Le Chatelier’s Principle

Consider the following reaction at equilibrium:

$$40.5 \text{ kJ} + \text{N}_2\text{O}_3(g) \rightleftharpoons \text{NO}(g) + \text{NO}_2(g)$$

1. If the reaction shifts to the right, will the concentration of \(\text{N}_2\text{O}_3\) increase or decrease?

2. Predict which way the equilibrium will shift (to the left or to the right) when the following changes are made and explain why the equilibrium will shift in that direction:
   a. Adding more \(\text{N}_2\text{O}_3\)
   b. Adding more \(\text{NO}_2\)
   c. Increasing the pressure of the reaction flask by decreasing its volume without adding more reactant or product
   d. Decreasing the temperature

3. If the concentration of \(\text{NO}_2\) is increased, what will be the effect on the concentration of \(\text{NO}\)?

4. What effect will adding \(\text{N}_2\text{O}_3\) have on the reaction rate of the forward reaction?

5. What effect will adding \(\text{N}_2\text{O}_3\) have on the reaction rate of the reverse reaction?

For the following reaction, \(\Delta H = -230 \text{ kJ}\).

$$\text{CS}_2(g) + 3\text{Cl}_2(g) \rightleftharpoons \text{S}_2\text{Cl}_2(g) + \text{CCl}_4(g)$$

6. If the reaction shifts to the right, will the concentration of \(\text{CCl}_4\) increase or decrease?

7. Predict which way the equilibrium will shift when the following changes are made and explain why the equilibrium will shift in that direction:
   a. Adding more \(\text{CCl}_4\)
   b. Adding more \(\text{Cl}_2\)
   c. Increasing the volume of the reaction flask without adding more reactant or product
   d. Decreasing the temperature

8. If the concentration of \(\text{S}_2\text{Cl}_2\) is increased, what will be the effect on the concentration of \(\text{CCl}_4\)?

9. What effect will adding \(\text{Cl}_2\) have on the reaction rate of the forward reaction?

10. What effect will adding \(\text{Cl}_2\) have on the reaction rate of the reverse reaction?