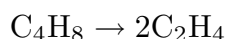


ASSIGNMENT 7

CHEMISTRY 300

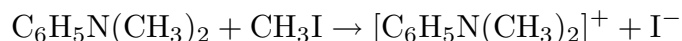
Due: 4:30 pm Monday 13 November 2006

1. The rate of formation of phosgene in the reaction $\text{Cl}_2 + \text{CO} \rightarrow \text{Cl}_2\text{O}$ has been studied extensively. Consider an experiment in which Cl_2 and CO are mixed rapidly in a constant volume container. Derive an expression for the rate of this reaction in terms of the rate of change of the pressure in the container and any other experimental variables that are relevant.
2. The only isotope of radium that occurs naturally is ^{226}Ra which decays through the emission of α particles. A 0.1 mg sample emits 3.7×10^6 α particles per second. This rate is observed to be constant over many years. Why?
3. Consider the decomposition of cyclobutane at 438°C :



The rate is to be measured by observing the pressure change in a constant volume system. Assume that the gas mixture is ideal.

- (a) Express the rate of reaction $d(\xi/V)/dt$ in terms of dp/dt .
 - (b) Let p^∞ be the pressure in the system after the C_4H_8 is completely decomposed. If the reaction is first order in C_4H_8 , derive the relation between pressure and time. What function of pressure should be plotted against time to determine the rate coefficient?
 - (c) If the rate coefficient is $2.48 \times 10^{-4} \text{ s}^{-1}$, what is the half life? How long would it take for 98% of the C_4H_8 to decompose?
 - (d) What will the value of p/p^∞ be after 2.0 hours?
4. At 24.8°C , the reaction:



has a rate coefficient $k = 8.39 \times 10^{-5} \text{ L mol}^{-1} \text{ s}^{-1}$ in nitrobenzene. The reaction is first order with respect to each of the reactants.

- (a) If equal volumes of the solutions that are 0.12 mol L^{-1} in dimethylaniline and methyl iodide are mixed, how much time is required for 70% of the reactants to disappear?
- (b) If the concentration of each reagent is doubled, what length of time is required for 70% to disappear?