Problem Set 3

Reading

Chapter 14.1 - 14.5

Text Exercises

Chapter 14: 21, 29, 33(a), 44, 46, 56, 63.

Exercises

1. Molecular Oxygen combines into Ozone when an appropriate frequency of Ultraviolet light:

\[ 3 \text{O}_2(g) \rightarrow 2 \text{O}_3(g) \]

It is found, at a particular point in time:

\[ \Delta [\text{O}_2] / \Delta t = 2.17 \times 10^{-5} \text{ M/sec} \]

What is the rate of the chemical reaction at this point? What is:

\[ \Delta [\text{O}_3] / \Delta t \]

2. The rate law for the reaction of Bromate with Bromide is found to be:

\[ \text{rate} = k [\text{BrO}_3^-] [\text{Br}^-] [\text{H}^+]^2 \]

How does the rate for this reaction change if:

a) the Bromide Ion concentration is tripled.

b) the Bromate Ion, BrO₃⁻, concentration is cut in half.

c) the Hydrogen Ion concentration is doubled.

3. Ammonia decomposes in the presence of Tungsten at 1100°C according to zeroth order kinetics; with \( k = 0.00025 \text{ M min}^{-1} \). If the concentration of ammonia starts at 0.08M, how much remains after 3 hours?
4. The rate constant for the zeroth order decomposition of HI on a Gold surface is 0.050 M sec\(^{-1}\). How long will it take for the concentration of HI to drop from 1.0M to 0.2M?

5. The decomposition of Nitrogen Dioxide, NO\(_2\), is second order with respect to NO\(_2\) and overall, with \(k = 0.31 \text{ M}^{-1}\text{sec}^{-1}\). How much NO\(_2\) remains after 25sec if we start with 0.05M?

6. The rate constant for the second-order reaction:

\[
2 \text{NOBr(g)} \rightarrow 2 \text{NO(g)} + \text{Br}_2(g)
\]

is 48 M\(^{-1}\)min\(^{-1}\). How long will it take for 0.02M NOBr to decompose to 0.05M?