➡ The rate constant k, for the reaction $N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}0_2(g)$ is $2.3 \times 10^{-2} s^{-1}$. Which equation given below describes the change of $[N_2O_5]$ with time? $[N_2O_5]_0$ and $[N_2O_5]_t$ correspond to concentration of N_2O_5 initially and at time, t [AIIMS 2004]

A) $[N_2O_5]_t = [N_2O_5]_0 + kt$

B) $[N_2O_5]_0 = [N_2O_5]_t e^{kt}$

C) $\log_{10}[N_2O_5]_t = \log_{10}[N_2O_5]_0 - kt$

D) $\text{In}\frac{[N_2O_5]_0}{[N_2O_5]_t} = kt$

Correct Answer: D

Solution :

Rate constant $= 2.3 \times 10^{-2}\text{sec}^{-1}$ It means it is a first order reaction (because unit of rate constant is sec?1)

For first order reaction $K = \frac{1}{t}\ln\frac{a}{a-x}$ $Kt = \ln\frac{a}{a-x} = \ln\frac{[N_2O_5]_0}{[N_2O_5]_t}$