Lower Merion High School Chemistry

Le Chatêlier's Principle

Lab #29

Reactions that reach equilibrium can be manipulated to shift the equilibrium either toward the reactants or products. The addition of a stress to the reaction will cause this shift to occur. The equilibrium reaction will shift in order to compensate for the added stress. This is the basis for Le Chatelier's Principle. In this lab, we will study several reactions and add stresses to them in order to examine the equilibrium shift.

Materials:

5 Test Tubes	Test Tube Rack	0.1 M HCl	0.1 M NaOH
2 – 250 mL Erlenmeyer Flasks	2 – 100 mL Beakers	0.2 M $FeCl_3$	0.2 M KSCN
1 – 250 mL Beaker	Beaker Tongs	0.2 M KCl	6.0 M NaOH
Ring Stand and Ring	Bunsen Burner	0.2 M $Fe(NO_3)_3$	Cobalt (II) Chloride
Goggles	Graduated Cylinder	6.0 M HCl	Universal Indicator
Wire Gauze		De-ionized Water	

Procedure:

PartA:

Reaction: Universal Indicator (In) + H^+ ⇄ Universal Indicator (Hin^{+1})

Obtain two 250 mL Erlenmeyer flasks and clean them. You must rinse them with de-ionized water before performing this part of the lab. Place approximately 100 mL of de-ionized water into each of the flasks. Add 20 drops of universal indicator to each of the flasks. Record the color of the solutions. If the color of both of the solutions is not the same, pour out the solutions, rinse the flasks again with de-ionized water and start again.

To one of the flasks, add one (and only one) drop of 0.1 M HCl, swirl the solution and record your results. Now add one drop of 0.1 M NaOH, swirl the solution and record your results. Add one more drop of 0.1 M NaOH, swirl the solution and record your observations. The solutions may be poured down the sink. Clean up.

Part B:

Reaction: $Fe^{+3}_{(aq)} + SCN^-_{(aq)} \rightleftarrows FeSCN^{+2}_{(aq)}$

Place 20 drops of 0.2 M $FeCl_3$ solution into a 250 mL beaker. Add 20 drops of 0.2 M KSCN solution to this beaker. Record the color of the mixture. Add tap water to this mixture until the solution is light amber in color. Obtain five clean test tubes and place them into the test tube rack. Label the test tubes A-E. Pour approximately 5 mL of the amber solution into each of the test tubes. Test tube A will serve as the control. Add 10 drops of 0.2 M KCl to test tube B. Add 10 drops of 0.2 M $Fe(NO_3)_3$ to test tube C. Add 10 drops of 0.2 M KSCN to test tube D. Add 10 drops of 6.0 M NaOH to test tube E. Record your observations for each of these trials. All solutions may be poured down the sink. Clean up.

Part C:

Reaction: $Co(H_2O)_6^{+2}{}_{(aq)} + 2\ Cl^-_{(aq)} \rightleftarrows Co(H_2O)_4Cl_{2(aq)} + 2\ H_2O_{(l)}$

Obtain two clean 100 mL beakers. Place a pea-sized sample of cobalt (II) chloride into each of the two 100 mL beakers. To the first beaker, add 10 mL of 6.0 M HCl. To the second beaker, add 10 mL of de-ionized water. Record the colors of the solutions in both beakers. Add tap water to the first beaker until a definite color change occurs. Record your observations. Place the first beaker on the ring with a wire gauze and heat it gently until a definite color change is noted. Prepare a water bath by placing approximately 150 mL of water in a 250 mL beaker. Using the beaker tongs, remove the beaker from the ring stand and place it into the water bath. Record any changes in the color of the solution. The solutions may be poured down the sink. Clean up.

Results

Describe the stresses added to the reactions in Parts A, B, and C in this lab. In which direction did these stresses cause the equilibrium to shift? Why? If no changes were observed, why not?