Answer the following questions about equilibrium.

1. At 740°C, \( K_{eq} = 0.0060 \) for the decomposition of calcium carbonate (CaCO\(_3\)). Find \( Q \) and predict how the reaction will proceed if \([\text{CO}_2] = 0.004\, \text{M}\).

\[
\text{CaCO}_3 (s) \rightleftharpoons \text{CaO} (s) + \text{CO}_2 (g)
\]

2. The equilibrium constant for the following reaction at 527°C is 5.10. If \( [\text{CO}] = 0.15 \, \text{M}, [\text{H}_2\text{O}] = 0.25 \, \text{M}, [\text{H}_2] = 0.42 \, \text{M}, \) and \( [\text{CO}_2] = 0.37 \, \text{M} \), calculate \( Q \) and determine how the reaction will proceed.

\[
\text{CO} (g) + \text{H}_2\text{O} (g) \rightleftharpoons \text{H}_2 (g) + \text{CO}_2 (g)
\]

3. At 340°C, \( K_{eq} = 0.064 \) for the reaction of rust with hydrogen gas. Given the \([\text{H}_2] = 0.45 \, \text{M}\) and \([\text{H}_2\text{O}] = 0.37 \, \text{M}\), find \( Q \) and predict how the reaction will proceed.

\[
\text{Fe}_2\text{O}_3 (s) + 3\text{H}_2 (g) \rightleftharpoons 2\text{Fe} (s) + 3\text{H}_2\text{O} (g)
\]

4. The equilibrium constant for the following reaction at 2130°C is 0.0025. If \([\text{N}_2] = 0.81 \, \text{M}, [\text{O}_2] = 0.75 \, \text{M}, \) and \([\text{NO}] = 0.030 \, \text{M}\), find \( Q \) and determine the direction in which the reaction will proceed.

\[
\text{N}_2 (g) + \text{O}_2 (g) \rightleftharpoons 2\text{NO} (g)
\]

5. At 500°C, the equilibrium constant for the following reaction is 0.080. Given that \([\text{NH}_3] = 0.0596 \, \text{M}, [\text{N}_2] = 0.600 \, \text{M}, \) and \([\text{H}_2] = 0.420 \, \text{M}\), find \( Q \) and predict how the reaction will proceed.

\[
\text{N}_2 (g) + 3\text{H}_2 (g) \rightleftharpoons 2\text{NH}_3 (g)
\]

6. For the decomposition of antimony pentachloride (SbCl\(_5\)) \( K_{eq} = 0.0251 \). What is the value of \( Q \) if \([\text{SbCl}_3] = 0.095 \, \text{M}, [\text{SbCl}_5] = 0.020 \, \text{M}, \) and \([\text{Cl}_2] = 0.050 \, \text{M}\)? How will this reaction proceed?

\[
\text{SbCl}_5 (g) \rightleftharpoons \text{SbCl}_3 (g) + \text{Cl}_2 (g)
\]

7. At 1000°C, \( K_{eq} = 1.0 \times 10^{-13} \) for the following reaction. If \([\text{HF}] = 23.0 \, \text{M}, [\text{H}_2] = 0.540 \, \text{M}, \) and \([\text{F}_2] = 0.38 \, \text{M}\), determine the value of \( Q \) and predict how the reaction will proceed.

\[
2\text{HF} (g) \rightleftharpoons \text{H}_2 (g) + \text{F}_2 (g)
\]

8. At 1227 °C, \( K_{eq} \) for the following reaction is 0.15. If \([\text{SO}_2] = 0.344 \, \text{M}, [\text{O}_2] = 0.172 \, \text{M}, \) and \([\text{SO}_3] = 0.056 \, \text{M}\), find \( Q \) and determine how the reaction will proceed.

\[
2\text{SO}_2 (g) + \text{O}_2 (g) \rightleftharpoons 2\text{SO}_3 (g)
\]