Chemistry 121
Fall 2004
Test 4, FORM A

Name:_____

Instructions: You have 50 minutes to complete this 100-point exam. You may use a simple scientific calculator. No programmable calculators allowed.

I. MULTIPLE CHOICE: (25 pts, 5 points each) Carefully and clearly circle the best answer. If you circle two answers, *one of which is correct*, you will receive 3 points.

1. Which of the following is a false statement?
    a. Gases expand to fill their container.
    b. Gases can be readily compressed.
    c. Gases form homogenous mixtures with each other.
    d. Individual gas molecules are relatively close together.
    e. None of the above.

2. The movement of gases through a tiny opening into a vacuum is:
    a. Diffusion.
    b. Effusion.
    c. Heterogeneous.
    d. Osmosis.
    e. None of the above

3. If the following gases are at the same temperature, which will have the fastest velocity (speed)?
    a. He
    b. Ne
    c. Ar
    d. Kr
    e. Xe

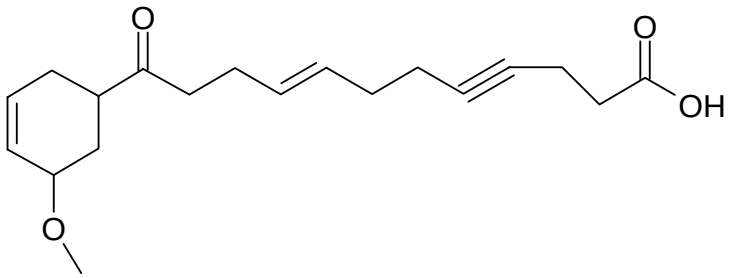
4. What type of forces hold network solids together?
    a. Dispersion
    b. Hydrogen bonding
    c. Covalent
    d. Coulombic
    e. Delocalized bonding

5. If the concentration of Na^+ inside a cell is 0.01M and the concentration of Na^+ outside the cell is 0.01M, the cell is:
    a. Isotonic
    b. Hypotonic
    c. Hypertonic
    d. Homogeneous
    e. None of the above

II. Short Answer and Calculations (85 pts): Clearly indicate your answer in the space provided. Partial credit will be given for correct work. If I cannot read the work, it will not be graded.

1. (10 pts) Rank the following solutions in order of increasing boiling point. 0.05 *m* $AlCl_3$, 0.05 *m* sugar, 0.05 *m* Na_2CO_3, pure water and 0.05 *m* NaCl.

2. (10 pts) Circle and identify the functional groups in the following molecule.



3. (10 pts) What is the complimentary base pairing for the following molecule?

TCTAGGTCAA

4. (10 pts) Pick **ONE** of the following essay questions to answer in 4 – 5 grammatically correct sentences.
   a. Describe the chemistry of sulfur in the troposphere.
   b. Describe the two types of secondary structure of RNA and what causes the structures to occur.
   c. Describe the secondary and tertiary structures of proteins and what causes the structures to occur.

5. (15 pts) A relief valve on a 450. L industrial storage tank operates whenever the pressure of the enclosed carbon dioxide gas exceeds 110 atm. In December, the tank was filled with carbon dioxide at 100. atm when the ambient temperature was – 10.˚C. On a hot summer day, the temperature rose to 5˚C.
(a) Calculate the pressure inside the tank.

(b) Would the relief valve open? Explain your answer

6. (10 pts) A closed tank contains 4.5 mol of F_2 and 2.0 mol of Cl_2. If the total pressure of in the tank is 2.50 atm, what is the partial pressure of Cl_2?

7. (20 pts) Iron pyrite, FeS_2, is the form in which much of the sulfur occurs in coal. In the combustion of the coal, oxygen reacts with iron pyrite to produce iron (III) oxide and sulfur dioxide in the reaction below. Calculate the mass of Fe_2O_3 that is produced from the reaction of 40.0g of FeS_2 with 25.0 L of O_2 at 2.33 atm and 50. ˚C. (MM of FeS_2 = 119.97 g/mol; MM of Fe_2O_3 = 159.7 g/mol)

$$4\ FeS_2 + 11\ O_2 \rightarrow 2\ Fe_2O_3 + 8\ SO_2$$

Chemistry 121
Fall 2004
Test 4, FORM B

Name:_____

Instructions: You have 50 minutes to complete this 100-point exam. You may use a simple scientific calculator. No programmable calculators allowed.

