# Activation energy

Calculate the activation energy for the reaction

$$H_2 + I_2 \rightarrow 2\,HI$$

given that the specific rate constant for reaction is $4.3 \times 10^{-7}$ $M^{-1}s^{-1}$ at 500 K and $6.3 \times 10^{-4}$ $M^{-1}s^{-1}$ at 700 K. Calculate the rate constant at 600 K.

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Solution: To calculate Ea use the equation

$$E_a = \frac{-R \ln \frac{k_2}{k_1}}{\left(\frac{1}{T_2} - \frac{1}{T_1}\right)}$$

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Solution: Use the equation

$$E_a = \frac{-8.31 \ln \frac{6.3\ x\ 10^{-4}}{4.3x\ 10^{-7}}}{\left(\frac{1}{700} - \frac{1}{500}\right)} = 106{,}000\ J/mol$$

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Solution: We can obtain the prefactor from the Arrhenius equation

$$k = Aexp\{-E_a/RT\}$$

Therefore,

$$A = \frac{k}{exp\{-E_a/RT\}}$$

$$A = \frac{4.3\ x\ 10^{-7}}{exp\{-106000/(8.31)(500)\}}$$

$$A = 51{,}600\ s^{-1}$$