Chemical Kinetics Questions

1. Derive an expression for the rate constant for a reaction of the first order.
2. What is the difference between rate law and Law of mass action?
3. Does the rate of reaction remain constant throughout the reaction? Why or why not?
4. What is the difference between average rate of reaction and instantaneous rate of reaction?
5. Write expression for rate constant for reactions of the second order of the type $A + B \rightarrow$ products with different initial concentrations. Show that if one of the reactants is present in excess, it becomes reaction of first order.
6. Starting with equal concentration of ethyl acetate and NaOH, the saponification of ethyl acetate was carried out. Same volume of the reaction mixture was withdrawn at different intervals of time and titrated with the same acid. The following data were obtained:

Time (minutes):	0	5	15	25	35
Acid used (mL):	16	10.24	6.13	4.32	3.41

7. 1.0 mL of ethyl acetate was added to 25 mL of N/2 HCl, 2 mL of the mixture were withdrawn from time to time during the progress of the hydrolysis of the ester and titrated against standard NaOH solution. The amount of NaOH required for titration at various intervals is given below:

Time (minutes):	0	20	75	119	183	∞
NaOH used (mL):	20.24	21.73	25.20	27.60	30.22	43.95

   The value at ∞ time was obtained by completing the hydrolysis on boiling. Show that it is a reaction of the first order and find the average value of the velocity constant.
8. How Arrhenius equation helps in the calculation of activation energy graphically?
9. For a reaction, if we start with initial concentration a_1, $t_{1/2}$ is found to be t_1 and when we start with a_2, $t_{1/2}$ is found to be t_2. How will you calculate the order of the reaction?
10. Half-life time of I^{st} order reaction is 60 minutes. Calculate rate constant of reaction. How long will it take for 90% of this reaction to complete?
11. Generally, the order of the reaction is not more than three.
12. Derive the integrated rate law equation for a second order reaction when the initial concentrations of both reactants are same.
13. The rate constant at a certain temperature of the first order decomposition of hydrogen peroxide in a suitable medium is $5X10^{-4}$ sec^{-1}. Calculate the time required to complete one-third of the reaction.
14. Starting from the integrated rate law equation, show that the half-life period of a first order reaction is independent of the initial concentration.
15. First order reaction never goes to completion. Explain.
16. The rate constant for a reaction is $1.5X10^{-7}$ s^{-1} at 50 ºC and $4.5X10^{-7}$ s^{-1} at 100 ºC. Calculate the value of activation energy for the reaction.
17. A reaction has the experimental rate equation rate = k[A][B]. If the concentration of A is doubled, and the concentration of B is halved, what happens to the reaction rate?
18. Derive the Integrated Arrhenius equation for showing effect of temperature on reaction rate.
19. The decomposition of N_2O_5 is an important process in tropospheric chemistry. The half-life for the first order decomposition of this compound is $2.05X10^4$ s. How long will it take for a sample of N_2O_5 to decay to 60% of its initial value?
20. The reaction $A + B \rightleftharpoons$ Product follows second order kinetics.
    (i) Write the differential rate law and unit of rate constant.
    (ii) Deduce integrated rate law, assuming equal concentration of A and B.
    (iii) The half-life for the first order reaction is $2.3X10^3$ s. How long will it take for 20% of the reactant to be left behind?