

Chemistry 146 – Van Bramer
Spring Problem Set – Week 4

Given the reaction: $R \rightleftharpoons 2 P$

Start with the following information:

- The forward reaction has
 - $E_a = 2 \text{ kJ/mole}$
 - $A = 0.01 \text{ s}^{-1}$
 - The reverse reaction has
 - $E_a = 4 \text{ kJ/mole}$
 - $A = 0.01 \text{ L mole}^{-1} \text{ s}^{-1}$
1. Calculate the rate constant for the forward and reverse reactions at 298 K.
 2. Calculate the rate of the forward and reverse reactions at 298 K and predict the direction of the net reaction when
 - a. $[R] = 0.1 \text{ M}$, $[P] = 0.0 \text{ M}$
 - b. $[R] = 0.1 \text{ M}$, $[P] = 0.1 \text{ M}$
 - c. $[R] = 0.1 \text{ M}$, $[P] = 0.5 \text{ M}$
 - d. $[R] = 0.0 \text{ M}$, $[P] = 0.1 \text{ M}$
 - e. $[R] = 0.2 \text{ M}$, $[P] = 0.2 \text{ M}$
 3. Write an expression for
 - a. the equilibrium constant for this reaction.
 - b. the rate of the forward reaction.
 - c. the rate of the reverse reaction
 4. At equilibrium, the rate of the forward and reverse reactions are equal. Combine the above expressions as appropriate and solve for the equilibrium constant K .
 5. Based upon the value for K at 298 K, calculate the equilibrium concentration of P when $[R]=0.1 \text{ M}$. Calculate the rate of the forward and reverse reactions and predict the direction of the net reaction at these concentrations.