Kinetics ③ Rate and Time Dependence – 1st order

Decomposition of H_2O_2 is 1st order with respect to H_2O_2

$$2H_2O_2 \longrightarrow 2H_2O + O_2$$

The rate constant at 20°C is $1.8 \times 10^{-5}\ s^{-1}$. If starting conc. of H_2O_2 is 0.75 M, Determine

→ (a) conc. of H_2O_2 after 3hr.

→ (b) how long will it take for H_2O_2 conc. to drop to 0.10 M >

$$\ln \frac{[A]_t}{[A]_0} = -kt$$

Ans

(a) $\ln \frac{[H_2O_2]_t}{0.75\,M} = -1.8 \times 10^{-5}/s \times (10{,}800)\,s$ (3hrs).

$= -0.1944$

inverse of natural log (ln) ($e^{-0.1944}$)

$$\frac{[H_2O_2]_t}{0.75\,M} = 0.823$$

$$[H_2O_2]_t = 0.823 \times 0.75\,M = \boxed{0.62\,M}$$

(b) $\ln \frac{(0.10)\,M}{(0.75)\,M} = -1.8 \times 10^{-5}/s \times t$

$-2.015 = -1.8 \times 10^{-5}/s \times t$

$\frac{-2.015}{-1.8 \times 10^{-5}/s} = t$

$= \boxed{1.12 \times 10^5\ s}$