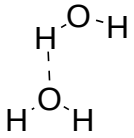
CH1010 Exam 2 Name Key

October 27, 2000 SSN Seat No

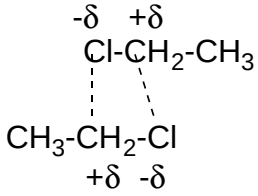
In solving problems, you must show all work. Little or no credit will be given for a correct answer with no work shown.

1. a. Pick a molecule that will show hydrogen bonding. Draw two of the molecules and show the hydrogen bonding interaction. (5%)



Or similar interaction involving an H bound to a O, N, F and hydrogen bound to another N, O, F.

b. Pick a molecule that will show dipole-dipole interaction. Draw two of the molecules and show the dipole-dipole interaction. (5%)



Or similar interaction involving an electronegative and electropositive atom

2. a) A sample of gas in a 2.0 L vessel at 80°C has a pressure of 450 torr. What will its pressure be when the vessel is heated to 200°C? (10%)

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

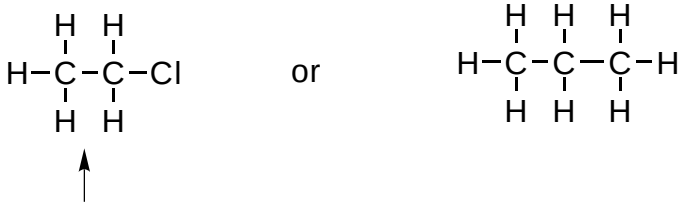
$$\frac{(473\ K)(450\ Torr)(2L)}{(2L)(353\ K)} = P_2 = 603\ Torr$$

b) How many moles of the above gas are present? (10%)

$PV = nRT$ $\qquad$ $P = 603\ T0rr/760\ Torr = 0.79\ Atm$

$$n = \frac{PV}{RT} = \frac{(0.79\ Atm)(2L)}{(0.082\ L\ atm\ mol^{-1}\ K^{-1})(473K)} = 0.041\ mol$$

3. Which of the two isomers below would you expect to have the higher boiling point? Briefly explain your answer. (5%)



This would have the higher bioling point dut to dipole-dip[ole interactions

4. a) How many grams of $KHCO_3$ must you add to 250 mL water to prepare 0.600% w/v solution? (10%)

0.6 % = 0.6 g/100 mL x 250 mL = 1.5 g

b) What is the molarity of the above solution? (Assume no volume change upon adding the $KHCO_3$ to the water). (10%)

Formula mass = 39.1 + 1 + 12 + (3x16) = 100.1 g/mol

$$\frac{1.5\ g}{100.1\ g/mol} = 0.015\ mol \qquad \frac{0.015\ mol}{0.25\ L} = 0.059\ mol/L$$

5. What weight of $AgNO_3$ would you need to prepare 1.0 L of a 2.5 ppm solution. (5%)

1 ppm = 1 mg/L

2.5 mg/L = 2.5 ppm

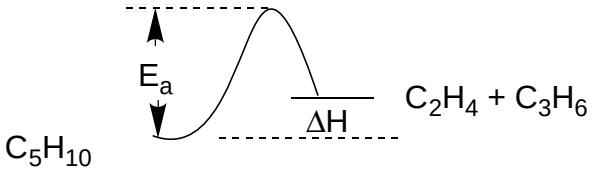
6. For the reaction below

$C_5H_{10} \rightleftharpoons C_2H_4 + C_3H_6 \quad \Delta H = +22.4$ kcal/mo

a) Is this reaction exothermic or endothermic? (5%)

Endothermic

b) Draw an energy diagram for the reaction. Label the activation energy and the ΔH. (10%)



c) Write the expression for the equilibrium constant. (5%)

$$K_{eq} = \frac{[C_2H_4][C_3H_6]}{[C_5H_{10}]}$$

d) If the reaction is heated, what happens to the position of equilibrium? (5%)

Goes to right (more $C_2H_4 + C_3H_6$)

7. What volume of oxygen, at STP, will be required to react with hydrogen to produce 5.0 g of water according to the equation below? (15%)

$$2H_2 + O_2 \longrightarrow 2H_2O$$

$$\frac{5 \text{ g } H_2O}{18 \text{ g/mol}} = 0.28 \text{ mol}$$

Since 1 mol $O_2 \longrightarrow$ 2 mol H_2O, we need 0.14 mol O_2

$PV = nRT$

$$V = \frac{(0.14 \text{ mol})\ (0.082 \text{ L atm mol}^{-1} \text{ K}^{-1})(273 \text{ K})}{1 \text{ Atm}} = 3.1 \text{ L}$$

1. _____ 2. _____

3. _____ 4. _____

5. _____ 6. _____

7. _____

Total minus _____ Grade _____

Name_____