

Chem 1105-2016 Summer Problem Set #3

1. Consider the reaction:



If the rate of consumption of A is 3.06×10^{-3} M/s, determine the rate of consumption of B and the rate of formation of C.

2. For a reaction in which A and B form C, the following data were obtained from three experiments:

Experiment	[A](Molarity)	[B](Molarity)	Rate of Formation of C(M/s)
1	0.300	0.150	1.60×10^{-5}
2	0.600	0.300	2.59×10^{-4}
3	0.300	0.300	1.28×10^{-4}

- a) What is the rate expression for the reaction and the overall reaction order?
b) What is the numerical value of the rate constant, k?

3. The reaction



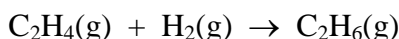
is first order in C_2H_5Cl . The rate constant is $1.60 \times 10^{-6} \text{ s}^{-1}$ for the reaction conducted at 650. K. In an investigation into the decomposition of $C_2H_5Cl(g)$, an initial concentration of 0.165 M was used. a) What will be the concentration of $C_2H_5Cl(g)$ after 125 hours? b) How long will it take for the concentration of C_2H_5Cl to drop to 0.100 M? c) How many hours will it take for 75.0% of the C_2H_5Cl to decompose? d) Determine the half-life, in hours, for this reaction at 650. K.

4. The decomposition of $NO_2(g)$:



is a second order reaction, and the rate constant is $0.755 \text{ M}^{-1} \cdot \text{s}^{-1}$ for the reaction conducted at 603 K. In an experiment at 603 K, the initial concentration of $NO_2(g)$ was 0.00650 M. a) What is the concentration of $NO_2(g)$ after 125 s have elapsed? b) How many seconds will it take for the concentration of $NO_2(g)$ to drop to 0.00100 M? c) Determine the half-life.

5. The reaction:



is first order in C_2H_4 , first order in H_2 , and second order overall. The energy of activation for the reaction is 181 kJ/mol and k is $1.3 \times 10^{-3} \text{ M}^{-1} \cdot \text{s}^{-1}$ for the reaction at 700. K. What is the value of k for the reaction at 730. K.

6. A mechanism for the gas-phase reaction between iodine and hydrogen is as follows:

Step 1: $I_2 \rightleftharpoons 2I$ (fast, equilibrium)

Step 2: $H_2 + I \rightleftharpoons H_2I$ (fast, equilibrium)

Step 3: $H_2I + I \rightarrow 2HI$ (slow)

- a) Write the overall reaction. b) Identify the reaction intermediate?

Answer Set for Chem 1105-2016 Summer Problem Set #3

1. $-\Delta[B]/\Delta t = 1.53 \times 10^{-3} \text{ M/s}$; $\Delta[C]/\Delta t = 4.59 \times 10^{-3} \text{ M/s}$

2.a) $\text{rate} = k[A][B]^3$, 4th order overall; b) $k = 0.0159 \text{ M}^{-3} \cdot \text{s}^{-1}$

3.a) 0.0803 M; b) 87.0 hours; c) 241 hours; d) $t_{1/2} = 120. \text{ hours}$

4.a) 0.00403 M; b) $1.12 \times 10^3 \text{ s}$; c) 204 s

5. $k = 4.7 \times 10^{-3} \text{ M}^{-1} \cdot \text{s}^{-1}$

