

Spring 2008

CBE 430
Problem Set #3
Due Friday, February 15

Review chapter 3, read sections 4.0-4.2 in the textbook

1. Reaction order analysis

Optical rotation measurements have been used to study the kinetics of polymerization of optically active D-s-butyl- α -chloroacrylate in dioxane solution. The specific rotation angle is a linear combination of the contributions of the monomer and the polymer repeat unit. The optical rotation of the repeat units in the polymer chain is independent of chain length. Use the data given to determine the order of the reaction and the rate constant. The initial concentration of monomer is 66.5 g/liter of dioxane.

Time (hr)	Rotation
0	3.04
1	2.42
2	2.08
3	1.80
4	1.64
5	1.56
Inf.	1.39

2. Chapter 3, #10 – Bromination reaction

3. Chapter 3, #13 – Volume changes

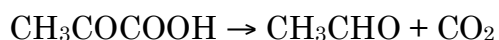
4. Chapter 3, #28 – Gas phase addition

Do calculation for both constant-volume and constant-pressure reactor cases, and comment on the difference in the results.

(more on back)

5. Pyruvic acid decomposition

Pressure measurements can be used to monitor the irreversible decomposition of pyruvic acid in an isothermal, constant volume reactor.



For reaction at 568.5 K, the data at right are representative of reaction kinetics.

The feed to the reactor is pure pyruvic acid. Secondary decomposition of acetaldehyde is negligible during the time of the experiment.

Time (s)	P (Torr)
0	110.0
15	117.4
30	124.3
45	130.6
60	136.8
75	142.3
90	147.5
250	185.3
265	187.8

- A. Determine the order of the reaction and the reaction rate constant at this temperature.
- B. The following values of the rate constant (in consistent units) for this reaction were found in separate experiments. Determine the activation energy and pre-exponential factor for the reaction.

T (K)	604.7	597.3	588.1	578.5	568.5
k ($\times 10^3$)	49.1	27.4	16.3	8.79	??