

Using Ammonium Thiocyanate and Iron(III) Chloride to Demonstrate Le Chatelier's Principle

You can use the reaction between ammonium thiocyanate (NH_4SCN) and iron(III) chloride (FeCl_3) to demonstrate Le Chatelier's Principle through the formation of the iron(III) thiocyanate complex.

Reaction Involved



- Iron(III) ions (Fe^{3+}) are pale yellow in solution.
- Thiocyanate ions (SCN^{-}) are colorless in solution.
- When they react, they form iron(III) thiocyanate complex ($[\text{Fe}(\text{SCN})]^{2+}$), which is deep red.

Demonstrating Le Chatelier's Principle

Le Chatelier's Principle states that if a system at equilibrium is disturbed, it will shift to counteract the disturbance.

1. Adding More Fe^{3+} (Iron(III) Chloride)

- Effect: The system has an increase in Fe^{3+} , so the equilibrium will shift right to consume the excess ions.
- Observation: The solution becomes darker red because more $[\text{Fe}(\text{SCN})]^{2+}$ is formed.

2. Adding More SCN^{-} (Ammonium Thiocyanate)

- Effect: The system has an increase in SCN^{-} , so the equilibrium will shift right to use up the extra thiocyanate ions.
- Observation: The solution becomes darker red due to more complex formation.

3. Adding More Water (Dilution)

- Effect: Diluting the solution decreases ion concentration, causing the equilibrium to shift left to counteract the dilution.
- Observation: The solution becomes paler, indicating that the complex is breaking apart into Fe^{3+} and SCN^{-} .

4. Adding a Source of Fe^{3+} Precipitation (e.g., Sodium Hydroxide NaOH)

- Effect: Hydroxide ions (OH^{-}) react with Fe^{3+} to form $\text{Fe}(\text{OH})_3$ precipitate, removing Fe^{3+} from the solution.
- Observation: The equilibrium shifts left, and the red color fades as Fe^{3+} is depleted.

5. Adding Heat

- If the reaction is exothermic, adding heat shifts the equilibrium left (favoring reactants), making the solution paler.
- If the reaction is endothermic, adding heat shifts the equilibrium right, making the solution darker red.