CHM152 Quiz 2a 25 Pts Spring 2018 Name: Key

Show all Work to Receive Credit

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

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

1. (5 Pts) Calculate the activation energy, in kJ/mol, for the redox reaction
$Sn^{2+} + 2Co^{3+} \rightarrow Sn^{4+} + 2Co^{2+}$.

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

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

$$\ln\frac{3.12\times10^3}{27.0\times10^3} = \frac{E_a}{8.314}\left(\frac{1}{300} - \frac{1}{275}\right)$$

$$E_a = 59207\ J/mol \approx 59.2\ J/mol$$

2. (4 Pts) A certain reaction A → *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?

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

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

$$k = 1.1\times10^{-1}\ M^{-1}\cdot min^{-1}$$

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

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

$$\ln\frac{k_1}{2.5\times10^{-2}} = \frac{48\times10^3\ J/mol}{8.314\ J/mol\cdot K}\left(\frac{1}{288} - \frac{1}{310}\right)$$

$$\ln\frac{k_1}{2.5\times10^{-2}} = 1.422\ldots$$

$$\frac{k_1}{2.5\times10^{-2}} = e^{1.422\ldots}$$

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

MORE QUESTIONS ON BACK.

Key

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 → *products*, has a rate constant of 0.150 s^{-1}. Starting with $[A]_o = 0.350$ M, how much time is required for $[A]_t = 0.125$ M?

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

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

$$t = 6.86\ s$$