I. MULTIPLE CHOICE: (25 pts, 5 points each) Carefully and clearly circle the best answer. If you circle two answers, *one of which is correct*, you will receive 3 points.

1. Which of the following is a false statement?
    a. Gases expand to fill their container.
    b. Gases can be readily compressed.
    c. Gases form homogenous mixtures with each other.
    d. Individual gas molecules are relatively far apart.
    e. None of the above.

2. The mixing of two gases due to their molecular motion is:
    a. Diffusion.
    b. Effusion.
    c. Heterogeneous.
    d. Osmosis.
    e. None of the above

3. If the following gases are at the same temperature, which will have the slowest velocity (speed)?
    a. He
    b. Ne
    c. Ar
    d. Kr
    e. Xe

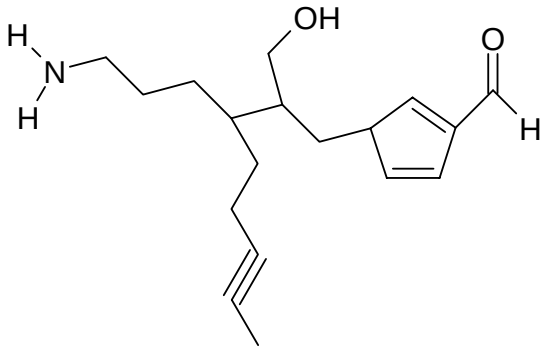
4. What type of forces hold metallic solids together?
    a. Dispersion
    b. Delocalized bonding
    c. Covalent
    d. Coulombic
    e. Hydrogen bonding

5. If the concentration of Na^+ inside a cell is 0.01M and the concentration of Na^+ outside the cell is 0.001M, the cell is:
    a. Isotonic
    b. Hypotonic
    c. Hypertonic
    d. Homogeneous
    e. None of the above

II. Short Answer and Calculations (85 pts): Clearly indicate your answer in the space provided. Partial credit will be given for correct work. If I cannot read the work, it will not be graded.

1. (10 pts) Rank the following solutions in order of increasing freezing point. 0.05 *m* Na_3PO_4, 0.05 *m* sugar, 0.05 *m* KCl, pure water and 0.05 *m* CaF_2.

2. (10 pts) Circle and identify the functional groups in the following molecule.



3. (10 pts) What is the complimentary base pairing for the following molecule?

UCGAGGACAU

4. (10 pts) Pick **ONE** of the following essay questions to answer in 4 – 5 grammatically correct sentences.
   a. Describe the chemistry of nitrogen in the troposphere.
   b. Describe the two types of secondary structure of RNA and what causes the structures to occur.
   c. Describe the secondary and tertiary structures of proteins and what causes the structures to occur.

5. (15 pts) When the temperature in an aerosol can reaches 600˚ C, the can will explode. A 250. mL aerosol can at 25˚ C and 1.10 atm was thrown in an incinerator.
(a) Calculate the temperature in the can when the pressure reaches 5.00 atm.

(b) Would the can explode?

6. (10 pts) A closed tank contains 5.0 mol of O_2 and 8.0 mol of N_2. If the total pressure of in the tank is 1.25 atm, what is the partial pressure of N_2?

7. (20 pts) Iron pyrite, FeS_2, is the form in which much of the sulfur occurs in coal. In the combustion of the coal, oxygen reacts with iron pyrite to produce iron (III) oxide and sulfur dioxide in the reaction below. Calculate the mass of Fe_2O_3 that is produced from the reaction of 65.0g of FeS_2 with 20.0 L of O_2 at 2.33 atm and 150. ˚C. (MM of FeS_2 = 119.97 g/mol; MM of Fe_2O_3 = 159.7 g/mol)

$$4\ FeS_2 + 11\ O_2 \rightarrow 2\ Fe_2O_3 + 8\ SO_2$$