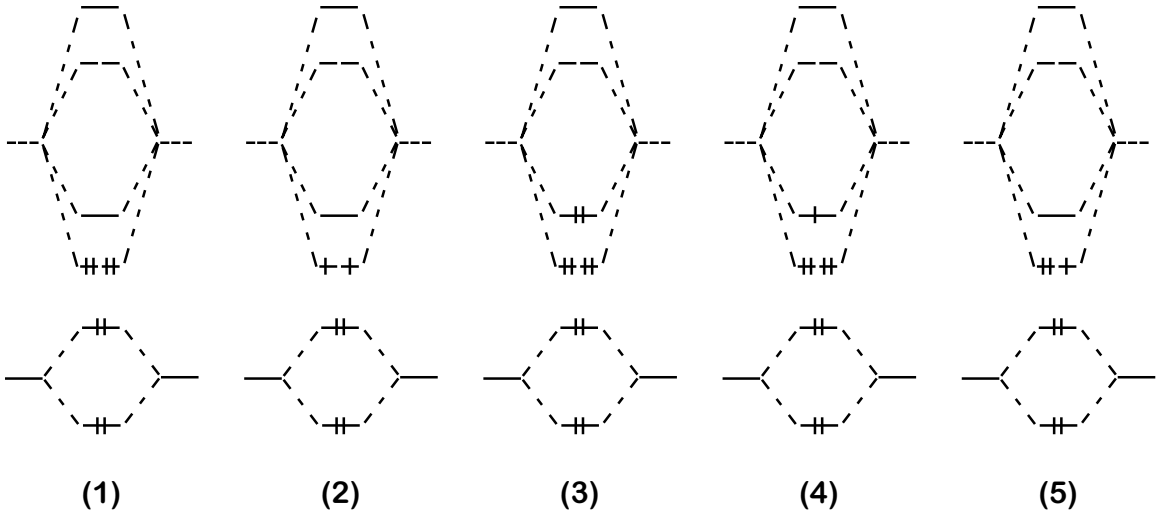
    1) tetrahedral 2) octahedral 3) linear
    4) square pyramidal 5) trigonal bipyramidal

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

 Name: _____

17. Which of the following molecular orbital representations correctly describes $\mathbf{C_2^-}$?

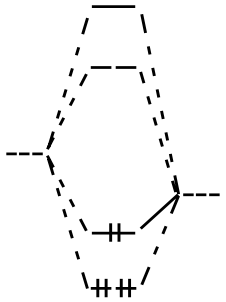


18. From molecular orbital theory, the bond order in $\mathbf{C_2^-}$ is:

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

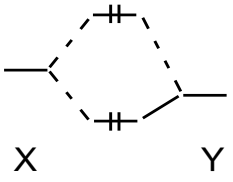
19. Consider the molecular orbital diagram shown at right:
This energy diagram best describes:

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 $\mathbf{N_2^-}$?

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

 Name: _____

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^+, $NH4^+$, 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:

    $AlCl_3 + Na_3PO_4 \rightarrow AlPO_4 + NaCl$

    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)

 Name: _____

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

$CaCl_2 + Na_2CO_3 \rightarrow CaCO_3 + NaCl$

In the net ionic equation, the coefficient in front of $\mathbf{Ca^{2+}}$ (aq) is:

1) 1 2) 2 3) 3 4) 4

5) 0 (Ca^{2+} doesn't occur in the net ionic equation)

25. The correct designator for this course is:

1) Chem 111 2) Chem 363 3) Econ 3.33 4) Sports 01

PERIODIC TABLE OF THE ELEMENTS

1A	2A	3B	4B	5B	6B	7B	8B	8B	8B	1B	2B	3A	4A	5A	6A	7A	8A
1 H 1.008																	2 He 4.003
3 Li 6.939	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.71	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (99)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 181.0	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.0	89 Ac 227.0	104 Unq (261)	105 Unp (262)	106 Unh (263)	107 Uns (262)	108 Uno (265)	109 Une (266)									