Le Châtelier’s Principle Pre-Lab

1. Explain what happens in a system at equilibrium and how Le Châtelier’s principle allows predictions about the equilibrium when stresses are applied.

2. Predict the equilibrium shift, left or right when the following stresses are applied to the system:

   - Ag⁺ is added to \( \text{AgCl (s)} \rightleftharpoons \text{Ag}^+ (aq) + \text{Cl}^- (aq) \)
   - NH₃ is added to \( \text{AgCl (s)} \rightleftharpoons \text{Ag}^+ (aq) + \text{Cl}^- (aq) \)
   - HNO₃ is added to \( \text{Ag}_2\text{CO}_3 (s) \rightleftharpoons \text{Ag}^+ (aq) + \text{CO}_3^{2-} (aq) \)
   - H₂O is added to \( 4 \text{Cl}^- (aq) + \text{Co(H}_2\text{O})_{6}^{2+} (aq) \rightleftharpoons \text{CoCl}^{2-} + 6 \text{H}_2\text{O (l)} \)

Consider the following equilibrium:
\[
\text{CaCO}_3 (s) + \text{CO}_2 (aq) + \text{H}_2\text{O (l)} \text{ heat} \rightleftharpoons \text{Ca}^{2+} (aq) + 2 \text{HCO}_3^-
\]

Indicate the shift direction and change in species concentration for the following:

- Add CO₂ (aq) \( \text{CaCO}_3 (s) + \text{CO}_2 (aq) + \text{H}_2\text{O (l)} + \text{heat} \rightleftharpoons \text{Ca}^{2+} (aq) + 2 \text{HCO}_3^- \)
- Remove Ca²⁺ (aq) \( \text{CaCO}_3 (s) + \text{CO}_2 (aq) + \text{H}_2\text{O (l)} + \text{heat} \rightleftharpoons \text{Ca}^{2+} (aq) + 2 \text{HCO}_3^- \)
- Add heat \( \text{CaCO}_3 (s) + \text{CO}_2 (aq) + \text{H}_2\text{O (l)} + \text{heat} \rightleftharpoons \text{Ca}^{2+} (aq) + 2 \text{HCO}_3^- \)
- Remove HCO₃⁻ (aq) \( \text{CaCO}_3 (s) + \text{CO}_2 (aq) + \text{H}_2\text{O (l)} + \text{heat} \rightleftharpoons \text{Ca}^{2+} (aq) + 2 \text{HCO}_3^- \)