IB Chem I/Diff. Chem: Ch. 9 Quest. Hybridization & Molecular Orbital Theories Name:

Multiple Guess: Choose the best answer for the following questions. Show your work on the reverse side.

1. _____ In counting electron dense regions about a central atom when predicting the shape by VSEPR theory, which of the following does not count as a single region?
   a. lone pair of valence electrons b. a single covalent bond c. a sub-valence level electron pair
   d. a double covalent bond e. a triple covalent bond f. all the above count as e^- dense regions

2. _____ What is the shape of the PF_4^+ ion?
   a. square planar b. tetrahedral c. seesaw d. trigonal pyramidal e. T-shaped f. none of the above

3. _____ What is(are) the bond angle(s) in the tribromide ion?
   a. 109.5° b. 120° c. 180° d. 90° e. c & d f. b & d g. none of the above

4. _____ If LP represents a lone pair, which one of the following has the smallest bond angle?
   a. AX_2LP_2 b. AX_3LP_1 c. AX_4LP_0 d. they all have the same bond angles

5. _____ Which of the following molecules is polar?
   a. SbF_5 b. AsH_3 c. SF_6 d. I_2 e. none of the above

6. _____ In general, molecules with a tetrahedral geometry have what central atom hybridization?
   a. sp b. sp^2 c. sp^3 d. sp^3d e. sp^3d^2

7. _____ Which of the following choices has sp^2 hybridization?
   a. SO_3 b. CH_2O c. HCO_2^{-1} d. all the above e. a & b only f. none of the above

8. _____ What type of hybrid orbital is used for bonding by Xe in XeF_2?
   a. sp b. sp^2 c. sp^3 d. sp^3d e. sp^3d^2

9. _____ A triple covalent bond typically consists of
   a. three sigma bonds b. three pi bonds c. one sigma and two pi bonds d. two sigma and one pi bond

10. ____ The are ____ σ and ____ π bonds, respectively, in $H_2C=C=CH_2$
    a. 4 & 2 b. 2 & 4 c. 2 & 2 d. 2 & 6 e. 6 & 2

11. ____ The combination of two atomic orbitals results in the formation of ____ molecular orbitals
    a. 1 b. 2 c. 3 d. 4

12. ____ The bond order of any molecule containing equal numbers of bonding and anti-bonding electrons is
    a. 0 b. 1 c. 2 d. 3

13. ____ Electrons that are distributed about the inter-nuclear axis are most likely found in which of the following
    a. σ_{1s} b. σ_{2p} c. π_{2p^*} d. σ_{2s^*} e. σ_{1p} f. a & b only g. a, b & e.

14. ____ Molecular orbital theory describes the respective bond order in He_2^{+2} as
    a. 0 b. 0.5 c. 1 d. 1.5 e. 2 f. none of the above

15. ____ How many electrons can an anti-bonding pi molecular orbital hold at most.
    a. 1 b. 2 c. 4 d. 6 e. 8 f. none of the above

16. ____ Which of the following species is paramagnetic?
    a. N_2 b. C_2^{-2} c. F_2 d. B_2^+ e. a & b only f. b & d only g. all the above

17. Matching

_____ He_2+	a. number of electrons in πp orbitals equals the number of electrons in πp* orbitals
_____ Li_2	b. bond order = 1 and no p electrons
_____ N_2	c. σ bond plus 2 π bonds and nonpolar
_____ F_2	d. bond order = ½
_____ He_2	e. unstable

18. a. Draw a molecular orbital diagram for the Be_2^{+1} ion

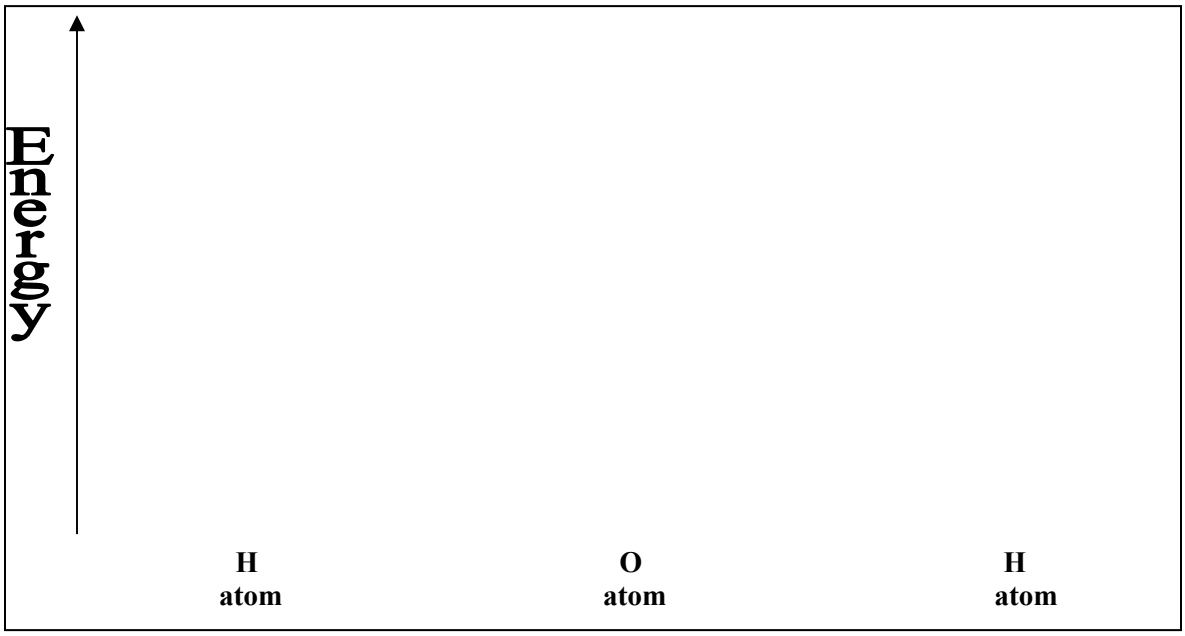
b. Write the electron configuration for the Be_2^{+1} ion

c. Calculate the bond order for the Be_2^{+1} ion.

18. Draw the molecular orbitals for H_2O. The ionization energies for the electrons are as follows:

H.	O	(eV is an electron-volt, a unit of energy)
1s = 13.6 eV	1s = 538.3 eV	
	2s = 28.7 eV	
	2p = 13.6 eV	

[I am getting you started by setting up the diagram]



BONUS: Explain what the HOMO-LUMO gap is and the significance of this gap.