Dr. Ali El-Rayyes **HW #: 8**

Ser.#:

Q1. The molecular geometry of XeF_4 and hybridization of the central Xe atom are:

A. square planar; sp^3d^2

B. square planar; sp^3

C. octahedral; sp^3

D. octahedral; sp^3d^2

Q2. Which statement is correct concerning the valence bond theory of H_2O?

A. The two sp hybrid orbitals of oxygen overlap with the 1s orbital of each hydrogen forming sigma bonds.

B. Two of the sp^2 hybrid orbitals of oxygen overlap with the 1s orbital of each hydrogen forming sigma bonds. The remaining sp^2 hybrid orbital contains a lone pair of electrons.

C. Two of the sp^3 hybrid orbitals of oxygen overlaps with the 1s orbital of each hydrogen forming sigma bonds. The remaining two sp^3 hybrid orbitals contain a lone pair each.

D. The half-filled 2p orbitals of oxygen overlaps with the 1s orbitals of hydrogen to form sigma bonds. The lone pair are contained in the 2s and 2p orbitals of oxygen.

Q3. According to valence bond theory, which of the following pairs of atomic orbitals can combine to form hybrid orbitals?

A. 2s and 3s

B. $2p_x$ and $2p_y$

C. 2p and 2s

D. 4d and 3p

Q4. The number of sigma and pi bonds in ethene (C_2H_4) are:

A. 4 sigma, 1 pi

B. 4 sigma, 0 pi

C. 1 sigma, 1 pi

D. 5 sigma, 1 pi

Q5. Which statement is **false**?

A. Valence Bond Theory describes bonds as being formed by atoms sharing valence electrons in overlapping valence orbitals.

B. Hybrid orbitals are the mathematical mixing of two or more orbitals on the same atom.

C. When three orbitals are mixed to form hybrid orbitals, three hybrid orbitals are **always** formed.

D. The overlap of p orbitals on adjacent atoms **always** results in a pi bond.

Q6. A molecular orbital is a wave function of an electron in a(n) _____. Molecular orbitals are formed by combining valence orbitals of _____.

A. atom; an atom

B. molecule; an atom

C. atom; more than one atom

D. molecule; more than one atom

Q7. Which of the following is the correct valence shell molecular orbital configuration of OF^+? (Assume the same energy level diagram as for homonuclear diatomic molecules.)

Q8. According to molecular orbital theory, the bond order and number of unpaired electrons in N_2^- are:

A. 2.5, 1

B. 3, 0

C. 3, 1

D. 2.5, 0

Q9. Which of the following molecules are diamagnetic?

O_2, NO, CH_4, H_2O

A. O_2 and NO

B. CH_4 and H_2O

C. CH_4, O_2, and H_2O

D. none of the above

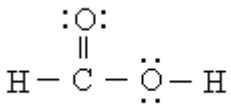
Q10. Indicate the expected bond angle in NO_2^-.

A. 90^o

B. $109^o28'$

C. 180^o

Q11. Formic acid, HCOOH, can be considered as the simplest organic carboxylic acid. What is the hybridization about the central carbon atom if the Lewis structure of the molecule can be written as



A. sp B. s^2p C. sp^2 D. sp^3

Q12. The hybridization schemes used by the **carbon atoms** in

$$CH_3\text{-}C\text{=-}C\text{-}CH_2\text{-}OH$$

are

A. sp^3, sp

B. sp, sp^2, sp^3

C. sp, sp^2

D. sp^2, sp^3

Q13. Acetylene, C_2H_2, contains

A. 1 **sigma** bond and 1 **pi** bond

B. 3 **sigma** bonds and 2 **pi** bonds

C. 3 **sigma** bonds and 1 **pi** bond

D. 2 **sigma** bonds and 3 **pi** bonds

Q14. The bond orders of **H_2, H, He, and He_2**, in that order, are

A. 1, -1/2, -1/2, 0

B. 1, 1/2, 1/2, 0

C. 1, 1/2, 0, 0

D. 1, 0, 0, 0

Q15. What is the electron configuration and bond order of C_2^+?

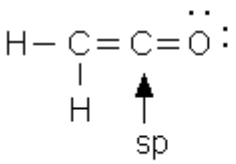
A. $(s_{1s})^2 (s^*_{1s})^2 (s_{2s})^2 (s^*_{2s})^2 (p_{2p})^4$, BO = 2

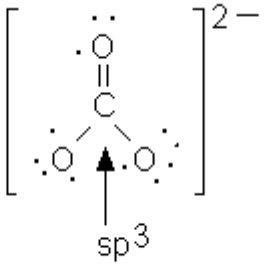
B. $(s_{1s})^2 (s^*_{1s})^2 (s_{2s})^2 (s^*_{2s})^2 (p_{2p})^4 (s_{2p})^2$, BO = 3

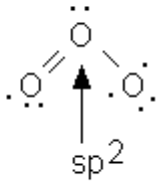
C. $(s_{1s})^2 (s^*_{1s})^2 (s_{2s})^2 (s^*_{2s})^2 (p_{2p})^3$, BO = 1.5

D. $(s_{1s})^2 (s^*_{1s})^2 (s_{2s})^2 (s^*_{2s})^2 (p_{2p})^2$, BO = 1

Q16. In which of the following molecules species is the hybridization of the indicated atom **correctly** given ?

1. 

2. 

3. 

A. All indicated hybridizations are correct.

B. 1 only is correct.

C. 1 and 2 only are correct.

D. 1 and 3 only are correct.

Q17. The molecule N_2O (N-N-O connectivity) has

A. two sigma bonds and no pi bonds.

B. two sigma bonds and one pi bond.

C. one sigma bond and two pi bonds.

D. two sigma bonds and two pi bonds.

Q18. Which one of the following statements is **true** ?

A. One may never put electrons in antibonding orbitals.

B. Molecular orbitals are formed by combining atomic orbitals on the same atom.

C. In sigma bonding molecular orbitals, electron density is concentrated between the nuclei.

D. Molecular orbital theory predicts that the He_2 molecule has two unpaired electrons.

Q19. Which of the following are paramagnetic according to molecular orbital theory ?

1. $\mathbf{C_2^{2-}}$ **2.** $\mathbf{N_2}$ **3.** $\mathbf{O_2}$ **4.** $\mathbf{B_2}$

A. 1 and 2

B. 2 and 3

C. 3 and 4

D. 1 and 4

Q20. Which one of the following has a bond order of 2 ?

A. C_2

B. B_2

C. Li_2

D. O_2^{2-}