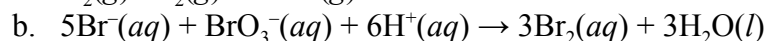
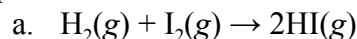


Name:
College ID:
Thomas Edison State University
General Chemistry II with Labs (CHE-122)
Section no.:
Semester and year:

Written Assignment 3: Chemical Kinetics

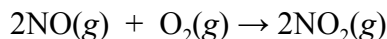
Answer all assigned questions and problems, and show all work.

1. Write the reaction rate expressions for the following reactions in terms of the disappearance of the reactants and the appearance of products: (6 points)



(Reference: Chang 13.5)

2. Consider the reaction

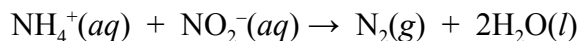


Suppose that at a particular moment during the reaction nitric oxide (NO) is reacting at the rate of 0.066 M/s.

- a. At what rate is NO_2 being formed? (3 points)
b. At what rate is molecular oxygen reacting? (3 points)

(Reference: Chang 13.7)

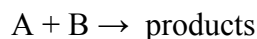
3. The rate law for the reaction



is given by $\text{rate} = k[\text{NH}_4^+][\text{NO}_2^-]$. At 25°C , the rate constant is $3.0 \times 10^{-4} / \text{M} \cdot \text{s}$. Calculate the rate of the reaction at this temperature if $[\text{NH}_4^+] = 0.26 \text{ M}$ and $[\text{NO}_2^-] = 0.080 \text{ M}$. (5 points)

(Reference: Chang 13.13)

4. Consider the reaction



From the following data obtained at a certain temperature, determine the order of the reaction and calculate the rate constant: (5 points)

[A] (M)	[B] (M)	Rate (M/s)
1.50	1.50	3.20×10^{-1}
1.50	2.50	3.20×10^{-1}
3.00	1.50	6.40×10^{-1}

(Reference: Chang 13.15)

5. Determine the overall orders of the reactions to which the following rate laws apply: (8 points)

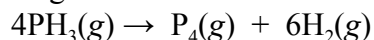
- rate = $k[\text{NO}_2]^2$
- rate = k
- rate = $k[\text{H}_2][\text{Br}_2]^{1/2}$
- rate = $k[\text{NO}]^2[\text{O}_2]$

(Reference: Chang 13.17)

6. What is the half-life of a compound if 75 percent of a given sample of the compound decomposes in 60 minutes? Assume first-order kinetics. (5 points)

(Reference: Chang 13.25)

7. The thermal decomposition of phosphine (PH_3) into phosphorus and molecular hydrogen is a first-order reaction:



The half-life of the reaction is 35.0 s at 680°C. Calculate (a) the first-order rate constant for the reaction and (b) the time required for 95 percent of the phosphine to decompose.

(10 points)

(Reference: Chang 13.26)

8. The rate constant for the second-order reaction



is $0.80/\text{M} \cdot \text{s}$ at 10°C .

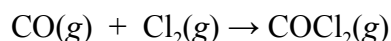
- Starting with a concentration of 0.086 M , calculate the concentration of NOBr after 22 s . (5 points)
- Calculate the half-lives when $[\text{NOBr}]_0 = 0.072\text{ M}$ and $[\text{NOBr}]_0 = 0.054\text{ M}$. (5 points)

(Reference: Chang 13.27)

9. Define activation energy. What role does activation energy play in chemical kinetics? (5 points)

(Reference: Chang 13.31)

10. Given the same reactant concentrations, the reaction



at 250°C is 1.50×10^3 times as fast as the same reaction at 150°C . Calculate the activation energy for this reaction. Assume that the frequency factor is constant. (Hint: use equation 13.14.) (10 points)

(Reference: Chang 13.38)

11. Most reactions, including enzyme-catalyzed reactions, proceed faster at higher temperatures. However, for a given enzyme, the rate drops off abruptly at a certain temperature. Account for this behavior. (5 points)

12. The bromination of acetone is acid-catalyzed:



The rate of disappearance of bromine was measured for several different concentrations of acetone, bromine, and H^+ ions at a certain temperature:

	$[\text{CH}_3\text{COCH}_3]$	$[\text{Br}_2]$	$[\text{H}^+]$	Rate of Disappearance of Br_2 (M/s)
(1)	0.30	0.050	0.050	5.7×10^{-5}
(2)	0.30	0.10	0.050	5.7×10^{-5}
(3)	0.30	0.050	0.10	1.2×10^{-4}
(4)	0.40	0.050	0.20	3.1×10^{-4}
(5)	0.40	0.050	0.050	7.6×10^{-5}

- What is the rate law for the reaction? (5 points)
- Determine the rate constant. (5 points)

(Reference: Chang 13.79)

13. Briefly comment on the effect of a catalyst on each of the following: (a) activation energy, (b) reaction mechanism, (c) enthalpy of reaction, (d) rate of forward step, (e) rate of reverse step. (15 points)

(Reference: Chang 13.91)