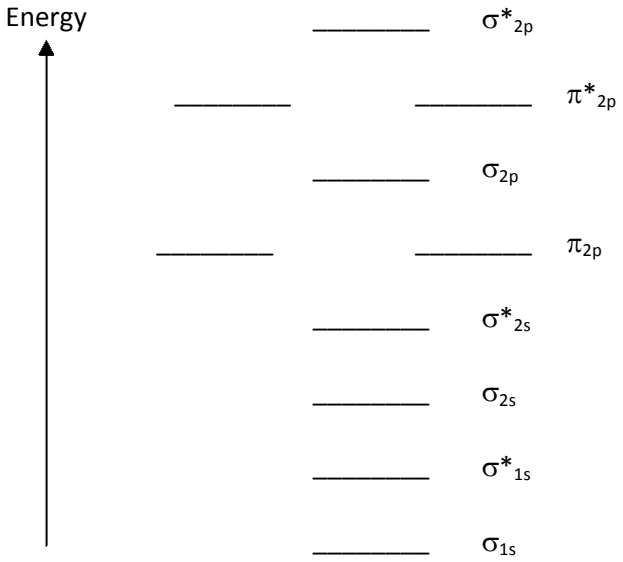
ex3 MO supplement

Diagram 9-1

The molecular orbital diagram below may be used for the following problem(s). For oxygen and fluorine, the σ_{2p} orbital should be lower in energy than the π_{2p}. However, the diagram will still yield correct bond order and magnetic behavior for these molecules.



1. Refer to Diagram 9-1. According to molecular orbital theory, which of the following species is the most likely to exist (i.e., which will have the greatest bond order)?
   a. H_2^{2+} b. F_2^{2-} c. N_2^{2-} d. Be_2 e. O_2^{2+}

2. Refer to Diagram 9-1. According to molecular orbital theory, which of the following species is least likely to exist (i.e., has the lowest bond order)?
   a. H_2^{2-} b. F_2^{2+} c. C_2^{2-} d. O_2^{2+} e. B_2^{2-}

3. Refer to Diagram 9-1. According to molecular orbital theory, which of the following species has the highest bond order?
   a. F_2 b. F_2^{2+} c. C_2^{2-} d. Li_2 e. B_2^{2+}

4. Refer to Diagram 9-1. According to molecular orbital theory, what is the bond order of oxygen, N_2^{2-}?
   a. 1 b. 3/2 c. 2 d. 5/2 e. 3

5. Refer to Diagram 9-1. According to molecular orbital theory, what is the bond order of O_2^{+}?
   a. 1 b. 3/2 c. 2 d. 5/2 e. 3

6. Refer to Diagram 9-1. According to molecular orbital theory, which of the following lists ranks the fluorine species in terms of increasing bond order?
   a. $F_2^{2+} < F_2^{2-} < F_2$
   b. $F_2^{2-} < F_2 < F_2^{2+}$
   c. $F_2 < F_2^{2+} < F_2^{2-}$
   d. $F_2 < F_2^{2-} < F_2^{2+}$
   e. $F_2^{2+} < F_2 < F_2^{2-}$

7. Refer to Diagram 9-1. Consider the molecules B_2, C_2, N_2 and F_2. Which two molecules have the same bond order?
   a. B_2 and C_2 b. B_2 and F_2 c. C_2 and N_2 d. C_2 and F_2 e. N_2 and F_2

8. Refer to Diagram 9-1. Use molecular orbital theory to predict which species is paramagnetic.
   a. N_2 b. B_2 c. F_2 d. Li_2 e. H_2

9. Refer to Diagram 9-1. Use molecular orbital theory to predict which ion is paramagnetic.
   a. F_2^{2+} b. O_2^{2-} c. O_2^{2+} d. N_2^{2+} e. B_2^{2-}

10. Refer to Diagram 9-1. What is the molecular orbital configuration of F_2?
    a. [core electrons] $(\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2p})^4 (\sigma_{2p})^2 (\sigma^*_{2p})^2$
    b. [core electrons] $(\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2p})^2 (\sigma_{2p})^2 (\pi^*_{2p})^2$
    c. [core electrons] $(\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2p})^4 (\pi^*_{2p})^4$
    d. [core electrons] $(\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2p})^4 (\sigma_{2p})^2 (\pi^*_{2p})^6$
    e. [core electrons] $(\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2p})^4 (\sigma_{2p})^2 (\pi^*_{2p})^4$

11. Refer to Diagram 9-1. What is the molecular orbital configuration of N_2^{2+}?
    a. [core electrons] $(\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2p})^4 (\sigma_{2p})^2 (\pi^*_{2p})^2$
    b. [core electrons] $(\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2p})^4$
    c. [core electrons] $(\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2p})^2 (\sigma_{2p})^2$
    d. [core electrons] $(\sigma_{2s})^4 (\sigma^*_{2s})^4$
    e. [core electrons] $(\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2p})^4 (\sigma_{2p})^2 (\pi^*_{2p})^4$

12. Refer to Diagram 9-1. Assume that the molecular orbital energy diagram for a homonuclear diatomic molecule applies to a heteronuclear diatomic molecule. What is the molecular orbital configuration of CO?
    a. [core electrons] $(\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2p})^4 (\sigma_{2p})^2$
    b. [core electrons] $(\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2p})^2 (\sigma_{2p})^2 (\pi^*_{2p})^2$
    c. [core electrons] $(\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2p})^2 (\sigma_{2p})^4$
    d. [core electrons] $(\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2p})^6$
    e. [core electrons] $(\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2p})^3 (\sigma_{2p})^3$

13. Refer to Diagram 9-1. Assuming that the molecular orbital energy diagram for a homonuclear diatomic molecule applies to a heteronuclear diatomic molecule, determine which of the following species has the highest bond order.
    a. NO^- b. OF^- c. C_2 d. O_2^{2-} e. NO^+

14. Refer to Diagram 9-1. Assuming that the molecular orbital energy diagram for a homonuclear diatomic molecule applies to a heteronuclear diatomic molecule, determine which of the following species is paramagnetic.

a. NO^+ b. CO c. CN^- d. OF^- e. NO

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Answer Section

1. E
2. A
3. C
4. C
5. D
6. B
7. B
8. B
9. A
10. E
11. B
12. A
13. E
14. E