

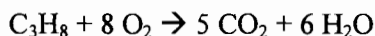
Name: KEY

Chemistry 121
Spring 2006
Test 4

Instructions: You have 75 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.

1. How many liters of CO₂ are produced if 16.0 L of O₂ is allowed to react with liquid pentane at STP?



- a. 2.50 L CO₂
b. 10.0 L CO₂
c. 16.0 L CO₂
d. 25.6 L CO₂

$$16.0 \text{ L} \times \frac{5 \text{ L CO}_2}{8 \text{ L O}_2} = 10.0 \text{ L CO}_2$$

2. Which of the following molecules has the lowest boiling point?

- a.** CH₄ *lightest*
b. SiH₄
c. GeH₄
d. SnH₄

3. The ability of a nonpolar molecule to distort its electron cloud is called:

- a. Compressibility
b. Polarizability
c. Viscosity
d. Energy

4. Which of the following molecular properties is not affected by intermolecular forces?

- a. Viscosity
b. Wetting
c. Surface tension
d. Color

5. Which of the following is a false statement about nucleic acids?

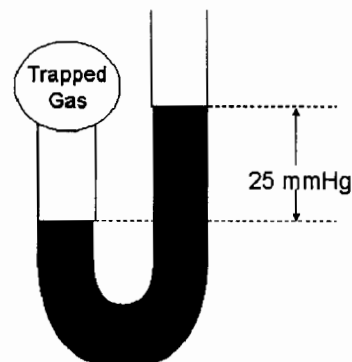
- a. DNA contains adenine
b. RNA can have helical structure.
c. DNA is composed of nucleotides.
d. Thymine pairs with cytosine.

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.

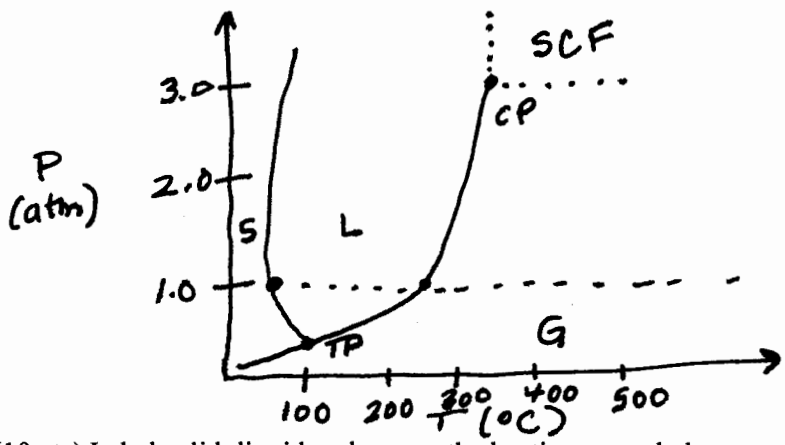
1. (10 pts) What is the pressure (in mmHg) of the trapped gas in the U-tube (at left) if the atmospheric pressure is 1.25 atm?

$$1.25 \text{ atm} \times \frac{760 \text{ mmHg}}{1 \text{ atm}} = 950 \text{ mmHg}$$

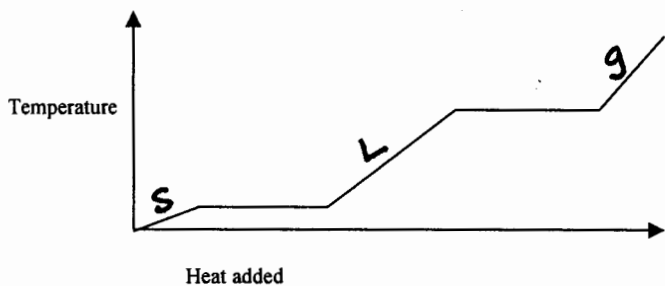
$$950 \text{ mmHg} + 25 \text{ mmHg} = \boxed{975 \text{ mmHg}}$$



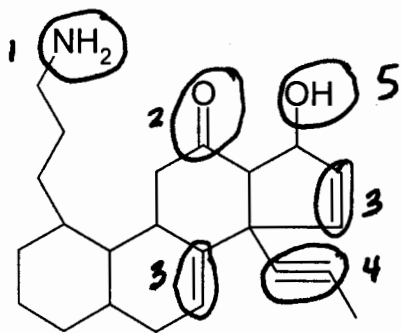
2. (15 pts) Draw the phase diagram for a substance that has a triple point at a pressure of 0.25 atm and a temperature of 100°C, a critical point of 3.0 atm and 350°C, a nfp of 50°C and a nbp of 250°C. Label the phases, the critical point and the triple point.



