Chem 1515.001 - 006
Problem Set #14
Fall 2001

Name_____

TA's Name _____

Sec _____

ALL work must be shown in all problems for full credit. **Due at the beginning of class on Wednesday, December 5, 2001.**

PS14.1. Phosphate buffers are commonly used in soft drinks to help control the pH. What is the pH of a soft drink in which the major buffer components are 8.50 g of NaH_2PO_4 and 9.23 g of Na_2HPO_4 per 355 mLs of solution?

PS14.2. Specify the reagents (an acid and its conjugate base or a base and its conjugate acid) and the concentration of each reagent needed to prepare buffer solutions having the listed pH values.

NOTE: The optimum buffer solution is one with equal concentrations of the weak acid (weak base) and its conjugate base (conjugate acid). Under these conditions, the pH of the solution is equal to the pK_a (pK_b). So the best reagent for each of the solutions below is one whose pK is equal to the pH. Since the tables in the appendix list K values, each of the pH's must be converted to their corresponding $[H^+]$ and compared to an equilibrium constant in Appendix D.

a) 4.74

b) 9.81

c) 2.92

PS14.3. Write the reaction that occurs when a strong acid is added to each of the buffer solutions below.

a) $HC_2H_3O_2/NaC_2H_3O_2$

b) $C_2H_5NH_3/ C_2H_5NH_3Cl$

c) HCN/KCN

PS14.4. Write the reaction that occurs when a strong base is added to each of the buffer solutions below.

a) $HC_2H_3O_2/NaC_2H_3O_2$

b) $C_2H_5NH_3/ C_2H_5NH_3Cl$

c) HCN/KCN

PS14.5. Determine the pH of a buffer prepared by mixing 0.675 moles of $HC_2H_3O_2$ and 0.575 moles of $NaC_2H_3O_2$ in enough water to give 1.00 liter of solution.

Calculate the pH when

a) 0.0500 mol of HCl is added

b) 0.0500 mol of NaOH is added

PS14.5. (CONTINUED)

c) 1 liter of water is added

d) 5.00 mL of a 1.00 M HNO_3 solution is added

PS14.6. Calculate the pH **change** produced when 0.100 mol of gaseous HCl is added to each of the following buffer solutions.

a) 500 mL of 0.900 M NH_3 and 0.900 M NH_4Cl

b) 500 mL of 0.200 M NH_3 and 0.800 M NH_4Cl

c) 500 mL of 0.100 M NH_3 and 0.900 M NH_4Cl

PS14.7. Calculate the pH **change** produced when 0.100 mol of gaseous NaOH is added to each of the following buffer solutions.

a) 500 mL of 0.600 M $HC_2H_3O_2$ and 0.600 M $NaC_2H_3O_2$

b) 500 mL of 0.400 M $HC_2H_3O_2$ and 0.600 M $NaC_2H_3O_2$

c) 500 mL of 0.100 M $HC_2H_3O_2$ and 0.700 M $NaC_2H_3O_2$