DPP – 08
CLASS – 12th
TOPIC – PRACTICE QUES.

Q.1 An organic compound undergoes first-order decomposition. The time taken for its decomposition to 1/8 and 1/10 of its initial concentration are $t_1/8$ and $t_1/10$ respectively. What is the value of $[t(1/8)/t(1/10) \times 10]$? ($\log 10^2 = 0.3$)

Q.2 The half-life period of a first order reaction is 15 minutes. The amount of substance left after one hour will be :

(1) 1/4 of the original amount

(2) 1/8 of the original amount

(3) 1/16 of the original amount

(4) 1/32 of the original amount

Q.3 The rate of a reaction A doubles on increasing the temperature from 300 to 310 K. By how much, the temperature of reaction B should be increased from 300 K so that rate doubles if activation energy of the reaction B is twice to that of reaction A.

(1) 4.92 K

(2) 19.67 K

(3) 2.45 K

(4) 9.84 K

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Sol.1

Correct option is A)

$t = \frac{2.303}{k}\log\left(\frac{a}{a-x}\right)$

For decomposition to 1/8 of its initial concentration

$t_{1/8} = \frac{2.303}{k}\log\left(\frac{1}{1/8}\right) = \frac{2.08}{k}$

For decomposition to 1/10 of its initial concentration

$t_{1/10} = \frac{2.303}{k}\log\left(\frac{1}{1/10}\right) = \frac{2.303}{k}$

Hence, $\frac{[t_{1/8}]}{[t_{1/10}]} \times 10 = \frac{\frac{2.08}{k}}{\frac{2.303}{k}} \times 10 = 9$

Sol.2

Correct option is C)

For first order reaction,

$\frac{A_t}{A_0} = e^{-kt}$

$t_{1/2} = \frac{0.69}{k}$

$k = 0.046\ \text{min}^{-1}$

$\frac{A_t}{A_0} = e^{-0.046\times 60}$

$\frac{A_t}{A_0} = \frac{1}{16}$

$A_t = \frac{A_0}{16}$

Sol.3

Correct option is A)

For the reaction A

$\log\frac{k'}{k} = \frac{E}{2.303R}\left[\frac{T'-T}{TT'}\right]$

$k' = 2k$

$T = 300\ K\ T' = 310\ K$

Substitute values in the above equation.

$$\log\frac{2k}{k} = \frac{E}{2.303R}\left[\frac{310 - 300}{300 \times 310}\right]$$

$$\log 2 = \frac{E}{2.303R}\left[\frac{10}{300 \times 310}\right] \text{......(1)}$$

For the reaction B

$$\log\frac{k'}{k} = \frac{E}{2.303R}\left[\frac{T' - T}{TT'}\right]$$

$k' = 2k$

$E_a(B) = 2E_a(A)$

$T = 300$ K $T' = ?$

Substitute values in the above equation.

$$\log\frac{2k}{k} = \frac{2E}{2.303R}\left[\frac{T' - 300}{300 \times T'}\right]$$

$$\log 2 = \frac{2E}{2.303R}\left[\frac{T' - 300}{300 \times T'}\right] \text{......(2)}$$

Divide equation (2) with (1)

$$\frac{\log 2}{\log 2} = \frac{\frac{2E}{2.303R}}{\frac{E}{2.303R}} \times \frac{\left[\frac{T' - 300}{300 \times T'}\right]}{\left[\frac{10}{300 \times 310}\right]}$$

$$1 = 2 \times \frac{\left[\frac{T' - 300}{T'}\right]}{\left[\frac{1}{31}\right]}$$

$$\frac{1}{62} = \left[\frac{T' - 300}{T'}\right]$$

$T' - 300 = 0.01613T'$

$0.9838T' = 300$

$T' = 304.92$ K

Hence, the temperature of reaction B should be increased from 300K by 304.92 − 300 = 4.92 K.