1. Consider the following reaction:

\[ 2A (g) + C (g) \rightleftharpoons 2D (g) \]

The reaction is started with 4 M A and 3 M C. At equilibrium the concentration of C is 2 M. Calculate K for this reaction.

2. Consider the following reaction:

\[ \text{CaC}_2 (s) + \text{N}_2 (g) \rightleftharpoons \text{CaNCN} (s) + \text{C} (s) \quad \Delta H \text{ is positive} \]

Which direction does the equilibrium position shift (right, left, or no change) after the following stresses? Also state whether K increase decrease or stays the same.

a. The volume is increased

b. CaNCN is added

c. The temperature is increased

d. Argon is added

3. Write out the \( K_p \) expression for the reaction given in problem 1.

4. Write out the K expression for the reaction given in problem 2.
5. The reaction of nitrogen monoxide gas with bromine gas gives nitrosyl bromide (NOBr) gas. At a certain temperature $K_p$ for this reaction is 109. If the equilibrium partial pressure of bromine gas is 0.0159 atm and the equilibrium partial pressure of NOBr is 0.0768 atm, calculate the partial pressure of nitrogen monoxide at equilibrium.

6. Assume that the reaction for the formation of gaseous hydrogen fluoride from hydrogen and fluorine has an equilibrium constant of $1.15 \times 10^2$ at a certain temperature. In a particular experiment the three gases were mixed each gas had a concentration of 2.00 M after some time had passed. Calculate the equilibrium concentrations of each of the gases.
7. Consider the following reaction:

\[
\begin{align*}
2 \text{H}_2 (g) + \text{O}_2 (g) & \rightarrow 2 \text{H}_2\text{O} (l) \quad \Delta H = -572 \text{ kJ}
\end{align*}
\]

a. How much heat is evolved for the production of 1.00 mol of H\(_2\)O (l)?
b. How much heat is evolved when 4.03 g of hydrogen (g) is reacted with excess oxygen (g)?
c. How much heat is evolved when 186 g of oxygen (g) is reacted with excess hydrogen (g)?
d. The total volume of hydrogen gas needed to fill the Hindenburg was \(2.0 \times 10^8\) L at 1.0 atm and 25 °C. How much heat was evolved when the Hindenburg exploded, assuming all of the hydrogen (g) reacted?