MEGA LECTURE

Topic 11 Exercise 2 - CONCENTRATION-TIME GRAPHS

1. Sulphur dichloride dioxide, SO_2Cl_2, decomposes according to the equation:

   $SO_2Cl_2(g) \rightarrow SO_2(g) + Cl_2(g)$

In an experiment, the concentration of the reactant SO_2Cl_2 was measured over a period of time. The results are shown below:

Time/s	0	500	1000	2000	3000	4000
$[SO_2Cl_2]$/moldm^{-3}	0.50	0.43	0.37	0.27	0.20	0.15

Plot a graph to show how concentration varies with time and use your graph to calculate the rate of reaction:

a) Initially
b) After 1000 s
c) After 2500 s
d) Explain why the rate of reaction decreases with time.
e) Work out the rate of reaction when $[SO_2Cl_2]$= 0.25 moldm^{-3}. Hence deduce the order of reaction with respect to SO_2Cl_2.
f) Hence write the rate equation, calculate a value for the rate constant and give its units.

2. Hydrogen peroxide, H_2O_2, decomposes according to the equation:

   $2H_2O_2(g) \rightarrow 2H_2O(g) + O_2(g)$

In an experiment, the concentration of the reactant H_2O_2 was measured over a period of time. The results are shown below:

Time/s	0	15	30	60	100	180
$[H_2O_2]$/moldm^{-3}	0.40	0.28	0.19	0.07	0.03	0.01

Plot a graph to show how concentration varies with time and use your graph to calculate the rate of reaction:

a) Initially
b) When $[H_2O_2]$= 0.20 moldm^{-3}
c) When $[H_2O_2]$= 0.10 moldm^{-3}
d) Hence write the rate equation, calculate a value for the rate constant and give its units.

3. The decomposition of nitrogen dioxide $2NO_2(g) \rightarrow 2NO + O_2(g)$ was measured and the following data was collected.

Time, s	$[NO_2]$, $moldm^{-3}$
0	0.0100
50	0.00787
100	0.00649
200	0.00481
300	0.00380
400	0.00318
500	0.00275
600	0.00234

Use the graph to determine the order of reaction with respect to nitrogen dioxide and hence deduce the rate equation for the reaction. Determine the value of k and give its units.