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 $4PH_3\ (g) \rightarrow P_4(g)+6H_2(g)$ has rate law: Rate=K $[PH_3]$. Rate constant is $6.0X10^{-4}\ s^{-1}$ at 300 K,activation energy is $3.05X10^5$ J $mol^{-1.}$ Calculate value of rate constant at 310 K. ($R=8.314\ J\ K^{-1}\ mol^{-1}$)

Q7. Define a) Order of a reaction b) Activation energy of a reaction.

Q8. The data given below is for the reaction:
$2\ N_2O_5(g) \rightarrow 4NO_2\ (g) + O_2\ (g)$ at 298K

Sr.No.	N_2O_5 (mol L^{-1})	Rate of disappearance of N_2O_5 (mol $L^{-1}\ min^{-1}$)
1	$1.13X10^{-2}$	$34X10^{-5}$
2	$0.84X10^{-2}$	$25X10^{-5}$
3	$0.62X10^{-2}$	$18X10^{-5}$

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

Q9. What is the molecularity of the reaction:
$Cl \rightarrow 1/2\ Cl_2\ (g)$

Q10. As a reaction proceeds why does its rate keep on changing?

Q11. The rate of reaction $X \rightarrow Y$ becomes 8 times when the conc. of X is doubled. Write rate law.

Q12. A reaction is 50% complete in 2hours and 75% in 4hours. What is the order of the reaction.

Q13. When the rate of reaction is 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 $3H_2(g)+ N_2(g)\rightarrow 2NH_3(g)$, how the rate of reaction expressions $-d[H_2]/dt$ and $d[NH_3]/dt$ are interrelated?

Q17. The activation energy for the reaction:
$2HI\ (g) \rightarrow H_2+I_2\ (g)$ is 209.5 KJ mol^{-1}
Calculate the fraction of molecules of reactants having energy equal to or greater than activation energy?

Q18. The decomposition of $N_2O_5(g)$ is a first order reaction with a rate of constant of $5X10^{-4}$ sec^{-1} at 45^0C i.e.2 $N_2O_5(g) \rightarrow 4\ NO_2(g)+ O_2(g)$. If initial concentration of N_2O_5 is 0.25M, calculate its concentration after 2 min. Also calculate half life of decomposition of $N_2O_5(g)$

Q19. A first order decomposition reaction takes 40 min for 30% decomposition. Calculate its $t_{½}$ value.

Q20. At elevated temperatures, HI decomposes according to the chemical equation:
$2HI\ (g) \rightarrow H_2\ (g) + I_2\ (g)$ at 44.3^0C. 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	→	$7.5X10^{-4}$	$3.0X10^{-3}$	$1.2X10^{-2}$

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% completation is twice the time required for the completation of 90% reaction.

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