Q. The rate of a certain biochemical reaction at physiological temperature (T) occurs 10^6 times faster with enzyme than without. The change in the activation energy upon adding the enzyme is:

[JEE Main 2020 (Online)]

(A) $+6RT$ (B) $-6(2.303)RT$

(C) $-6RT$ (D) $+6(2.303)RT$

Ans: (B)

Explanation: Arrhenius Equation: $K = Ae^{-Ea/RT}$

Now,

Rate constant in presence of enzyme $K' = 10^6 K$

So, the activation energy in presence of enzyme Ea' is given as:

$$K' = 10^6 K$$

$$(Ae^{-Ea'/RT}) = 10^6 (Ae^{-Ea/RT})$$

$$\Rightarrow \frac{-Ea'}{RT} = \ln(10^6) - \frac{Ea}{RT}$$

$$\Rightarrow Ea' - Ea = -RT \ln(10^6)$$

$$\Delta Ea = Ea' - Ea = -6(2.303)RT$$