

Answer on Question #42188 - Chemistry - Physical Chemistry

Question:

Activation energy is 100 KJ/mol. Presence of catalyst lower activation energy by 75%. What is the effect of rate of reaction at 20 degree other things being equal.

Answer:

Write the expression for the reaction rate constant:

$$k_1 = k_0 \cdot \exp(-E_{a1}/RT)$$

Substitute values of activation energy E_a and temperature into expression:

$$k_1 = k_0 \cdot \exp(-100000/8.314 \cdot 293) = 1.485 \cdot 10^{-18} k_0$$

Find the expression for reaction rate constant in presence of catalyst:

$$k_2 = k_0 \cdot \exp(-E_{a2}/RT) = k_0 \cdot \exp(-25000/8.314 \cdot 293) = 3.491 \cdot 10^{-5} k_0$$

Now we can find the ratio between the reaction rate constants:

$$k_2/k_1 = 3.491 \cdot 10^{-5} k_0 / 1.485 \cdot 10^{-18} k_0 = 2.35 \cdot 10^{13}$$

So, the reaction rate will increase by $2.35 \cdot 10^{13}$ times.