Answer on the Question #42344, Chemistry, Physical Chemistry

Question:

Consider the following reactions at 300 K.
A → B (uncatalysed reaction)
A →B (catalyst reaction)
The activation energy is lowered by 8.314 KJ mol–1 for the catalysed reaction. How many times the rate of this catalysed reaction greater than that of uncatalysed reaction ?
(1) 15 times
(2) 18 times
(3) 22 times
(4) 28 times

Solution:

Reaction rate is defined as a products income in the period of time and depends on the concentration of reagents in the way the following equation shows:

$$v = \frac{d[P]}{dt} = k_T * [A]^n$$

Where [P] is products concentration, k_T is rate constant at the temperature T and [A] is the concentration of reagent to the power n, which is called “reaction order”.

According to the Arrhenius equation, the rate constant k_T is the function of activation energy:

$$k_T = Ae^{-E_a/(RT)}$$

Thus, lowering of activation energy by 8.314 kJ/mol will cause the lowering of rate constant k_T:

$$\frac{k_1}{k_2} = e^{(-E_{a1} + E_{a2})/RT)} = e^{(\frac{8314}{8.3144622*300})} = 28.03 \approx 28$$

That means, that the rate for catalysed reaction is 28 times greater than that of uncatalysed reaction.

Answer: (4) 28 times