

Revised August 2012

HONORS LAB 11a: Le Chatelier's Principle

ADAPTED FROM VONDERBRINK: Lab Experiments for AP Chemistry

Aim To investigate Le Chatelier's Principle

Apparatus Test tubes, 100. mL beaker, stirring rod, test tube rack, 10.0 mL Measuring Cylinder, Funnel, Filter Paper

Chemicals 3.0 M HCl, 0.100 M HCl, solid Na₂HPO₄, 0.100 M NaOH, 0.200 M iron (III) nitrate, solid KSCN, bromothymol blue Indicator solution, 0.002 M KSCN, solid NaCl, solid NH₄Cl, phenolphthalein, 0.1 M NH₃, 1.5 M NH₃

Method

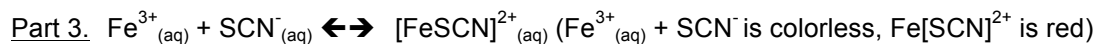


Pour solid NaCl into a test tube to a depth of about 1.00 cm and then add water until the tube is about half full. Cork and shake the tube. If all the solid dissolves add more NaCl until a solution is formed with some excess solid undissolved. Filter this saturated solution into a second tube. Add a few drop of concentrated HCl to the saturated solution. Record your observations.



Half fill a small test tube with distilled water, and add a few drops of Bromothymol Blue Indicator. Add a few drops of 0.100 M HCl and stir. Record your observations.

Now add a few drops of 0.100 M NaOH with stirring until no further color change is observable. Record your observations.



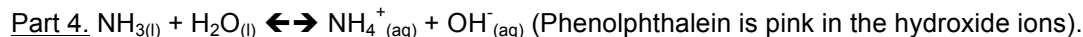
Pour about 10.0 mL of 0.002 M KSCN solution into a beaker. Add 10.0 mL of distilled water and 5 drops of 0.200 M Fe(NO₃)₃ solution. Stir the solution and record your observations.

Split the solution in the beaker equally into three separate test tubes. Carry out the following experiments, each time recording your observations.

To one test tube add 3 crystals of solid KSCN.

To another test tube add, with stirring, 6 drops of Fe(NO₃)₃ solution.

To another test tube add, with stirring, a few small crystals of Na₂HPO₄.



Take a few drops of 0.1M NH₃ solution and add two drops of phenolphthalein. Add a few crystal of solid NH₄Cl. Add a few drops of 1.5M NH₃. Add a few drops of 3.0M HCl. Record your observations after each addition.



A sealed pipet containing the purple equilibrium mixture is immersed it in hot water, then immersed in an ice bath. In each case record your observations.



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Results

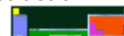
Part 1.

Result of adding conc. HCl to saturated NaCl	Explanation

Part 2.

Result of adding HCl	Explanation

Result of adding NaOH	Explanation

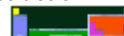


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Part 3.

Color of $\text{Fe}(\text{NO}_3)_3$	
Color of KSCN	
Color of complex ion $[\text{Fe}(\text{SCN})]^{2+}$	

Complex Solution	Observations AND Explanation
Test tube with solid KSCN added	
Test tube with $\text{Fe}(\text{NO}_3)_3$ added	
Test tube with Na_2HPO_4 added	



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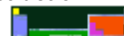
Part 4.

Result of adding Phenolphthalein	Explanation

Result of adding NH_4Cl solid	Explanation

Result of adding 1.5M NH_3	Explanation

Result of adding 3.0M HCl	Explanation

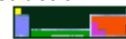


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Part 5 (DEMO).

Effect of heating the pipet	Explanation

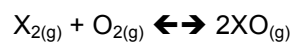
Effect of cooling the pipet	Explanation



Conclusion/Calculations

1. State Le Chatelier's Principle.

2. Consider the equilibrium below, for which the forward reaction is exothermic.



Predict and explain the effect of making the following changes on this equilibrium

(i) Adding more $X_{2(g)}$

(ii) Adding more $O_{2(g)}$

(iii) Increasing the pressure

(iv) Increasing the temperature