

CHE 112 - Homework - Ch 13a
Kinetics - Rate Laws

Name: _____

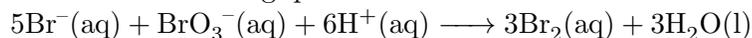
Date: _____

1. The following rate data was collected for the reaction: $2\text{NO}_2(\text{g}) \longrightarrow 2\text{NO}(\text{g}) + \text{O}_2(\text{g})$. Using this data, answer the following questions:

| Time | [NO ₂] (M) | Time | [NO ₂] (M) |
|------|------------------------|------|------------------------|
| 0 | 8.00×10^{-3} | 200 | 4.29×10^{-3} |
| 50 | 6.58×10^{-3} | 300 | 3.48×10^{-3} |
| 100 | 5.59×10^{-3} | 400 | 2.93×10^{-3} |
| 150 | 4.85×10^{-3} | 500 | 2.53×10^{-3} |

- 1(a) What is the average rate of decomposition of NO₂ between 50-100 seconds using the data below?
- 1(b) How is the rate of consumption of NO₂ related to the rate of production of NO? (in words and an equation)
- 1(c) How is the rate of consumption of NO₂ related to the rate of production of O₂? (in words and an equation)

2. Answer the following questions about the reaction:



The reaction is first order in Br⁻ and BrO₃⁻ and second order in H⁺.

- 2(a) Write the rate law.
- 2(b) What is the overall reaction order?
- 2(c) How does the reaction rate change if the H⁺ concentration triples? Explain.
- 2(d) How does the reaction rate change if the concentration of Br⁻ and BrO₃⁻ is halved? Explain.

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3. Given the reaction $\text{H}_2\text{O}_2(\text{aq}) + 3\text{I}^-(\text{aq}) + 2\text{H}^+(\text{aq}) \longrightarrow \text{I}_3^-(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$ and the following experimental rate data based on the rate of formation of $\text{I}_3^-(\text{aq})$, answer the following questions:

| Exp | $[\text{H}_2\text{O}_2]$ (M) | $[\text{I}^-]$ (M) | Rate (M/s) |
|-----|------------------------------|--------------------|-----------------------|
| 1 | 0.100 | 0.100 | 1.15×10^{-4} |
| 2 | 0.100 | 0.200 | 2.30×10^{-4} |
| 3 | 0.200 | 0.100 | 2.30×10^{-4} |
| 4 | 0.200 | 0.200 | 4.60×10^{-4} |

(a) What is the rate law?

(b) What is the value of the rate constant?

3(b) _____

(c) What is the reaction rate when the initial concentration are:
 $\text{H}_2\text{O}_2 = 0.300 \text{ M}$ and $\text{I}^- = 0.400 \text{ M}$?

3(c) _____

4. Given the reaction $2\text{NO}(\text{g}) + \text{Cl}_2(\text{g}) \longrightarrow 2\text{NOCl}(\text{g})$ and the following experimental rate data based on the consumption of Cl_2 , answer the following questions:

| Exp | $[\text{NO}]$ (M) | $[\text{Cl}_2]$ (M) | Rate (M/s) |
|-----|-------------------|---------------------|----------------------|
| 1 | 0.13 | 0.20 | 1.0×10^{-2} |
| 2 | 0.26 | 0.20 | 4.0×10^{-2} |
| 3 | 0.13 | 0.10 | 5.0×10^{-3} |

(a) What is the rate law?

(b) What is the value of the rate constant?

4(b) _____

(c) What is the reaction rate when both reactant concentrations are 0.12 M?

4(c) _____