Lecture Demonstration

EFFECTS ON EQUILIBRIUM

To demonstrate the effect of various perturbations on the equilibrium position of a chemical reaction we will use solutions of cobalt(II) chloride. CoCl₂ has different colors in absolute ethanol (EtOH) and in the presence of water, due to different species bonded to the Co(II) ion (shown within the brackets).

\[
[\text{CoCl}_2(\text{EtOH})] + \text{H}_2\text{O(ethanol)} \rightleftharpoons [\text{Co(H}_2\text{O)}_6]^{3+} (\text{EtOH}) + 2 \text{Cl}^- (\text{EtOH})
\]

A purple color results from a mixture of the two species.

Effect of Concentration Changes

Observation when [H₂O] is increased

Observation when [Cl⁻] is increased (by adding 12 M HCl)

What is the equilibrium expression for this mixture? Does it reflect Le Chatelier's Principle with respect to the concentrations of species in the solution?

Effect of Temperature

Observation when temperature is increased

Observation when temperature is decreased

Is the reaction as written above endothermic or exothermic? Explain