**Assignment 2**

(Submission deadline-8th Sept 2021, 5 PM)

1. In a liquid phase reaction, 30% of the reactant disappears in 34 minutes for initial reactant concentrations of 0.04 and also for 0.8 mol/liter. What rate law represents the disappearance of the reactant?

2. In a batch reactor, a reactant, with $C_{A0}$ = 1 mol/liter, is converted 80% in 8 min; and after 18 min, the conversion is 90%. Find a rate law to represent this reaction.

3. A first order reversible liquid-phase reaction $A \leftrightarrow B$ takes place in a constant volume batch reactor. With $C_{A0}$ = 0.5 mol/liter and $C_{B0}$ = 0, after 8 minutes conversion of A is 0.333 while equilibrium conversion is 0.667. Find the rate law for this reaction.

4. The kinetics of thermal decomposition of species A is carried out in a differential packed bed reactor. From the data given in the table below, determine the rate law parameters.

| Run | Rate mol/(liter.s) | Concentration of A in the reactor mol/liter | Temperature (K) |
|---|---|---|---|
| 1 | $4.9\times10^{-4}$ | 0.2 | 700 |
| 2 | $1.1\times10^{-4}$ | 0.02 | 750 |
| 3 | $2.4\times10^{-3}$ | 0.05 | 800 |
| 4 | $2.2\times10^{-2}$ | 0.08 | 850 |
| 5 | $1.18\times10^{-1}$ | 0.1 | 900 |
| 6 | $1.82\times10^{-2}$ | 0.06 | 950 |

*Hint:* Use Arrhenius equation [$k$ = Aexp(-$E_a$/RT)] for temperature dependence of rate constant. Use non-linear regression using MATLAB to obtain $\alpha$, A, and $E_a$. Include the MATLAB code in your solution.

5. The following data are obtained at 0 °C in a constant volume batch reactor using pure gaseous A:

| Time (min) | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | ∞ |
|---|---|---|---|---|---|---|---|---|---|
| Partial pressure mmHg | 760 | 600 | 475 | 390 | 320 | 275 | 240 | 215 | 150 |

The stoichiometry of the decomposition is A → 2.5R. Find a rate law which satisfactorily represents this decomposition using (i) Integral approach and (ii) Differential approach.