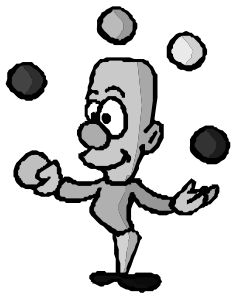
Altering an Equilibrium System: Le Chatelier's Principle

Background

1. KSCN and $Fe(NO_3)_3$ form ions in water:
   $KSCN \leftrightarrow K^+ + SCN^-$ $Fe(NO_3)_3 \leftrightarrow Fe^{3+} + 3NO_3^-$
2. Na_2HPO_4 binds strongly to Fe^{3+} ions, essentially removing them from solution.
3. KSCN is toxic in high concentrations. Avoid contact with skin.



Purpose

1. To examine the equilibrium: $Fe^{3+} + SCN^- \leftrightarrow FeSCN^{2+}$
   (colourless) (brown)
2. To use Le Chatelier's principle to explain changes in the equilibrium

Procedure:

1. Obtain 4 clean test tubes, a clean 50 mL beaker, and a glass stirring rod.
2. Into the beaker place approximately 40 mL of 0.001 M KSCN.
3. Add four drops of $Fe(NO_3)_3$ solution to the beaker containing the KSCN. Stir. Rinse off stirring rod.

   Colour of KSCN _____, Colour of $Fe(NO_3)_3$ _____,

   Colour when the two are added _____. What product/ion provides the colour? _____
4. Divide the coloured solution into the 4 tubes (the levels only need to be roughly equal).
5. The first test tube will act as a control (i.e. you will compare the colour of the other tubes to tube #1).
6. To tube #2 add some KSCN(s) (about ¼ - ½ a small spoonful). Stir. Record colour change in chart.
7. To tube #3 add three drops of $Fe(NO_3)_3$. Stir with clean glass rod. Record any colour change.
8. To tube #4 add 5-10 small crystals of Na_2HPO_4. Stir with clean glass rod. Record any colour change.
9. Using any of the chemicals in the lab, see if you can return one of the tubes to the colour of tube 1. See if you can change the colour of one of the tubes from brown to colourless and then back to brown.
10. Dump the contents of test tubes and beakers down the sink. Rinse and return all equipment.

tube	addition of	Colour change	Explanation according to Le chatelier's principle
2	KSCN		
3	$Fe(NO_3)_3$		
4	Na_2HPO_4		

11. Which of the tubes has a different Kc value than tube #1? _____

    Explain: _____

12. For each of the tubes indicate how the level of each ion was affected (use ↑ for increased, ↓ for decreased, – for no change). Also, predict which chemicals (KSCN, $Fe(NO_3)_3$, and/or Na_2HPO_4), if any, could be used to return the tubes to <u>exactly</u> their original equilibrium concentrations for <u>all three</u> ions (Fe^{3+}, SCN^- and $FeSCN^{2+}$).

tube	stress imposed on equilibrium	Change from original concentration (↑, ↓, or –)			Chemical that could <u>exactly</u> restore [ ]s
		Fe^{3+}	SCN^-	$FeSCN^{2+}$	
2	↑ SCN^-				
3					
4					