1. Consider the reaction: \(2 \text{N}_2\text{O}_5(\text{g}) \rightleftharpoons 2 \text{N}_2(\text{g}) + 5 \text{O}_2(\text{g})\). If the initial partial pressure of \(\text{N}_2\text{O}_5\) was 3.20 atm and the total pressure of the system was 7.80 atm at equilibrium, what is \(K_P\) for the reaction?

2. At 298 K, the equilibrium expression for the reaction below is \(K_P = 1.7 \times 10^{-4}\).
   \(2 \text{CO}_2(\text{g}) \rightleftharpoons 2 \text{CO}(\text{g}) + \text{O}_2(\text{g})\)
   A) Calculate \(K_C\).
   B) If 2.0 mol of carbon dioxide is placed into a 5.0 L flask, what will be the concentration of all species at equilibrium?

3. Consider the reaction: \(\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2 \text{HI}(\text{g})\). If \(K_C = 150\) at 25°C, and a mixture at that temperature contains \([\text{H}_2] = 0.75\ M\), \([\text{I}_2] = 0.75\ M\), and \([\text{HI}] = 2.5\ M\),
   A) Is the system at equilibrium?
   B) If not, to which direction will it shift?
   C) What will be the equilibrium concentrations of reactants and products?

4. At 298 K, \(K_p = 3.5 \times 10^6\) for the reaction of \(2 \text{NO}(\text{g}) \rightleftharpoons \text{N}_2(\text{g}) + \text{O}_2(\text{g})\). If a mixture initially contains \(P_{\text{NO}} = 1.50\) atm, \(P_{\text{O}_2} = 0.20\) atm, and \(P_{\text{N}_2} = 0\) atm, what are the equilibrium pressures of all species?

5. Consider the reaction: \(\text{CO}_2(\text{g}) + \text{H}_2(\text{g}) \rightleftharpoons \text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g})\), for which \(K_C = 6.00\) at 400 K. If a mixture initially contains 1.00 M \(\text{CO}_2\) and 4.00 M \(\text{H}_2\) and is allowed to come to equilibrium, what are the equilibrium concentrations of all species?

6. A gas mixture initially containing 4.00 mol of \(\text{N}_2\text{O}_4\) and 6.00 mol \(\text{O}_2\) in a 3.00 L container are allowed to come to equilibrium by the reaction: \(2 \text{N}_2\text{O}_4(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2 \text{N}_2\text{O}_5(\text{g})\).
   What are the equilibrium concentrations of all species if \(K_C = 1.25 \times 10^{-5}\).

7. Consider the gas phase decomposition reaction of hydrogen sulfite at high temperature:
   \(\text{H}_2\text{SO}_3(\text{g}) \rightleftharpoons \text{SO}_2(\text{g}) + \text{H}_2\text{O}(\text{g})\)
   A mixture of the gases initially contains 5.00 atm of hydrogen sulfite and 1.00 atm water vapor, with no sulfur dioxide present. If the equilibrium mixture has a total pressure of 8.62 atm, what is the value of \(K_P\)?