Name: _____ Date: _____

Title: Disturbing Equilibrium

Introduction:

In this experiment you will determine the effect of altering various ion concentrations on the iron (III) thiocyanate equilibrium system. The system is illustrated below:

Fe^{3+} (aq)	+	SCN^- (aq)	↔	$FeSCN^{2+}$ (aq)
(pale yellow)		(colorless)		(blood red)

Your experimental observations will provide you a basis for explaining some of the concepts related to Le Châtelier's Principle. (The chemical principle that states that if a system in equilibrium is disturbed by changes in determining factors, such as temperature, pressure, and concentration of components, the system will tend to shift its equilibrium position so as to counteract the effect of the disturbance)

Materials

$FeSCN^{2+}$ equilibrium (prepared by combining 2.5 mL of 0.2 M $Fe(NO_3)_3$ (aq) and 2.5 mL of 0.2 M KSCN and then diluting with approximately 100 mL with distilled water (I will demonstrate the preparation of this in class)
5 test tubes and rack
graduated cylinder
0.2 M $Fe(NO_3)_3$ (aq) in dropper bottles
0.2 M KSCN (aq) in dropper bottles
6.0 M NaOH in dropper bottles
Crystals of Na_2HPO_4

Procedure

1. Before beginning the experiment be sure to prepare a proper data table to collect your observations. Read the procedures carefully to know how to made it.

2. Pour 5 mL of the $FeSCN^{2+}$ equilibrium solution into each of 5 test tubes.

3. Label the tubes 1, 2, 3, 4, and 5.

4. Hold the test tubes over a white background and look through them. The colors of the solutions in the test tubes should be identical.

5. Use test tube 1 as a control. It will not be changed.

6. To test tube 2, add 20 drops of 0.2 mol/L solution of $Fe(NO_3)_3$. Make a prediction (say it out loud to your lab partner(s) as to what you would expect to see).

7. To test tube 3, add 20 drops of 0.20 mol/L solution of KSCN.

8. To test tube 4, add 20 drops of 6.0 mol/L solution of NaOH.

9. To test tube 5, using a scoopula, add a few crystals of Na_2HPO_4.

10. Flick the tubes to mix the solutions. Compare the colors in test tubes 2, 3, 4, and 5 with the color of the solution in the control test tube. Record your observations. (Note: It is best to make these comparisons all at once – when you have finished adding all the reagents to each of the test tubes).

Data:

Analysis and Conclusion

1. What evidence was there that the equilibrium shifted when $Fe(NO_3)_3$ (aq) was added? In which direction did it shift?

2. Use your understanding of Le Châtelier's Principle ***and*** collision theory to explain why the equilibrium shifted.

3. What evidence was there that the equilibrium shifted when KSCN (aq) was added? In which direction did it shift?

4. Use your understanding of Le Châtelier's Principle ***and*** collision theory to explain why the equilibrium shifted.

5. What evidence was there that the equilibrium shifted when NaOH (aq) was added? In which direction did it shift?

6. Given that Fe^{3+} (aq) and OH^- (aq) combine to form an very insoluble $Fe(OH)_3$ (s) use your understanding of Le Châtelier's Principle ***and*** collision theory to explain why the equilibrium shifted.

7. What evidence was there that the equilibrium shifted when Na_2HPO_4 was added? In which direction did it shift?

8. Given that Fe^{3+} (aq) and HPO_4^{2-} (aq) combine to form a colorless $FeHPO_4^+$ (aq) complex, use your understanding of Le Châtelier's Principle ***and*** collision theory to explain why the equilibrium shifted.

Conclusion: