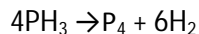


CHEMICAL KINETICS

Q1) Define a) rate of a reaction b) activation energy

Q2) The decomposition of PH_3 follows the following reaction



Rate equation is $\rightarrow \text{Rate} = k [\text{PH}_3]$. The Half life of PH_3 is 37.9 sec at 120°C

- a) How much time is required for $3/4^{\text{th}}$ of PH_3 to decompose? Ans[75.82 sec]
- b) What fraction of the original sample of PH_3 remains behind after one minute? Ans[2.995]

Q3) Define a) order of reaction b) molecularity of a reaction

Q4) the rate of a reaction increases four times when the temperature changes from 300K to 320K. Find the activation energy. ($R=8.314 \text{ J/K/mol}$) Ans [35.34 KJ/mol]

Q5) A reaction is of first order in reactant A and of second order in reactant B. How is the rate of this reaction affected when a) conc. Of B alone is increased to 3 times? b) the conc. A as well as B are doubled? Ans [9 times, 8 times]

Q6) The rate constant for a reaction of zero order in A is 0.0030 mol/L/s . How long will it take for the initial conc. Of A to fall from $0.1 \rightarrow 0\text{M}$ to 0.75M ? Ans [8.3sec]

Q7) Identify the order from units $\rightarrow \text{L/mol/s}$

Q8) What are elementary reactions? Give examples.

Q9) A first order reaction has a rate constant of 0.0051 min^{-1} . If we begin with 0.10M conc. Of reactant, what conc. of reactant will remain in the solution after 3 hours? Ans [0.04M]

Q10) $\text{H}_2\text{O}_2 (\text{aq})$ decomposes to $\text{H}_2\text{O} (\text{l})$ and $\text{O}_2 (\text{g})$ in a reaction that is of first order in H_2O_2 and has a rate constant $k=1.06 \times 10^{-3} \text{ min}^{-1}$. a) How long will it take 15% of a sample of H_2O_2 to decompose? Ans [153.4 min]

b) How long will it take 85% of sample of H_2O_2 to decompose? Ans [1790 min]

Q11) Why does the rate of a reaction not remain constant throughout the reaction process?

Q12) Show that for first order reaction half life is independent of initial conc.?

Q13) A first order decomposition reaction takes 40 min for 30% decomposition. Calculate $t_{1/2}$.

Q14) The decomposition of NH_3 on Pt surface is zero order reaction. What are the rates of production of N_2 and H_2 if $K = 2.5 \times 10^{-4} \text{ mol/L/s}$.

Q15) For a first order reaction, it takes for the initial conc. Of 0.6 mol/L to become 0.4 mol/L. How long will it take for the initial conc. To become 0.3 mol/L? Ans [8.55 min]

Q16) A first order reaction takes 100 min for completion of 60% of the reaction. Find the time when 90% of the reaction will be completed? Ans [251.3 min]

Q17) The slope of the line for the graph of $\log K$ v/s $1/T$ for the reaction $\text{N}_2\text{O}_5 \rightarrow 2\text{NO}_2 + \frac{1}{2} \text{O}_2$ is -5000. Find activation energy. Ans [95.7 KJ/mol]

Q18) For a reaction, activation energy is zero. What is the value of the rate constant at 300K if $K = 1.6 \times 10^6 \text{ sec}^{-1}$ at 280K.

Q19) Find $t_{2/3}$ of a first order reaction in which $K = 5.4 \times 10^{-14} \text{ sec}^{-1}$? Ans [$0.2005 \times 10^{14} \text{ sec}$]

Q20) The decomposition of phosphine: $4\text{PH}_3 \rightarrow \text{P}_4 + 6\text{H}_2$ has the rate law expression, $\text{Rate} = K [\text{PH}_3]$. The rate constant is $6.0 \times 10^{-4} \text{ sec}^{-1}$ at 300K and activation energy = $3.05 \times 10^5 \text{ J/mol}$. Find rate constant at 310K. $R = 8.314 \text{ J/K/mol}$. Ans [$3.1 \times 10^{-2} \text{ sec}^{-1}$]

Q21) Show that the time required for the completion of $\frac{3}{4}$ of first order reaction is twice the time required for the completion of half of the reaction.

Q22) The reaction $\text{SO}_2\text{Cl}_2 \rightarrow \text{SO}_2 + \text{Cl}_2$ is a first order reaction with $K = 2.2 \times 10^{-5} \text{ sec}^{-1}$ at 320°C . Find the percentage of SO_2Cl_2 that is decomposed on heating this gas for 30 minutes. Ans [3.84%]