

Name: KEY

Chem 121

Test 4

Fall 2008

Form A

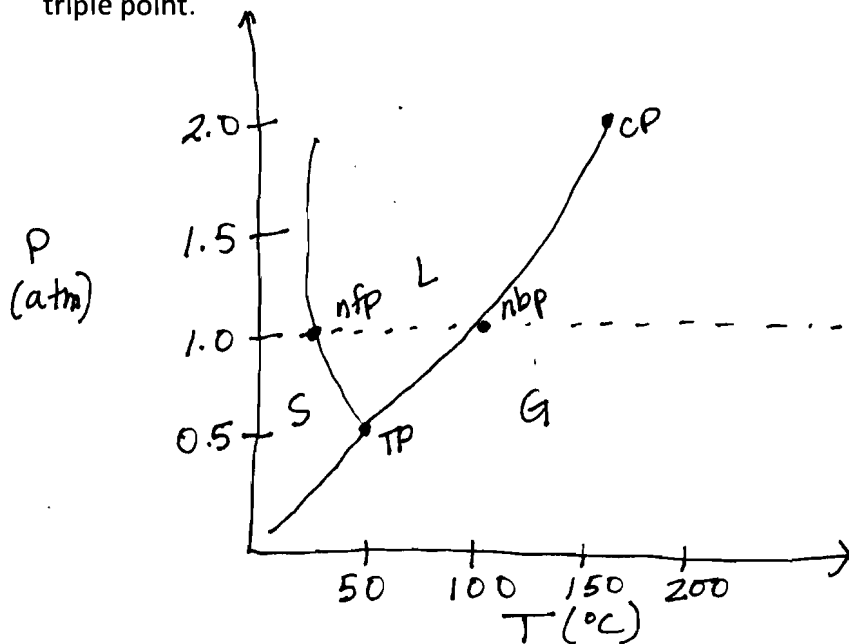
You have 75 minutes to complete this 100 point test. Please mark each answer clearly and show all work. You may use a scientific calculator.

I. Fill-in the blank: (10 pts) Clearly fill-in the blank with the appropriate answer.

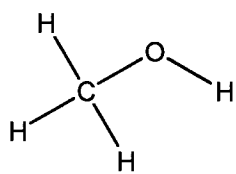
1. monosaccharides are a class of carbohydrates that give small amounts of quick energy and polysaccharides are a class of carbohydrates the give large amounts of sustainable energy.
2. Ideal gases become non-ideal under conditions of high pressure and low temperature. The Van der Waals equation can be used to correct for these conditions.
3. Lipids are a large group of biological molecules with the membership requirement that hydrocarbons compose a large portion of the molecules.
4. Proteins are macromolecules whose monomers are amino acids.
5. If the three most common intermolecular forces are placed in order of increasing strength, they would be listed in the following order: London forces < dipole-dipole < hydrogen bonding.

II. Forces, Phase Changes and Trends (30 pts)

1. (10 pts) Draw a phase diagram for a substance that has a triple point at a pressure of 0.50 atm and a temperature of 50°C, a critical point of 2.0 atm and 150°C, a nfp of 25°C and a nbp of 100°C. Label the axes, phases, the critical point, the nfp, the nbp and the triple point.



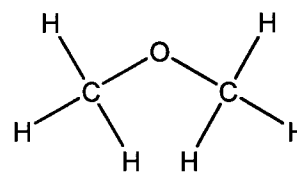
2. (10 pts) List the intermolecular forces present in CH_3OH , Ar, Ne, and CH_3OCH_3 and then rank them from lowest to highest boiling point.



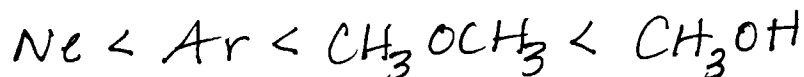
dipole-dipole
Hydrogen bonding
London

Ar
London

Ne
London



dipole-dipole
London

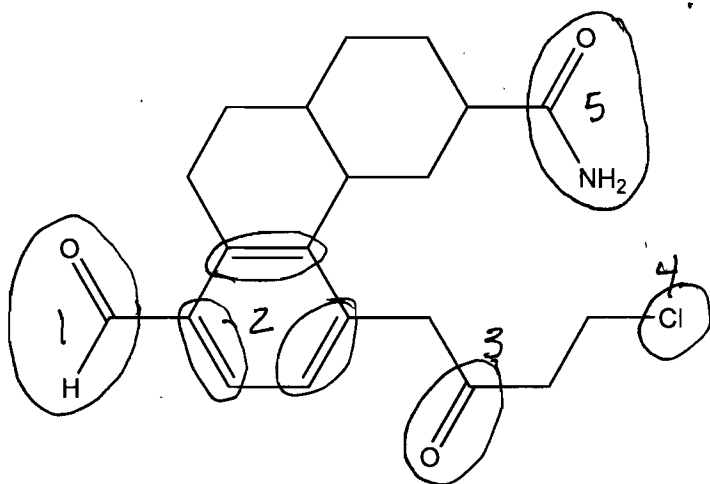


3. (10 pts) Essay Question: Pick one of the following and answer in 4 – 6 grammatically correct sentences.
- Define viscosity and discuss what controls a liquid's viscosity.
 - Explain LeChatelier's principle and give an example of it at work.

