Assignment 5

1. For the enzyme catalyzed reaction: A → B + C, the concentration A in a Batch reactor is given as a function of time below.

t(min)	0	10	100
C_A(mol/L)	0.04	0.035	0.005

Determine the Michaelis-Menten constants V_{max} and K_M from the slope and intercept of a relevant plot. Please upload the plots with your solutions too.

2. Derive the rate law for the following enzymatic reaction as a function of observable concentrations and given rate constants (k_i's).

$$E + S \underset{k_2}{\overset{k_1}{\rightleftarrows}} E\bullet S \xrightarrow{k_3} P$$

$$E + P \underset{k_5}{\overset{k_4}{\rightleftarrows}} E\bullet P$$

3. Determine the reaction mechanism of a non-elementary reaction :
Overall observed reaction: $2NO + O_2 \rightarrow 2NO_2$.
Overall observed rate expression: $-r_{NO} = \frac{k_A C_{NO}^2 C_{O_2}}{1 + k_B C_{NO}}$

Assume pseudo steady state hypothesis and show expressions for k_A and k_B in terms of the elementary steps you have proposed.

4. The pyrolysis of acetaldehyde is believed to take place according to the following set of elementary steps:

$$CH_3CHO \xrightarrow{k1} CH_3 + CHO$$

$$CH_3 + CH_3CHO \xrightarrow{k2} CH_3 + CO + CH_4$$

$$CHO + CH_3CHO \xrightarrow{k3} CH_3 + 2CO + H_2$$

$$2CH_3 \xrightarrow{k4} C_2H_6$$

Derive the rate expression for the rate of disappearance of acetaldehyde as a function of observable concentrations and rate constants (k_i's).