CHM152 Quiz 2a 25 Pts Spring 2017 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) For a given reaction, the activation energy is 19.0 kJ/mol. If the reaction rate constant is 8.30×10^{-3} $M^{-1}s^{-1}$ at 298 K, what is the reaction rate constant at 348 K?

$$\ln\frac{k_1}{8.30\times10^{-3}} = \frac{19.0\times10^{3}\ J/mol}{8.314\ J/mol\cdot K}\left(\frac{1}{298K} - \frac{1}{348K}\right) = 1.1018..$$

$$k = 2.50\times10^{-2}\ M^{-1}\cdot s^{-1}$$

2. (5Pts) Calculate the activation energy, E_a for $N_2O_5(g) \rightarrow 2\ NO_2(g) + 1/2\ O_2(g)$ given k (at 25°C) = 3.46×10^{-5} s^{-1} and k (at 35°C) = 1.48×10^{-4} s^{-1}.

$$\ln\frac{3.46\times10^{-5}}{1.48\times10^{-4}} = \frac{E_a}{8.314\ J/mol\cdot K}\left(\frac{1}{308K} - \frac{1}{298K}\right) = 110\,904\ J/mol$$

111 kJ/mol

3. (5 Pts) For a second-order reaction, the initial concentration of reactant A is 0.24 M. If the rate constant for the reaction is 8.1×10^{-2} $M^{-1}s^{-1}$, what is the concentration of A after 29 seconds?

$$\frac{1}{[A]_t} = (8.1\times10^{-2})(29\,s) + \frac{1}{[0.24]}$$

$$[A]_t = 0.15\ M$$

4. (5 Pts) What is the half-life of a first-order reaction if it takes 298 seconds for the concentration to decrease from 2.20 M to 0.32 M? (Hint find k first)

Find k 1st then $t_{1/2}$:

$$\ln[0.32] = -k(298\,s) + \ln[2.20]$$

$$0.006469\ s^{-1} = k$$

$$t_{1/2} = \frac{0.693}{0.006469\ s^{-1}}$$

$$t_{1/2} = 1.07\times10^{2}\ s$$

107 s

5. (5 Pts) Which of the following factors often affect the value of the rate constant of a chemical reaction? (more than one is possible)

1. changes in the concentrations of reactants
2. changes in the temperature of the system
3. the addition of a catalyst

Your answer 2 & 3