QUESTION

76. For reaction $A \longrightarrow B$, the rate constant $k_1 = A_1(e^{-E_{a_1}/RT})$ and for the reaction $X \longrightarrow Y$, the rate constant $k_2 = A_2(e^{-E_{a_2}/RT})$. If $A_1 = 10^9$, $A_2 = 10^{10}$ and $E_{a_1} = 1200$ cal/mol, then the temperature at which $k_1 = k_2$ is: (Given; $R = 2$ cal/K-mol)

(a) 300K   (b) 300×2.303K   (c) $\dfrac{300}{2.303}K$ (d) None of these

ANSWER :

76. (c) $A_1 e^{-E_{a_1}/RT} = A_2 e^{-E_{a_2}/RT}$

$$\frac{A_2}{A_1} = e^{(E_{a_2}-E_{a_1})/RT}$$

$$10 = \text{Exp}\left(\frac{600}{RT}\right), R = 2 \text{ cal/K-mol}$$

$$\ln 10 = \frac{600}{2T}$$

$$T = \frac{300}{2.303}K$$