

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.

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

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

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

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

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

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

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

(1) F is smallest of F, Cl, Br, I OWL 9-xx

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

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

(4) – longest bond, weakest bond OWL 9-xx

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

- 1) B₂ 2) C₂ 3) N₂ 4) O₂ 5) F₂

(3) N₂ – triple bond OWL 9-xx

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

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

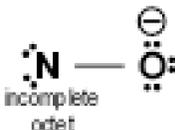
(2) From OWL units 9-1d and 9-2b. See Study Questions 13-14, Chapter 9 of K&T. This and the following 3 questions are basic exercises in drawing Lewis structures.

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

(2) double**OWL 9-xx**

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

(2) double**OWL 9-xx**

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

**OWL 9-4**

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

(2) see above**OWL 9-4**

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

1) 0

2) +1

3) -1

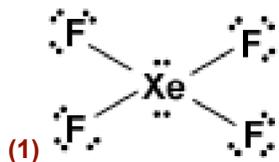
4) -0.5

5) -1 for one O and 0 for the other O

(1) 0**OWL 9-4**

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



OWL 9-xx

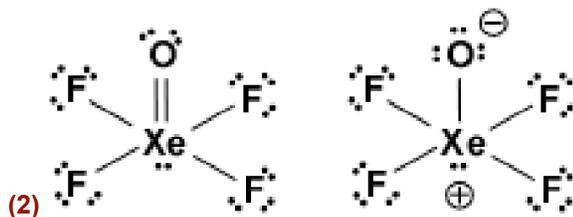
11. The molecule XeF_4 is:

- 1) polar 2) nonpolar 3) can't tell

(2) nonpolar – the individual dipoles cancel out. OWL 9-10b

12. Draw the Lewis structure for XeOF_4 (Xe is the central atom). What is the hybridization on Xe?

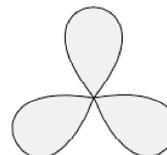
- 1) sp^3d^3 2) sp^3d^2 3) sp^3d 4) sp^3 5) sp^2



OWL 9-xx

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



(2) from OWL 10-2b

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

(3) from OWL 10-2b

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

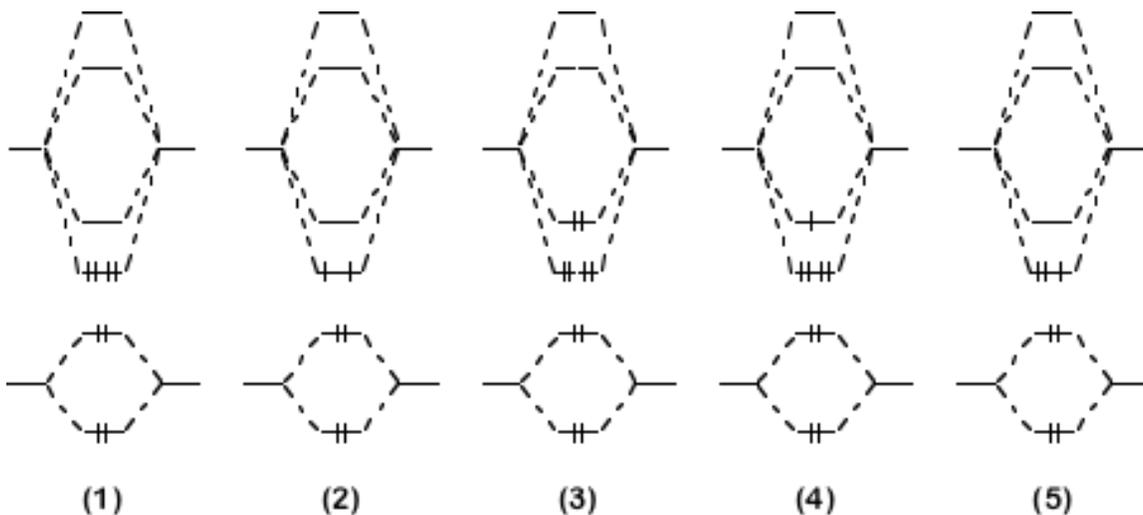
(2) from OWL 10-2b

16. What hybrid orbitals make up the sigma bond between **C2** and **C3** in propylene, **CH₂CHCH₃**?

- 1) sp & sp^3 2) sp & sp^2 3) sp^2 & sp^3 4) sp^2 & sp^2 5) sp^3 & sp^3

(3) – from OWL 10-2c

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



(4) – nine electrons – from OWL 10-5c

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

- 1) single 2) double 3) 0.5 4) 1.5 5) 2.5

(5) 3.5 bonding, 1 antibonding – from OWL 10-5c

19. Consider the molecular orbital diagram shown at right:

This energy diagram best describes:

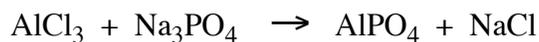
- 1) C_2 2) CN^- 3) CN^+ 4) N_2

(2) count electrons!! – from OWL 10-5c w/ a minor twist

Note that N is more electronegative, and therefore lower in energy, than C (N is on the right). OWL 10-xx



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



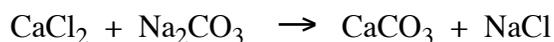
The coefficient in front of Na^+ (aq) is:

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



(5) Na^+ cancels out of the net ionic equation OWL 10-xx

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



In the net ionic equation, the coefficient in front of 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

(1)

