Lesson 23: Titration curves

text: 351-364

what to know:
- acid-base titrations, related terms and diagrams, §8-6
- equilibrium (qualitative only) of polyprotic acids, §8-7
- concept of Lewis acid and bases, §8-8

questions:
1. Which would neutralize the most 0.100 M NaOH solution, 25.00 mL of 0.200 M HCl or 25.00 mL of 0.200 M H$_3$C$_2$H$_4$O$_2$?

2. Indicate whether the following aqueous solutions would have pHs < 7, 7 or > 7.

   a. 0.50 M NH$_4$NO$_3$  
   b. 0.50 M KCN  
   c. 0.50 M (NH$_4$)$_2$S  
   d. 0.50 M Al(NO$_3$)$_3$  
   e. mixture of 25 mL of 0.10 M Ba(OH)$_2$ and 25 mL of 0.05 M H$_2$SO$_4$  
   f. mixture of 25 mL of 0.10 M Ba(OH)$_2$ and 25 mL of 0.10 M H$_2$SO$_4$  
   g. mixture of 25 mL of 0.050 M Ba(OH)$_2$ and 25 mL of 0.10 M H$_2$SO$_4$  
   h. mixture of 25 mL of 0.10 M NaOH and 25 mL of 0.10 M H$_2$SO$_4$  
   i. mixture of 25 mL of 0.30 M formic acid (HFO) and 25 mL of 0.10 M NaOH  
   j. mixture of 25 mL of 0.30 M formic acid (HFO) and 25 mL of 0.30 M NaOH  
   k. mixture of 25 mL of 0.30 M formic acid (HFO) and 25 mL of 0.50 M NaOH  
   l. mixture of 25 mL of 0.30 M formic acid (HFO) and 25 mL of 0.50 M NaF  
   m. mixture of 25 mL of 0.30 M HCl and 25 mL of 0.50 M NaF  
   n. mixture of 25 mL of 0.50 M HCl and 25 mL of 0.50 M NaF  
   o. 0.50 M NaF  

3. Which of the solutions in 2 above are buffers?

4. Which species which are present in 2.j above.  HFO  FO$^-$  H$^+$  OH$^-$  H$_2$O

5. Given an indicator with a $K_a$ of 1.0 x 10$^{-5}$, where the HIn species is red and the In$^-$ species is yellow.
   a. What color is the indicator in a pH 5.0 solution?  red  orange  yellow
   b. What color is the indicator in a pH 10 solution?  red  orange  yellow
   c. At what minimum pH will the indicator be about as yellow as it can be?  pH 4  pH 5  pH 6
   d. Would this indicator be appropriate for a HCl-NaOH titration?  yes  no

6. If phosphoric acid, H$_3$PO$_4$, has $pK_a$ values of about 2, 7 and 12, what species would be present in the highest concentration in human blood at a pH of 7.4?