

Name: KEY

Chemistry 121  
Test 4  
Fall 2007

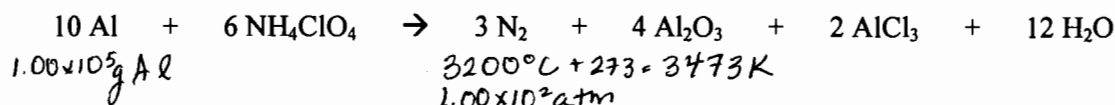
You have 50 minutes to complete this 100 point test. Please mark each answer clearly and show all work. You may use a simple scientific calculator. NO GAPHING CALCULATORS.

I. Fill in the blank

- (2 pt) Before you open a 2L of soda pop, a dynamic equilibrium exists between the gas and vapor phases. One you open the bottle, you disturb this and according to LeChatelier's Principle, the system will respond to counteract the disturbance.
- (3 pt) The double helix of DNA is held together by hydrogen bonding forces. (be specific) These forces result in a pairing of adenine with thymine and cytosine with guanine.
- (3 pt) A gas no longer follows the gas laws and becomes a(n) real gas at conditions of high pressure and low temperature. (nonideal)
- (2 pts) If a gas is at STP, the gas has a pressure of 1 atm and a temperature of 0 °C.

II. Calculations: Clearly show all work for full credit.

- (15 pts) The space shuttle relies on several fuel systems to lift off. One of those fuel systems, solid rocket booster propellant (SRB) relies on a reaction of aluminum with ammonium perchlorate. What volume (in L) of  $N_2$  would be generated from the reaction of  $1.00 \times 10^5$  g Al with excess ammonium perchlorate if the temperature is  $3200^\circ\text{C}$  and the pressure is  $1.00 \times 10^2$  atm?



$$1.00 \times 10^5 \text{ g Al} \times \frac{1 \text{ mol Al}}{26.98 \text{ g Al}} \times \frac{3 \text{ mol N}_2}{10 \text{ mol Al}} = 1.11 \times 10^3 \text{ mol N}_2$$

$$PV = nRT$$

$$V = \frac{nRT}{P} = \frac{(1.11 \times 10^3 \text{ mol N}_2)(0.0821 \frac{\text{Latm}}{\text{molK}})(3473\text{K})}{1.00 \times 10^2 \text{ atm}} = \boxed{3.16 \times 10^3 \text{ L}}$$

- (10 pts) Helium gas in a 20.0L tank has a pressure of 45.0 atm at  $57^\circ\text{C}$ . What would be the temperature (in °C) if the pressure is increased to 65.0 atm?

$$P_1 = 45.0 \text{ atm} \qquad P_2 = 65.0 \text{ atm}$$

$$V_1 = 20.0 \text{ L} \qquad V_2 = V_1$$

$$T_1 = 57^\circ\text{C} + 273 = 330 \text{ K} \qquad T_2 = ?^\circ\text{C}$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$T_2 = \frac{P_2 \cdot T_1}{P_1} = \frac{(65.0 \text{ atm})(330 \text{ K})}{(45.0 \text{ atm})} = 477 \text{ K}$$

$$T_2 = 477 \text{ K} - 273 = \boxed{204^\circ\text{C}}$$

3. (10 pts) A mixture of gases (A, B and C) in a 15L container has a total pressure of 758 mmHg at 25°C. What is the mole fraction and mole percent of gas A if the partial pressure of gas A is 225 mmHg?

$$\chi_A = \frac{P_A}{P_{\text{tot}}} = \frac{225 \text{ mmHg}}{758 \text{ mmHg}} = 0.297$$

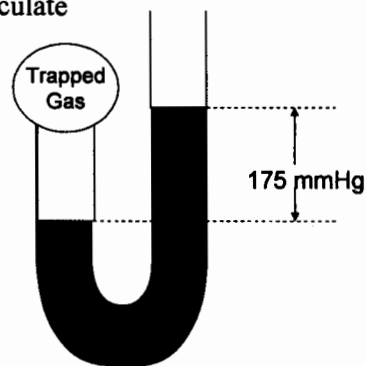
$$\text{mol}\% = 0.297 \cdot 100 = 29.7\%$$

4. (10 pts) A gas was collected in a u-tube at 28°C. Given the diagram below, calculate the partial pressure of O<sub>2</sub> (in atm), if the atmospheric pressure is 748 mmHg.

$$P_{\text{gas}} > P_{\text{atm}}$$

$$P_{\text{gas}} = P_{\text{atm}} + P_{\text{diff}} = 748 \text{ mmHg} + 175 \text{ mmHg}$$

$$P_{\text{gas}} = 923 \text{ mmHg} \times \frac{1 \text{ atm}}{760 \text{ mmHg}} = \boxed{1.21 \text{ atm}}$$



