

experiment date:

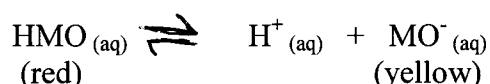
Experiment 20 - LeChatelier's Principle

Goal: To test LeChatelier's Principle through performance of a series of experiments.

LeChatelier's Principle - When stress is put on a system at equilibrium, the system responds to relieve the stress.

A. Use of Acid-Base Indicators

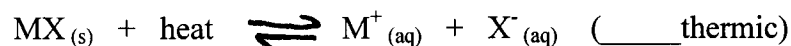
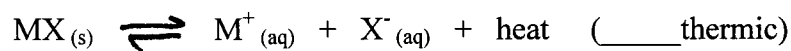
For example, we have an indicator dye called methyl orange (HMO). When dissolved in water, its color is yellow:



What happens to the color when H^+ is added?

What happens to the color when OH^- is then added?

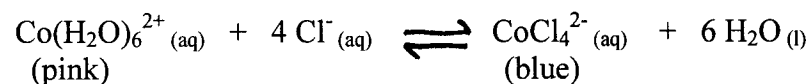
B. Effect of Temperature on Solubility of a Solid



What happens when heat is added to the exothermic process?

What happens when heat is added to the endothermic process?

C. Complex Ion Equilibria

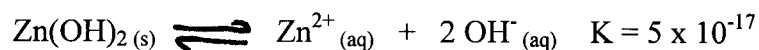


To initially set up the equilibrium we add concentrated HCl to a solid sample of $\text{Co}(\text{NO}_3)_2$. What color do you expect to see?

Next, excess H_2O is added to the mixture. What color do you expect to see?

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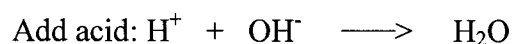
D. Simultaneous Equilibria



The K value tells us the reaction strongly favors the reactants, and that Zn(OH)_2 is essentially insoluble.

There are two possible ways to dissolve this solid (shift the equilibrium to the right), using LeChatelier's Principle: decrease the $[\text{Zn}^{2+}]$ or decrease the $[\text{OH}^-]$,

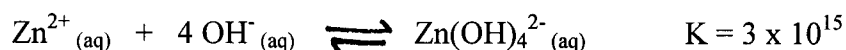
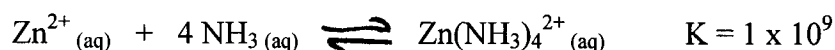
(1) How could we decrease the $[\text{OH}^-]$?



The effect on original equilibrium reaction is to decrease $[\text{OH}^-]$, rxn shifts right to make more OH^- , solid Zn(OH)_2 dissolves.

(2) How to decrease $[\text{Zn}^{2+}]$:

Add ligand(s) that will form complex ions with Zn^{2+}



Both of the above reactions (based on value of K), favor the products. The effect on the original equilibrium is to decrease $[\text{Zn}^{2+}]$, rxn shifts right to make more Zn^{2+} , solid Zn(OH)_2 dissolves.

ASA: all of it

Procedure: all of it

Waste Disposal: Pour all liquids and rinse all solids into the HEAVY METAL INORGANIC waste container.