

Tutorial 2

Chemical Kinetics

December 2022

1. Consider the following sequential reaction.

$A \xrightarrow{k_A} I \xrightarrow{k_I} P$. Assuming that only reactant 'A' is present at $t = 0$, what is the expected time dependence of $[P]$ using the steady state approximation.

2. The composition of a liquid phase reaction $2A \rightarrow B$ was followed by a spectrophotometric method with the following results.

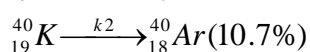
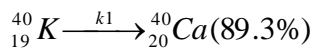
Determine the order of the reaction and rate constant.

t/min	0	10	20	30	40	∞
[B] mols/L	0	0.089	0.156	0.200	0.234	0.312

3. Consider the reaction $A \rightarrow B$
- If the reaction is half order with respect to $[A]$, what is the integrated rate law expression for this reaction
 - What would be the half life for this reaction ?
4. The total system pressure can be used to monitor the progress of a chemical reaction. Consider the following reaction:
 $SO_2Cl_2(g) \rightarrow SO_2(g) + Cl_2(g)$. The reaction is initiated and the following data are obtained. Find out the order of the reaction.

Time (h)	0	3	6	9	12	15
P total kPa	11.07	14.79	17.26	18.90	19.99	20.71

5. Potassium decay by two different paths



The half life of potassium decay is 1.39×10^9 years. Determine the rate constants for the individual channels.

6. You are given the following data for decomposition of acetaldehyde. Determine the order of the reaction and rate constant

Initial concentration (M)	9.72×10^{-3}	4.56×10^{-3}
Half life (s)	328	699

7. For the sequential reaction $A \xrightarrow{k_A} I \xrightarrow{k_I} P$ the rate constants are $k_A = 5 \times 10^6 \text{ s}^{-1}$ and $k_I = 3 \times 10^6 \text{ s}^{-1}$. Determine the time at which $[I]$ is at a maximum.

8. Consider the reaction $A+B \rightleftharpoons P$. Find out the expression for relaxation time.

9. Consider the dimerization $2A \rightleftharpoons A_2$. Find out the expression for relaxation time.

(Hint: reaction is second order in forward direction and first order in backward direction)

10. Find out the expression for relaxation time for $A+B \rightleftharpoons Y+Z$