

4. A weak acid, "HA", is found to be 3.2 % dissociated in 10.0 mL of solution and the solution has a pH of 4.82. The 10.0-mL solution is then diluted to 100.0 mL.

A) Will the pH of the new solution be higher or lower?

B) Will the acid have a higher percent dissociation or a lower percent dissociation. Explain your reasoning in terms of LeChatlier's Principle.

5. Consider the complex ion formation: $\text{Ni}^{2+}_{(\text{aq})} + 6 \text{NH}_{3(\text{aq})} \rightleftharpoons \text{Ni}(\text{NH}_3)_6^{2+}_{(\text{aq})}$ $K = 1 \times 10^4$

Nickel (II) and ammonia are colorless, but the complex is a deep green color. A mixture of 0.05 M nickel (II) and 0.05M ammonia is prepared and is found to be a moderate green color, still transparent. Heating the solution causes it to become a pale green color.

A) Is the reaction endothermic or exothermic? Explain.

B) Does K increase, decrease or stay the same?

Nickel (II) ions react with carbonate: $\text{Ni}^{2+}_{(\text{aq})} + \text{CO}_3^{2-}_{(\text{aq})} \rightarrow \text{NiCO}_{3(\text{s})}$ $K = 1 \times 10^{12}$

C) If carbonate ion is added to the solution containing the complex ion, what would you expect to be the effect on the solution? Explain.

6. The dimerization of cyclohexadiene, C_6H_8 , is believed to be a concerted (one-elementary step) reaction:



- A) With the data given below, determine the order of the reaction. Provide graphical support.

Time (s)	$[C_6H_8]$ in M		
0	0.1000		
120	0.0739		
240	0.0586		
360	0.0486		
480	0.0415		
600	0.0362		
720	0.0321		
840	0.0288		
960	0.0262		
1080	0.0240		

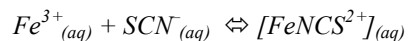
(Graph paper provided.)

- B) The order of the reaction is:

- C) What is k for the reaction?

- D) Does the experimental order determination support the idea of a one-step mechanism written above?
Explain briefly.

7. (20 points) *The reaction of iron (III) and thiocyanate follows the equation below.*



The data to the right is gathered for the $[\text{FeNCS}^{2+}]$ vs. Absorbance.

Absorbance	$[\text{FeNCS}^{2+}]$ in mol/L
0	0
0.115	2.5×10^{-4}
0.232	5.0×10^{-4}
0.340	7.5×10^{-4}
0.462	1.0×10^{-3}

- A) Make a Beer's law plot of the data (follow the rules of good graphing):

(Graph paper provided.)

A solution is then prepared by mixing 5.00 mL of a 0.0030 M Fe^{3+} solution with 3.00 mL of a 0.0030 M SCN^{-} solution and 2.00 mL of DI water. The absorbance of the solution is measured to be 0.311 (at the same wavelength as the data above).

- B) Determine the equilibrium $[\text{FeNCS}^{2+}]$ from the graph.

- C) Calculate K_c for this trial.