See lecture notes

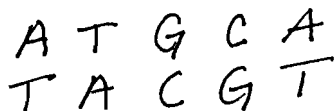
III. Organic chemistry and biochemicals (25 pts)

1. (10 pts) Circle and name the functional groups in the molecule below.

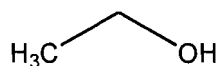


- aldehyde
- alkene
- ketone
- chloro
- amide

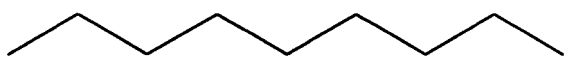
2. (5 pts) Using the appropriate letters, represent a strand of DNA with 5 base pairs and include the complimentary pairing.



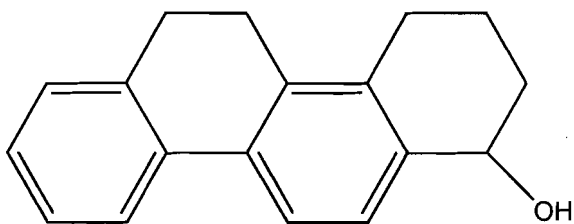
3. (10 pts) Indicate whether the following molecules would be soluble in water or benzene (a nonpolar solvent) and explain why. "likes dissolve likes"



H_2O , ability to hydrogen bond



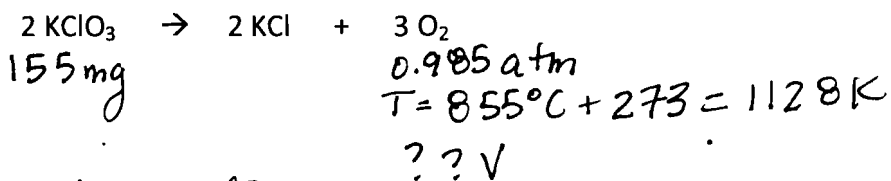
benzene, large nonpolar molecule



benzene, large nonpolar molecule

IV. Gases (35 pts)

1. (15 pts) Potassium chlorate is a common oxidizer used in sparklers and when it decomposes it generates oxygen. What volume of O_2 gas is generated by 155 mg KClO_3 decomposing if the gas is formed at a pressure of 0.985 atm and a temperature of 855°C . (MM of $\text{KClO}_3 = 122.55 \text{ g/mol}$)



$$155 \text{ mg KClO}_3 \times \frac{1 \text{ g}}{1000 \text{ mg}} \times \frac{1 \text{ mol KClO}_3}{122.55 \text{ g KClO}_3} \times \frac{3 \text{ mol O}_2}{2 \text{ mol KClO}_3} = 1.90 \times 10^{-3} \text{ mol O}_2$$

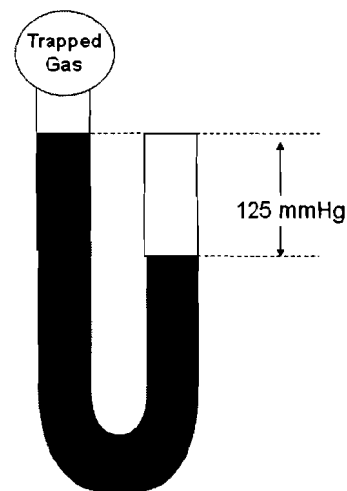
$$V = \frac{nRT}{P} = \frac{(1.90 \times 10^{-3} \text{ mol O}_2)(0.0821 \frac{\text{L atm}}{\text{mol K}})(1128 \text{ K})}{0.985 \text{ atm}} = \boxed{0.179 \text{ L}}$$

2. (10 pts) Argon and neon are trapped in the open-ended manometer seen at right. The atmospheric pressure is 1.12 atm.

- a. What is the total pressure of the trapped gases? (Hint: don't forget to convert atm to mmHg)

$$1.12 \text{ atm} \times \frac{760 \text{ mmHg}}{1 \text{ atm}} = 851 \text{ mmHg}$$

$$P_{\text{gas}} = P_{\text{atm}} - 125 \text{ mmHg} \\ = 851 \text{ mmHg} - 125 \text{ mmHg} = 726 \text{ mmHg}$$



- b. What is the mole fraction of neon if the partial pressure of neon is 455 mmHg?

$$\chi = \frac{P_{\text{Ne}}}{P_{\text{total}}} = \frac{455 \text{ mmHg}}{726 \text{ mmHg}} = 0.627$$

2. (10 pts) Hank Hill has plans to cook a nice steak dinner. He is out of gas at home so he puts a tank in the bed of his truck to take home. The gas pressure in the tank was 4.56 atm and the ambient temperature was 25°C. By the time Hank heads home, the temperature has dropped to 10°C. What is the pressure of the gas in the tank when Hank turns on his grill?

$$P_1 = 4.56 \text{ atm} \\ T_1 = 25^\circ\text{C} + 273 = 298 \text{ K}$$

$$P_2 = ?? \\ T_2 = 10^\circ\text{C} + 273 = 283 \text{ K}$$

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

$$V_1 = V_2 \text{ same tank}$$

$$P_2 = \frac{P_1 \cdot T_2}{T_1} = \frac{(4.56 \text{ atm})(283 \text{ K})}{298 \text{ K}} = 4.33 \text{ atm}$$