CH 121

General Chemistry
Examination 3
March 22, 2002

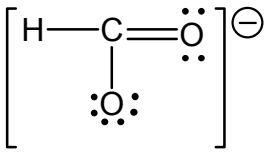
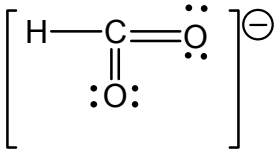
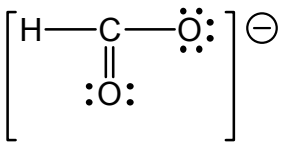
Name:_____
(please print)

SSN: * * * - * * - _____
(last 4 digits)

There are 20 Questions. Each question is worth 1 point.
Circle your answer **clearly**; otherwise no credit will be given.
Circle only **one** answer. If you circle two or more, you will receive no credit.

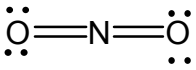
1. How many unpaired electrons are present in Fe^{2+}
    a. 0
    b. 2
    c. 4
    d. 5
    e. 6
2. Which of the following particles has the largest radius?
    a. Ne
    b. F^-
    c. O^{2-}
    d. Mg^{2+}
    e. N^{3-}
3. Rank Ba, Ca, Na in order of increasing 2nd ionization energy.
    a. Ba < Ca < Na
    b. Ba < Na < Ca
    c. Ca < Ba < Na
    d. Na < Ca < Ba
    e. Na < Ba < Ca
4. According to molecular orbital theory, which of the following species is unlikely to exist?
    a. H_2
    b. H_2^+
    c. He_2^+
    d. He_2
    e. H_2^-
5. Using the VSEPR theory, predict the molecular shape of SCl_2.
    a. triangular planar
    b. T-shaped
    c. linear
    d. tetrahedral
    e. angular (bent)

6. Which of the following sets of quantum numbers is not allowed?
   a. $n = 3, l = 2, m_l = 0, m_s = -1/2$
   b. $n = 3, l = 2, m_l = +2, m_2 = +1/2$
   c. $n = 2, l = 2, m_l = -1, m_S = +1/2$
   d. $n = 4, l = 2, m_l = +1, m_s = -1/2$
   e. $n = 4, l = 3, m_l = -3, m_s = -1/2$
7. Which of the following elements is a d-block element?
   a. copper
   b. chlorine
   c. aluminum
   d. sodium
   e. lead
8. Which of the following is (are) **CORRECT** resonance structure(s) for the formate ion?

1.  2.  3. 

   a. 1 only
   b. 2 only
   c. 3 only
   d. 1 and 3 only
   e. 1,2, and 3

9. The Lewis structure



   represents

   a. NO_2
   b. NO_2^+
   c. NO_2^-
   d. both NO_2^+ and NO_2^-
   e. NO_2, NO_2^+, and NO_2^-

10. In the Lewis electron dot structure for hydrazine, N_2H_4, the total number of lone electron pairs around the two nitrogen atoms is
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4

11. Which compound contains a carbon-oxygen bond with a bond order of 2?
    a. CO_2
    b. CH_3OH
    c. CH_3OCH_3
    d. CO
    e. C_2H_5OH

12. Using the VSEPR theory, predict the molecular shape of ClF_3.
    a. triangular planar
    b. T-shaped
    c. linear
    d. tetrahedral
    e. square planar

13. What is the hybridization of the nitrogen atoms in NH_3 and NH_4^+ respectively?
    a. sp^3, sp^4
    b. sp^3, sp^3
    c. sp^2, sp^3
    b. sp^2, sp^2
    b. sp^3, sp

14. In the combustion of methane, CH_4, what change in hybridization (if any) occurs to the carbon atom?
    a. sp^2 to sp^3
    b. sp^3 to sp^4
    b. sp^2 to sp^3
    d. sp^3 to sp
    e. no change in hybridization occurs

15. What type of hybrid orbital set is used by the sulfur atom in the compound SF_6?

a. sp
b. sp^2
c. sp^3
d. sp^3d
e. sp^3d^2

16. Consider the diatomic molecules of the second period Li_2, Be_2, and C_2. Which is (are) unlikely to exist?

a. Li_2
b. Li_2 and Be_2
c. Be_2
d. C_2
e. Be_2 and C_2

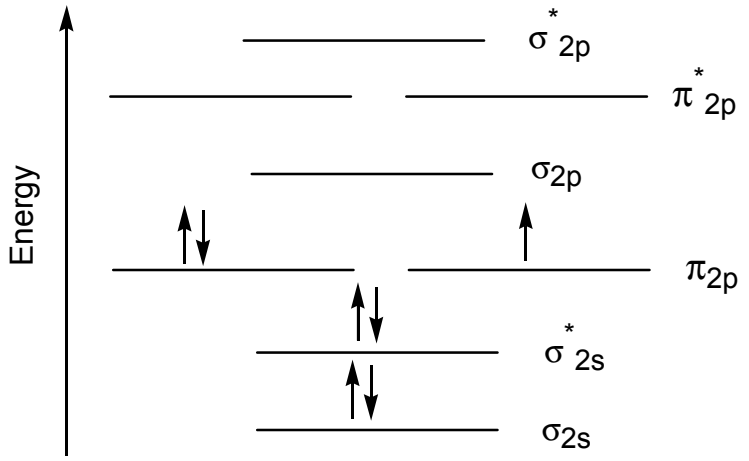
17. In order to create a *p-type* semiconductor, a silicon crystal could be doped with

a. Ga
b. Ge
c. As
d. He
e. None of these

18. What are the oxidation numbers of sulfur and oxygen in the molecule SO_3?

a. Sulfur is +1 and oxygen is –1.
b. Sulfur is +6 and oxygen is -2.
c. Sulfur is +6 and oxygen is -6.
d. Sulfur is +3/2 and oxygen is -3.
e. Sulfur is -2 and oxygen is -2.

19. The following molecular orbital energy level diagram is appropriate for which one of the listed particles?



a. B_2^+

b. B_2^-

c. N_2^+

d. N_2^-

e. N_2

20. Which response contains all the characteristics listed that should apply to BF_3?

1. trigonal planar
2. one unshared pair of electrons on B
3. sp^2 hybridized boron atom
4. polar molecule
5. polar bonds

a. 2,4, and 5

b. 1, 3, and 4

c. 1,2, and 3

d. 1, 3, and 5

e. 3, 4, and 5