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.

$$E = hv = \frac{hc}{\lambda}$$

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

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

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

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

- 1. Which of the following has the 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**⁺.

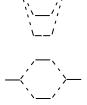


2) double

3) triple



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?



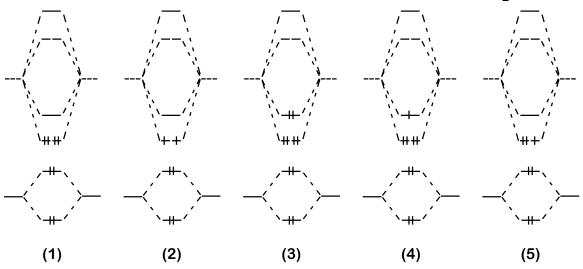
- 1) sp^4
- 2) sp³
- $3) \operatorname{sp}^2$
- 4) sp

- 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 sp³d² 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, CH₂CHCH₃?

- 1) sp & sp³ 2) sp & sp² 3) sp² & sp³ 4) sp² & sp² 5) sp³ & sp³

17. Which of the following molecular orbital representations correctly describes 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

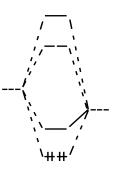
19. Consider the molecular orbital diagram shown at right: This energy diagram best describes:





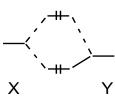
3) CN⁺

4) N₂



- 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 $\mathbf{O_2}^-$?
 - 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 (NH₄⁺) salts are SOLUBLE.
- 2. All nitrate (NO₃⁻), acetate (CH₃CO₂⁻), chlorate (ClO₃⁻), and perchlorate (ClO₄⁻) salts are SOLUBLE.
- 3. All chloride (Cl⁻), bromide (Br⁻), and iodide (l⁻) salts are SOLUBLE -- EXCEPT those also containing: lead, silver, or mercury (I) (Pb²⁺,Ag⁺, Hg₂²⁺) which are NOT soluble.
- 4. All sulfate (SO₄²⁻) salts are SOLUBLE - EXCEPT those also containing: calcium, silver, mercury (I), strontium, barium, or lead (Ca²⁺, Ag⁺, Hg₂²⁺, Sr²⁺, Ba²⁺, Pb²⁺) which are NOT soluble.

Not Soluble Ionic Compounds

- 5. Hydroxide (OH⁻) and oxide (O²⁻) compounds are NOT SOLUBLE -- EXCEPT those also containing: sodium, potassium, or barium (Na⁺, K⁺, Ba²⁺) which are soluble.
- 6. Sulfide (S²⁻) salts are NOT SOLUBLE -- EXCEPT those also containing: sodium, potassium, ammonium, or barium (Na⁺, K⁺, NH4⁺, Ba²⁺) which are soluble.
- 7. Carbonate (CO₃²⁻) and phosphate (PO₄³⁻) salts are NOT SOLUBLE -- EXCEPT those also containing: sodium, potassium, or ammonium (Na⁺, K⁺, NH₄⁺), which are soluble.
- 22. Mixing Na₂CO₃ with CaCl₂ in water leads to precipitation of:
 - 1) a CO₃²⁻ 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 \mathbf{Na}^+ (aq) is:

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

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 Ca^{2+} (aq) is:

- 2) 2
- 3) 3
- 4) 4
- 5) 0 (Ca²⁺ doesn't occur in the net ionic equation)

- 25. The correct designator for this course is:
 - 1) Chem 363
- 2) Chem 111
- 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	7 A	8A
1																	2
H																	He
1.008		1											ı	ı	1		4.003
3	4											5	6	7	8	9	10
Li	Be											В	C	N	О	F	Ne
6.939	9.012											10.81	12.01	14.01	16.00	19.00	20.18
11	12											13	14	15	16	17	18
Na	Mg											Al	Si	P	S	Cl	Ar
22.99	24.31											26.98	28.09	30.97	32.07	35.45	39.95
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
K	Ca	Sc	Ti	\mathbf{V}	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
39.10	40.08	44.96	47.90	50.94	52.00	54.94	55.85	58.93	58.71	63.55	65.39	69.72	72.61	74.92	78.96	79.90	83.80
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
85.47	87.62	88.91	91.22	92.91	95.94	(99)	101.1	102.9	106.4	107.9	112.4	114.8	118.7	121.8	127.6	126.9	131.3
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Cs	Ba	La	Hf	Ta	\mathbf{W}	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
132.9	137.3	138.9	178.5	181.0	183.8	186.2	190.2	192.2	195.1	197.0	200.6	204.4	207.2	209.0	(209)	(210)	(222)
87	88	89	104	105	106	107	108	109									
Fr	Ra	Ac	Unq	Unp	Unh	Uns	Uno	Une									
(223)	226.0	227.0	(261)	(262)	(263)	(262)	(265)	(266)									