

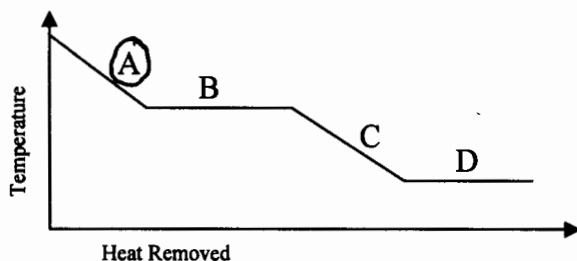
Name: KEY

Chemistry 121
Fall 2006
Test 4

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 (10 pts) Carefully and clearly circle the best answer.

- Which of the following molecules has the largest boiling point?
 - CF₄
 - CCl₄
 - CBr₄
 - Cl₄ heaviest
- What region is correctly labeled as the gas phase on the cooling curve below?



- Small structural units within a molecule where most of the compound's reactions occur are called:
 - inorganic groups.
 - isomer groups.
 - functional groups.
 - organic groups.
- Which of the following is not a component of nucleotides?
 - Pentose sugar
 - Peptide linkage
 - Phosphate
 - Nitrogen containing organic base
- Which of the following gases will diffuse the fastest?
 - N₂ lightest
 - O₂
 - F₂
 - Cl₂

II. Calculations, Functional Groups, Forces and Biochemicals Show all work. Partial credit will be given for correct work. If I cannot read the work, it will not be graded.

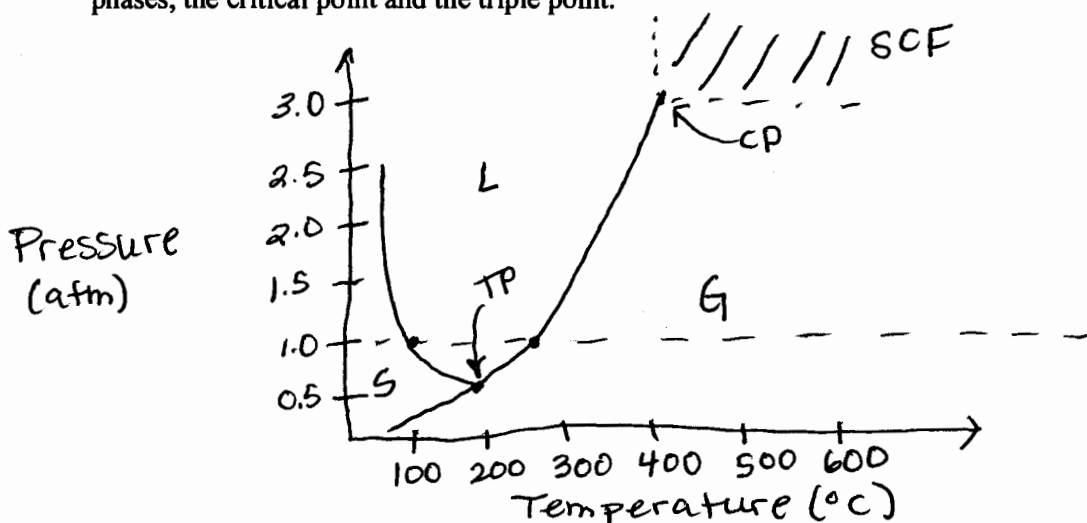
- (10 pts) A gas collected over water had a total pressure of 752.4 torr. Calculate the partial pressure of the gas in atm if the temperature was 15°C. (Hint: 1 torr = 1 mmHg)

$$752.4 \text{ torr} - 12.79 \text{ torr} = 739.6 \text{ torr}$$

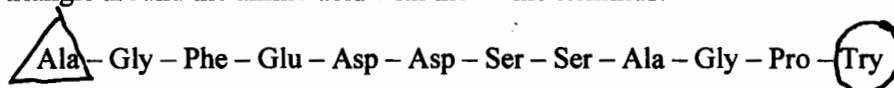
$$739.6 \text{ torr} \times \frac{1 \text{ mmHg}}{1 \text{ torr}} \times \frac{1 \text{ atm}}{760 \text{ mmHg}} = \boxed{0.9732 \text{ atm}}$$

Temperature (°C)	Vapor Pressure (torr)
0	4.579
5	6.543
10	9.209
15	12.79
20	17.54
25	23.76

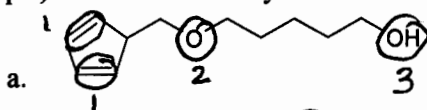
2. (20 pts) Draw the phase diagram for a substance that has a mp of 250°C, a nfp of 100°C, a triple point at a pressure of 0.50 atm and a temperature of 200°C and a critical point of 3.0 atm and 400°C. Label the phases, the critical point and the triple point.



