1. Consider the gas phase decomposition reaction of hydrogen sulfite at high temperature. Initially, 6.00 mol of hydrogen sulfite is present in a 15.0 L container, with no sulfur dioxide or water vapor present. If $K_C$ at the temperature is $4.60 \times 10^{-6}$ determine the equilibrium concentrations of all species.

$$H_2SO_3(g) \rightleftharpoons SO_2(g) + H_2O(g)$$

2. At 500 K, an equilibrium mixture for the reaction below is found to contain: $P_{NO}= 1.50$ atm, $P_{O2}= 2.50$ atm, and $P_{N2} = 4.00$ atm. The equilibrium is disturbed by quickly injecting enough $O_2$ gas to increase the $O_2$ pressure by an additional 1.50 atm. What will be the new partial pressures once equilibrium is reestablished?

$$2 \text{ NO(g)} \rightleftharpoons \text{ N}_2(g) + \text{ O}_2(g)$$
3. Consider the reaction below. If the initial \( P_{N_2} = 4.0 \, \text{atm} \) and the initial \( P_{O_2} = 5.5 \, \text{atm} \) with no product present and the final \( P_{\text{total}} = 7.0 \, \text{atm} \), calculate \( K_p \).

\[
2 \, N_2(g) + 5 \, O_2(g) \rightleftharpoons 2 \, N_2O_5(g)
\]

4. At 1000 K, the equilibrium constant for the reaction below is \( K_c = 2.8 \times 10^4 \). The initial concentration of each species is 3.0 M. What will be the equilibrium concentration of all species?

\[
2 \, CO_2(g) \rightleftharpoons 2 \, CO(g) + O_2(g)
\]