

Chemistry
Assignment 4
(Chemical Kinetics)

- Q1. A reaction is of second order with respect to a reactant. How will the rate of reaction be affected if concentration of this reaction is i) doubled ii) reduced to half.
- Q2. Define: a) Elementary step in a reaction.
b) Rate of a reaction.
- Q3. A 1st order reaction has a rate constant of 0.0051 min^{-1} . If we begin with 0.10M concentration of the reactant. What concentration of reactant will remain in solution after 3 hours.
- Q4. Distinguish between order and molecularity of a reaction. When will the order and molecularity of a reaction be the same.
- Q5. List four factors which affect the rate of reaction.
- Q6. The decomposition of phosphine $4\text{PH}_3(\text{g}) \rightarrow \text{P}_4(\text{g}) + 6\text{H}_2(\text{g})$ has rate law:
Rate = $k [\text{PH}_3]$. Rate constant is $6.0 \times 10^{-4} \text{ s}^{-1}$ at 300 K, activation energy is $3.05 \times 10^5 \text{ J mol}^{-1}$. Calculate value of rate constant at 310 K. ($R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$)
- Q7. Define a) Order of a reaction b) Activation energy of a reaction.
- Q8. The data given below is for the reaction:
 $2 \text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$ at 298K

Sr.No.	N_2O_5 (mol L^{-1})	Rate of disappearance of N_2O_5 ($\text{mol L}^{-1} \text{ min}^{-1}$)
1	1.13×10^{-2}	34×10^{-5}
2	0.84×10^{-2}	25×10^{-5}
3	0.62×10^{-2}	18×10^{-5}

Determine : i) order of the reaction ii) Rate constant iii) Rate law

- Q9. What is the molecularity of the reaction:
 $\text{Cl} \rightarrow 1/2 \text{Cl}_2(\text{g})$
- Q10. As a reaction proceeds why does its rate keep on changing?
- Q11. The rate of reaction $\text{X} \rightarrow \text{Y}$ becomes 8 times when the conc. of X is doubled. Write rate law.
- Q12. A reaction is 50% complete in 2 hours and 75% in 4 hours. What is the order of the reaction.

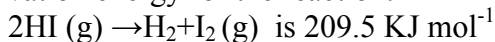
Q13. When the rate of reaction is equal to specific reaction rate.

Q14. State the unit of "rate constant in a zero order reaction.

Q15. Give one example of Pseudo first order reaction.

Q16. For the reaction $3\text{H}_2(\text{g}) + \text{N}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$, how the rate of reaction expressions $-\text{d}[\text{H}_2]/\text{dt}$ and $\text{d}[\text{NH}_3]/\text{dt}$ are interrelated?

Q17. The activation energy for the reaction:



Calculate the fraction of molecules of reactants having energy equal to or greater than activation energy?

Q18. The decomposition of $\text{N}_2\text{O}_5(\text{g})$ is a first order reaction with a rate of constant of $5 \times 10^{-4} \text{ sec}^{-1}$ at 45°C i.e. $2 \text{N}_2\text{O}_5(\text{g}) \rightarrow 4 \text{NO}_2(\text{g}) + \text{O}_2(\text{g})$. If initial concentration of N_2O_5 is 0.25M , calculate its concentration after 2 min. Also calculate half life of decomposition of $\text{N}_2\text{O}_5(\text{g})$

Q19. A first order decomposition reaction takes 40 min for 30% decomposition. Calculate its $t_{1/2}$ value.

Q20. At elevated temperatures, HI decomposes according to the chemical equation:

$2\text{HI}(\text{g}) \rightarrow \text{H}_2(\text{g}) + \text{I}_2(\text{g})$ at 44.3°C . The rate of reaction increases with concentration of HI as shown below:

	1	2	3
HI (mol L ⁻¹)	0.005	0.01	0.02
Rate	7.5×10^{-4}	3.0×10^{-3}	1.2×10^{-2}

Determine i) order of reaction and ii) write the rate expression.

Q21. A reaction is of first order in A and second order in B.

a. Write differential rate equation.

b. How is the rate affected if

i) conc. of B is tripled

ii) conc. of both A and B are doubled.

Q22. Calculate half life of a first order reaction from their rate constant given below:

a) 200 s^{-1} b) 2 min^{-1} c) 4 year^{-1}

Q23. The half life for decay of radioactive C-14 is 5730 years. An archaeological tool containing wood has only 80% of C-14 activity as found in living tree. Calculate the age of the tool.

Q24. Show that the time required for 99% completion is twice the time required for the completion of 90% reaction.

Q25. Derive the general expression for half life of a 1st order reaction.