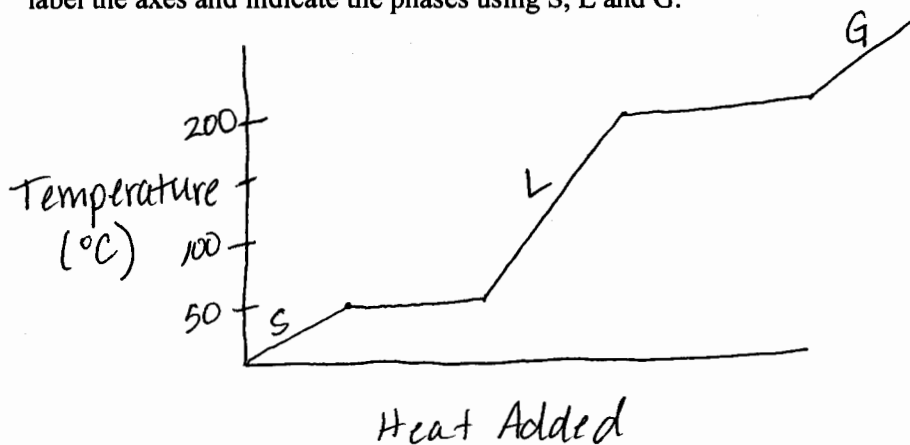
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### III. Phase Changes and Trends

1. (10 pts) Rank the following gases in order of increasing boiling point: N<sub>2</sub>, O<sub>2</sub>, Cl<sub>2</sub>, F<sub>2</sub> and H<sub>2</sub>.

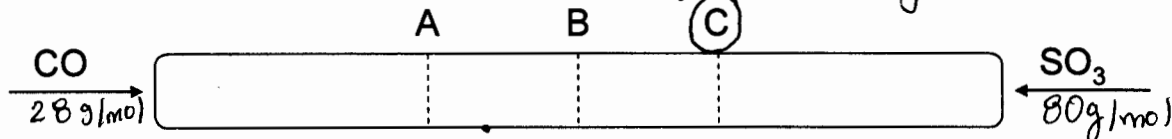


2. (10 pts) Draw a heating curve for a substance the melts at 50°C and boils at 200°C. Correctly label the axes and indicate the phases using S, L and G.



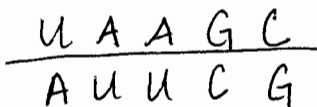
3. (5 pts) Two gases are allowed to diffuse as seen in the diagram below. Indicate where the gases will meet (Point A, B or C) and then in one sentence explain why.

CO travels faster over the same period of time and thus travels farther, according to Graham's Law.



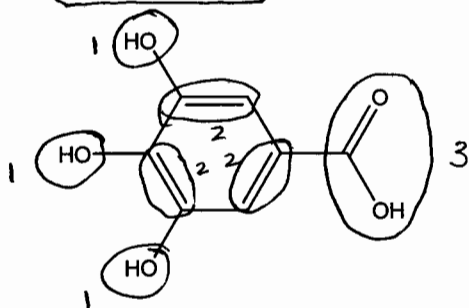
#### IV. Organic Compounds, Biochemicals and Forces

1. (10 pts) Give an example of a strand of RNA with 5 nucleotides. Then, write the complimentary base pair.

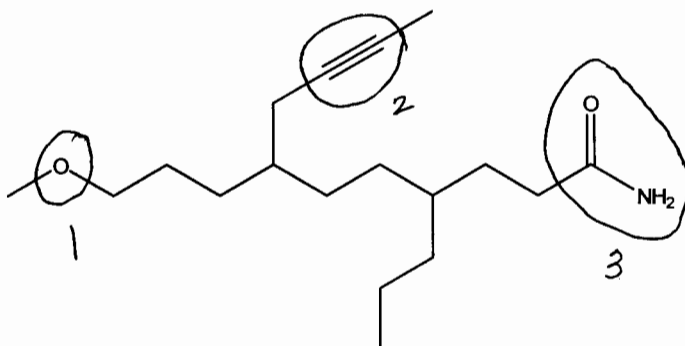


2. (10 pts) Circle and identify the important functional groups in the following molecules. Also indicate if the molecules would be soluble or insoluble in water.

- a. Soluble in water or Insoluble in water?



- b. Soluble in water or Insoluble in water?



3. (10 pts) Choose one of the following to answer in 4 – 6 grammatically correct sentences.
- Explain the difference between monosaccharides and polysaccharides; give examples when each would best be used for an energy source and why.
  - Explain the importance of shape in a protein's ability to function and discuss what three things can alter its shape.

see lecture notes.