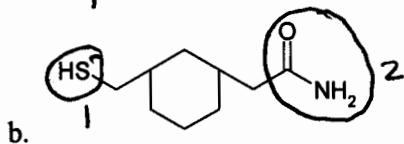
3. (5 pts) In the primary protein structure below, circle the amino acid that has the carboxylic acid terminus and put a triangle around the amino acid with the amine terminus.



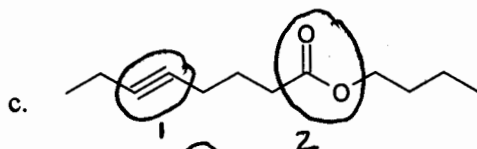
4. (10 pts) Circle and identify the functional groups in the molecules below.



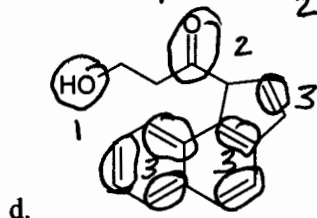
1. alkene
2. ether
3. alcohol



1. thiol
2. amide

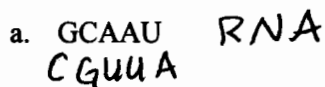


1. alkyne
2. ester

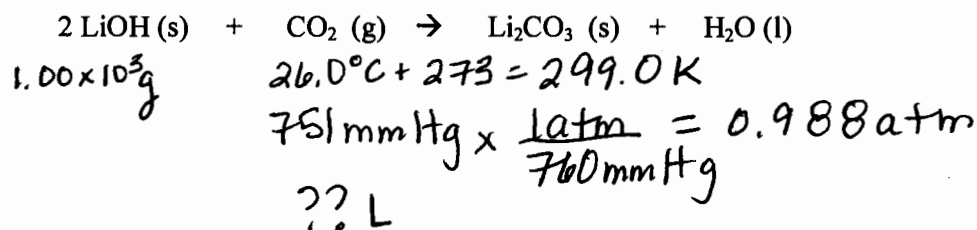


1. alcohol
2. ketone
3. alkene

5. (10 pts) Give the complimentary base pairing for the following nucleic acid sequences and identify if it is DNA or RNA.



6. (15 pts) One method of removing CO_2 (g) from a spacecraft is to allow CO_2 to react with LiOH . How many liters of CO_2 (g) at 26.0°C and 751 mmHg can be removed by $1.00 \times 10^3 \text{ g LiOH}$? (MM of $\text{LiOH} = 23.948 \text{ g/mol}$)



$$1.00 \times 10^3 \text{ g LiOH} \times \frac{1 \text{ mol LiOH}}{23.948 \text{ g LiOH}} \times \frac{1 \text{ mol CO}_2}{2 \text{ mol LiOH}} = 20.9 \text{ mol CO}_2$$

$$V = \frac{nRT}{P} = \frac{(20.9 \text{ mol CO}_2)(0.0821 \frac{\text{Latm}}{\text{molK}})(299.0 \text{ K})}{(0.988 \text{ atm})} = \boxed{519 \text{ L}}$$

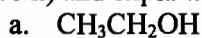
7. (10 pts) A sample of N_2 is placed in a rigid container at 2.00 atm and $100.^\circ\text{C}$. What is the pressure of the gas when the temperature is raised to $300.^\circ\text{C}$?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad V_1 = V_2 \text{ so they cancel}$$

$100.^\circ\text{C} + 273 = 373 \text{ K}$
 $300.^\circ\text{C} + 273 = 573 \text{ K}$

$$\frac{P_1}{T_1} = \frac{P_2}{T_2} \quad P_2 = \frac{P_1 T_2}{T_1} = \frac{(2.00 \text{ atm})(573 \text{ K})}{(373 \text{ K})} = \boxed{3.07 \text{ atm}}$$

8. (10 pts) Indicate whether the following molecules are more soluble in water or heptane (a nonpolar solvent) and explain why.



water; small molecule with the ability to hydrogen bond



heptane; large hydrocarbon, very nonpolar, "likes dissolve likes"

