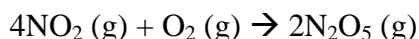


Homework #11
Due FRIDAY Dec 12th

Chapter 28

1. Nitrogen dioxide reacts with oxygen to form dinitrogen pentoxide via the following reaction:



Under certain conditions, the rate of reaction is $5.2 \times 10^{-4} \text{ mol}\cdot\text{L}^{-1}\cdot\text{s}^{-1}$. Calculate the value of $d[\text{NO}_2]/dt$, $d[\text{O}_2]/dt$, and $d[\text{N}_2\text{O}_5]/dt$.

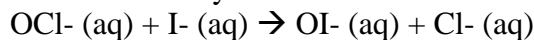
2. Consider the reaction: $\text{A} + \text{B} \rightarrow \text{C}$. The rate law for this reaction is:

$$v(t) = k[\text{A}]^m[\text{B}]^n$$

Using the following data, determine the order of reaction with respect to A and B and the rate constant for the reaction.

[A] (M)	[B] (M)	Initial Rate (M/s)
2.30×10^{-4}	3.10×10^{-5}	5.25×10^{-4}
4.60×10^{-4}	6.20×10^{-5}	4.20×10^{-3}
9.20×10^{-4}	6.20×10^{-5}	1.70×10^{-2}

3. Consider the base-catalyzed reaction

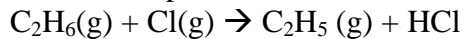


The following initial rate data was collected in the laboratory. The form of the rate law is: $v(t) = k[\text{OCl}^-]^m[\text{I}^-]^n[\text{OH}^-]^p$.

[OCl ⁻] (M)	[I ⁻] (M)	[OH ⁻] (M)	v_0 (M/s)
1.62×10^{-3}	1.62×10^{-3}	0.52	3.06×10^{-4}
1.62×10^{-3}	2.88×10^{-3}	0.52	5.44×10^{-4}
2.71×10^{-3}	1.62×10^{-3}	0.84	3.16×10^{-4}
1.62×10^{-3}	2.88×10^{-3}	0.91	3.11×10^{-4}

- a) Why does the rate depend on [OH⁻]? What pH range was used in these experiments?
- b) Use the given data to find the orders of reaction and the corresponding rate constant.
4. Do the units of the Arrhenius prefactor, A, always match the units of the rate constant, k? Why?
5. Cyclobutane, C₄H₈, decomposes to ethene, C₂H₄, by a first order kinetic process. A flask with cyclobutane at a concentration of 0.214 M has an initial rate of $5.31 \times 10^{-5} \text{ M/s}$. Calculate the rate constant (in s⁻¹) and half-life (in min) for the reaction.

6. Hydrogen abstraction from hydrocarbons by atomic chlorine is a mechanism for Cl loss in the atmosphere. Consider the reaction of Cl with ethane:



The reaction was studied in the laboratory and the following data was obtained.

T / K	k (M ⁻¹ s ⁻¹)
270	3.43×10^{-10}
370	3.77×10^{-10}
470	3.99×10^{-10}
570	4.13×10^{-10}
670	4.23×10^{-10}

- Determine the Arrhenius parameters for this reaction.
- At the tropopause (the boundary between the troposphere and stratosphere), the temperature is roughly 220 K. What do you expect the rate constant to be at this temperature?
- Using the Arrhenius parameters obtained in part (a), determine the Eyring parameters ΔH^\ddagger , ΔS^\ddagger , and ΔG^\ddagger .

Chapter 29

McQuarrie and Simon Problems: 4, 11, 13, 14, 24, (40)

* We may not get the material covered by problem 40, so I may remove that from the homework.