PRACTICE PROBLEMS FOR HE1 SUMMER 2006

1. Calculate the pH in each of the following solutions:
(a)   1.86 x 10-3 M HBr   (2.73)
(b)   1.86 x 10-3 M Ca(OH)2   ((11.57)
(c) 1.86 x 10-3 M acetic acid (look up Ka)   (3.75; you need the quadratic here!)

2. A new weak acid has been isolated with a molar mass of 268 g/mol; it is monoprotic. When 3.50 g of it was dissolved in 100.0 mL of water and 25.0 mL of 0.100 NaOH solution was added to it the resulting solution had a pH of 4.88. Calculate the pKa of the acid (5.51).

3. What are the conjugate bases of the following B-L acids: HCN; HCl; CH3NH3+; methane. List them in order of INCREASING base strength (you´ll need data from your text to answer this.)

4. Explain what is meant by a conjugate acid-base pair, and illustrate by giving an example.

5. What do buffer solutions do? Which of the following are buffer solutions (circle all that are):

i) H2O   ii) HCl(aq) + NaCl(aq)   iii) NaH2PO4(aq) + Na2HPO4(aq)

CH3NH2(aq) + CH3NH3Cl(aq)

6. Consider a 0.50 M solution of HNO2, a weak acid with Ka = 4.5 (10-4. Which statement is true?
a. [H3O+] > 0.50 M.
b. The acid is mostly ionized.
c. pH = 3.35.
d. pH = 0.32.
e. pH > 0.32.

ANSWER: e

7. A buffer solution may result if K3PO4 is mixed with
        a. HCl.
        b. K2HPO4.
        c. NaOH.
        d. either HCl or K2HPO4.
        e. either K2HPO4 or NaOH.

        ANSWER: d

8. Which acid, in combination with its conjugate base, would be the best choice to make a buffer of pH = 4.20?
a. acetic acid (Ka = 1.8 (10-5)
b. benzoic acid (Ka = 6.3 x 10-5)
c. formic acid (Ka = 1.8 (10-4)
d. hydrofluoric (Ka = 7.2 (10-4)
e. nitrous acid (Ka = 4.5 (10-4)

ANSWER: b

9. Which of the following indicator(s) would be most suitable for the titration of acetic acid
   (pKa = 4.74) with NaOH?
   a. bromothymol blue (transition range pH 6 to 8)
   b. methyl red (transition range pH 4 to 6.3)
   c. phenolphthalein (transition range pH 8.3 to 11)
   d. all of the above
   e. none of the above

   ANSWER: c

10. A 50.00 mL sample of 0.0950 M acetic acid (Ka = 1.8 (10-5) is being titrated with
0.0848 M NaOH. What is the pH after 28.00 mL of NaOH has been added?
a. 5.04
b. 4.74
c. 4.44
d. 3.18
e. 3.06

ANSWER: b