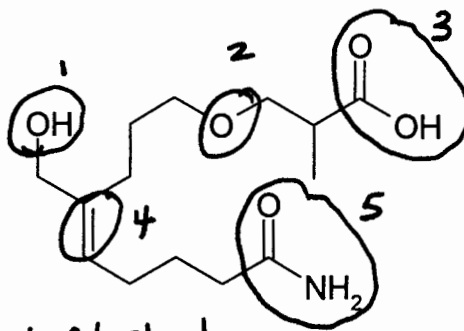
3. (10 pts) Label solid, liquid and gas on the heating curve below.



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



1. amine
2. ketone
3. alkene
4. alkyne
5. alcohol



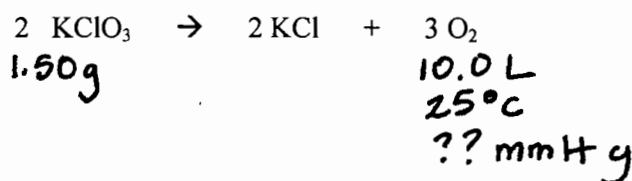
1. alcohol
2. ether
3. carboxylic acid
4. alkene
5. amide

5. (10 pts) Give the complimentary base pairing for the following nucleic acid sequences

a. TGGCCAATTC
ACCGGTTAAG

b. AACCCGGUUA
UUGGGCCA AU

6. (15 pts) What is the pressure (in mmHg) of O_2 gas produced by the decomposition of 1.50 g of $KClO_3$ in a 10.0L vessel if the gas is measured at $25^\circ C$ (MM of $KClO_3 = 122.55$ g/mol)?



$$1.50 \text{ g KClO}_3 \times \frac{1 \text{ mol KClO}_3}{122.55 \text{ g KClO}_3} \times \frac{3 \text{ mol O}_2}{2 \text{ mol KClO}_3} = 0.0184 \text{ mol O}_2$$

$$P = \frac{nRT}{V} = \frac{(0.0184 \text{ mol O}_2)(0.0821 \frac{\text{L atm}}{\text{mol K}})(298 \text{ K})}{10.0 \text{ L}} \times \frac{760 \text{ mmHg}}{1 \text{ atm}} = \boxed{34.2 \text{ mmHg}}$$

7. (10 pts) A sealed can with an internal pressure of 721 mmHg at $25^\circ C$ is thrown into an incinerator operating at $755^\circ C$. What will be the pressure inside the heated can, assuming the container remains intact during the incineration?

$$\begin{array}{ll}
 P_1 = 721 \text{ mmHg} & P_2 = ?? \\
 T_1 = 25^\circ \text{ C} + 273 = 298 \text{ K} & T_2 = 755^\circ \text{ C} + 273 = 1028 \text{ K}
 \end{array}$$

$$\frac{P_1}{T_1} = \frac{P_2}{T_2} \quad P_2 = \frac{P_1 T_2}{T_1} = \frac{(721 \text{ mmHg})(1028 \text{ K})}{(298 \text{ K})}$$

$$\boxed{P_2 = 2490 \text{ mmHg}}$$

8. (10 pts) A scuba diver's tank contains nitrogen and oxygen. What is the mole fraction of BOTH oxygen and nitrogen if the total pressure of the tank is 204.0 atm and the partial pressure of oxygen is 40.8 atm?

$$P_{\text{tot}} = 204.0 \text{ atm} \quad P_{O_2} = 40.8 \text{ atm}$$

$$\chi_{O_2} = \frac{40.8}{204.0} = \boxed{0.200}$$

$$\chi_{N_2} = 1 - 0.200 = \boxed{0.800}$$

