**Chem 402—Physical Chemistry**
Homework Problem Set—Chapter 22

Due Thursday, Feb. 14, 2008

1. At 518 ^{o}C, the rate of decomposition of a sample of gaseous acetaldehyde, initially at a pressure of 363 Torr, was 10.7 Torr s^{-1} when 5.0% has reacted, and 0.76 Torr s^{-1} when 20.0% had reacted. Determine the order of the reaction.

2. A second order reaction of the type A + B → products was carried out in a solution that was initially 0.050 M in A and 0.080 M in B. After 1.0 h the concentration of A had fallen to 0.020 M. (a) Calculate the rate coefficient. (b) What is the half-life of the reactants?

3. The second order rate coefficient for the reaction

   $$CH_3COOC_2H_5(aq) + OH^-(aq) \rightarrow CH_3CO_2^-(aq) + CH_3CH_2OH(aq)$$
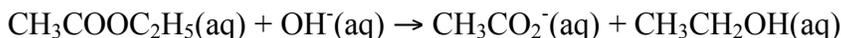
   is 0.11 L mol^{-1} s^{-1}. If the initial concentrations are [NaOH] = 0.050 M and [CH$_3$COOC$_2$H$_5$] = 0.100 M, what is the concentration of ester after (a) 10 s, and (b) 10 min?

4. A 1st order decomposition reaction is observed to have the following rate coefficients at the indicated temperatures. Determine the activation energy of the reaction.

k(s^{-1})	2.46 x 10^{-3}	45.1 x 10^{-3}	576 x 10^{-3}
T(^{o}C)	0.0	20.0	40.0

5. The 2nd order rate coefficients for the reaction of oxygen atom with benzene have been measured. Determine the pre-exponential factor and activation energy for this reaction.

k(L mol^{-1} s^{-1})	1.44 x 10^{7}	3.03 x 10^{7}	6.9 x 10^{7}
T(K)	300.3	341.2	392.2

6. The reaction mechanism below involves an intermediate A. Deduce the rate law for the reaction.

A$_2$ ↔ A + A	fast
A + B → P	slow

7. Pharmacokinetics is the study of the rates of absorption and elimination of drugs by organisms. Usually, elimination is slower than absorption and is a more important determinant of availability of a drug for binding to its target. Elimination mechanisms may include metabolism in the liver, intestine, or kidneys followed by excretion. Consider elimination of a beta blocker, a drug used for the treatment of hypertension. After intravenous administration of a beta blocker, the blood plasma of a patient was analyzed for remaining drug. The data are given below where c is the drug concentration measured at time t after injection. (a) Determine whether removal of the drug is a 1st order or 2nd order process. (b) Calculate the rate coefficient and half-life of the process.

t(min)	30	60	120	150	240	360	480
c(ng cm^{-3})	699	622	413	292	152	60	24