

HW 10 & 11
CHEM 362

Available: April 21, 2008

Due: April 28, 2008

Chapter 14

1. The electronic structure of C in its ground state is $1s^2 2s^2 2p^2$. Why does carbon typically form four single bonds and not two?
2. What is meant by catenation? Why does silicon have much less tendency to catenate than carbon? Could the same be said of nitrogen?
3. List ways in which CO can be made.
4. List ways in which CO₂ can be made.
5. On which side is the equilibrium favored? L or R?
$$\text{CO}_{2(\text{aq})} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{H}_3\text{CO}_3^+$$
6. Why does CaCO₃ dissolve, to some extent, to form CO₂ saturated water? Write balanced equations for the reactions involved. (see the book)
7. How does HCN act in the body? Why are KCN water solutions alkaline?
8. The C-C bond length in graphite is 1.42 Å. How does this compare with the C-C bond length in: (see the book)
 - a. diamond
 - b. ethylene
 - c. benzeneWhat do you expect the bond order is in graphite?
9. Explain the roles of CO and CO₂ in the environment. Be as complete as possible in your response.

Chapter 16

1. Complete and balance the following reactions:
 - a. $\text{H}_2\text{O}_2 + \text{NO}_2 \rightarrow$
 - b. $\text{Li} + \text{N}_2 \rightarrow$
 - c. $\text{O}_3 + \text{NO}_2 \rightarrow$
 - d. $\text{HI} + \text{HNO}_2 \rightarrow$
 - e. $\text{C} + \text{NO}_2 \rightarrow$
 - f. $\text{Cu} + \text{NO}_2 \rightarrow$
2. Write balanced equations for the different preparations of nitric oxide.
3. How can NO₂ and NO₃ be bonded to transition metals? (this was covered a long time ago but is still important)
4. Draw the Lewis structure and explain the geometry and hybridization at each atom in



5. Use MO theory to compare the bonding in CO, N₂, CN⁻ and NO⁺. Why does N₂ form complexes with metals much less than CO? (this is review but is being re-emphasized in this section)
6. Why does N₂ form a diatomic molecule unlike Phosphorus and other elements in Group VB(15)?
7. Give the principal products of the reactions:
 - a. O₂ + NH₃ → (uncatalyzed)
 - b. Disproportionation of NO
 - c. Oxidation of NO₂ by ozone
 - d. Reduction of NO₂ by excess hydrogen
 - e. The Haber process for ammonia
 - f. Dimerization of NO₂
8. Outline the synthesis of HNO₃ starting from the elements.
9. What is the role of NO_x gases in the environment? Be as complete as possible in your response.

Chapter 18

1. What is the difference between oxygenation and oxidation?
2. Describe the interaction with water of acidic, basic and neutral oxides. Give two examples of each type.
3. Give the electronic configuration of the oxygen *atom*.
4. Explain why the oxygen atom is paramagnetic.
5. Describe and compare the geometries of the oxygen atoms in the following pairs of molecules:
 - a. O₂ and O₃
 - b. CH₃OH and H₂O
 - c. O₂ and O₂²⁻
 - d. CO₂ and SO₃