Week 8, 9 Worksheet

Learning Objectives:

Chapter 6

➢ Use curved arrows to show the movement of electrons during an organic reaction
  ○ Differentiate between substitution, elimination, and addition reactions.
  ○ Define and differentiate between concerted and stepwise reactions
  ○ Define and differentiate between homolytic and heterolytic reactions
➢ Identify trends between activation energy, bond strength, bond dissociation energy
➢ Draw energy diagrams that showcase potential intermediates in an organic reaction
➢ Apply the first and second laws of thermodynamics to favorability of an organic reaction
➢ Define kinetic constant, equilibrium constant, Gibbs free energy, entropy, and enthalpy
  ○ Describe how each of these variables influence either the kinetics or thermodynamics of an organic reaction
➢ Identify factors that influence the rate of an organic reaction, such as activation energy, concentration, and temperature
➢ Define and identify organic reaction catalysts

Chapter 10

➢ Be able to calculate degrees of unsaturation for different compounds
Problem Set:

1. For each rate equation, what effect does the indicated concentration change have on the overall rate of the reaction?

\[ \text{rate} = k[\text{CH}_3\text{CH}_2\text{Br}][-\text{OH}] \]

a. tripling the concentration of \( \text{CH}_3\text{CH}_2\text{Br} \) only
b. tripling the concentration of \(-\text{OH}\) only
c. tripling the concentration of both \( \text{CH}_3\text{CH}_2\text{Br} \) and \(-\text{OH}\)

\[ \text{rate} = k[(\text{CH}_3)_3\text{COH}] \]

a. doubling the concentration of \((\text{CH}_3)_3\text{COH}\)
b. increasing the concentration of \((\text{CH}_3)_3\text{COH}\) by a factor of 10

2. Write a rate equation for each reaction, given the indicated mechanism.

a. \( \text{CH}_3\text{CH}_2\text{-Br} + \text{-OH} \rightarrow \text{CH}_3\text{CH}_2\text{OH} + \text{Br}^- \)

b. \( (\text{CH}_3)_3\text{C-Br} \xrightarrow{\text{slow}} (\text{CH}_3)_3\text{C}^+ + \text{Br}^- \xrightarrow{\text{fast}} (\text{CH}_3)_2\text{C=CH}_2 + \text{H}_2\text{O} \)

3. Consider the following energy diagram for the conversion of \(\text{A} \rightarrow \text{G}\).
   a. Which points on the graph correspond to transition states?
   b. Which points on the graph correspond to reactive intermediates?
   c. How many steps are present in the reaction mechanism?
   d. Label each step of the mechanism as endothermic or exothermic.
   e. Label the overall reaction as endothermic or exothermic.
4. Determine which of the two diagrams (both for the same reaction) here benefits from catalysis, and identify the activation energy for the catalyzed reaction.

![Graphs showing energy profiles for reactions](Image)

5. Identify the catalyst in each reaction.

a. 

\[ \text{H}_2\text{SO}_4 \]

b. 

![Reaction with chlorine and iodide](Image)

6. How many degrees of unsaturation does each of the following drugs contain?

a. Zolpidem, C\textsubscript{19}H\textsubscript{21}N\textsubscript{3}O

b. Mefloquine, C\textsubscript{17}H\textsubscript{16}F\textsubscript{6}N\textsubscript{2}O