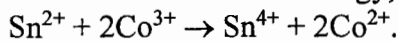


$$\text{rate} = k \quad \text{rate} = k[A] \quad \text{rate} = k[A]^2 \quad [A]_t = -kt + [A]_0 \quad \ln[A]_t = -kt + \ln[A]_0 \quad R = 8.314 \text{ J}/(\text{mol}\cdot\text{K})$$

$$1/[A]_t = kt + 1/[A]_0 \quad t_{1/2} = [A]_0/2k \quad t_{1/2} = 0.693/k \quad t_{1/2} = 1/k[A]_0 \quad \ln \frac{k_1}{k_2} = \frac{E_a}{R} \left(\frac{1}{T_2} - \frac{1}{T_1} \right) \quad e=mc^2$$

1. (5 Pts) Calculate the activation energy, in kJ/mol, for the redox reaction



Temp (°C)	k (1/M·s)
2	3.12×10^3
27	27.0×10^3

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

$$\ln \frac{3.12 \times 10^3}{27.0 \times 10^3} = \frac{E_a}{8.314} \left(\frac{1}{300} - \frac{1}{275} \right)$$

$$E_a = 59207 \text{ J/mol} \approx 59.2 \text{ J/mol}$$

2. (4 Pts) A certain reaction $A \rightarrow \text{products}$ is second order with respect to A. If it takes 45 min to reduce the concentration of A from 0.350 M to 0.125 M, what is the rate constant for this reaction?

$$\frac{1}{[A]_t} = kt + \frac{1}{[A]_0}$$

$$\frac{1}{0.125} = k(45 \text{ min}) + \frac{1}{0.350}$$

$$k = 1.1 \times 10^{-1} \text{ M}^{-1} \text{ min}^{-1}$$

3. (6 Pts) Given that E_a for a certain biological reaction is 48 kJ/mol and that the rate constant is $2.5 \times 10^{-2} \text{ s}^{-1}$ at 15°C, what is the rate constant at 37°C?

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

$$\ln \frac{k_1}{2.5 \times 10^{-2}} = \frac{48 \times 10^3 \text{ J/mol}}{8.314 \text{ J/mol}\cdot\text{K}} \left(\frac{1}{288} - \frac{1}{310} \right)$$

$$\ln \frac{k_1}{2.5 \times 10^{-2}} = 1.422 \dots$$

$$\frac{k_1}{2.5 \times 10^{-2}} = e^{1.422 \dots}$$

$$k_1 = 0.10 \text{ s}^{-1}$$

MORE QUESTIONS ON BACK.

4. (6 Pts) The isomerization of cyclopropane to form propene is a first-order reaction.



- a. At 760 K, 15% of a sample of cyclopropane changes to propene in 6.8 min. What is the rate constant at 760 K?

$$\ln \frac{85}{100} = -k(6.8 \text{ min})$$

$$k = 0.0239 \text{ min}^{-1}$$

- b. What is the half-life at 760 K?

$$t_{1/2} = \frac{\ln 2}{0.0239 \text{ min}^{-1}}$$

$$t_{1/2} = 29 \text{ min}$$

5. (4 Pts) The first-order decomposition, $A \rightarrow \text{products}$, has a rate constant of 0.150 s^{-1} . Starting with $[A]_0 = 0.350 \text{ M}$, how much time is required for $[A]_t = 0.125 \text{ M}$?

$$\ln [A]_t = -kt + \ln [A]_0$$

$$\ln [0.125] = (-0.150 \text{ s}^{-1})t + \ln [0.350]$$

$$t = 6.86 \text{ s}$$