Name:_____ Chem 202

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Quiz 9

11/7/2008

1) Calculate the pH of a solution of 0.3M sodium formate ($NaCO_2H$). The dissociation and K_a for formic acid is shown below:

$$HCO_2H \rightleftharpoons H^+ + CO_2H^- \qquad K_a = 1.8\times10^{-4}\,M$$

Under what conditions would the approximate answer not be accurate?(4)

2) Novocaine, used as a local anesthetic by dentists, is a weak base ($K_b = 8.91 \times 10^{-6}$). What is the ratio of the concentration of this weak base to that of its acidic form in the blood plasma (pH = 7.40) of a patient? (3)

3) When the concentration of a strong acid is not substantially higher than 1.0×10^{-7} M, the ionization of water must be taken into account in the calculation of the solution's pH. Derive a polynomial expression for the pH of a strong acid ([HA]) solution, which includes the contribution to $[H^+]$ from water by doing the following:

a.) Write down the major species (Hint: Since the strong acid (HA) dissociates completely, you need not consider it a major species.)(1)
b.) Write down the two equilibrium expressions/equations in solution and the charge balance equation. (1)
c.) Use your equations to derive the polynomial expression (set equal to zero) in terms of only $[H^+]$, $[A^-]$, and K_w. (1)

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Quiz 9

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1) You have an unknown salt NaA. You toss 0.120 mols of the salt into 500 mL of water. If you measure the pH to be 8.40, what is the Ka of HA? Perform calculations using the exact method with no approximations. Show final equation before plugging in variables. (4)

2) A. Calculate the pH of an $HC_3H_5O_2$ solution at the following concentrations. ($Ka(HC_3H_5O_2) = 1.3 \times 10^{-5}$)

i. 1.0 M (1.5)

ii. 1.0×10^{-7} M (1.5)

3) Determine the pK_a from the following information (Room temperature)(3):

a. $K_a = 5.67 \times 10^{-7}$
b. $K_b = 7.34 \times 10^{-4}$
c. $pK_b = 3.97$

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Quiz 9

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1) Determine the following (1 pt. each)
   a) pK_a if the K_a is $2x10^{-4}$
   b) K_a if the K_b is $3x10^{-2}$
   c) K_b if the pK_a is 4.6

2)) Calculate the pH of 4.0 x 10-5 M phenol (Ka = 1.6 x 10-10). You must use the "brute force" method. Be clear in your labeling of all steps. If you make assumptions after you come to your equation, please state them. (Note that this step is not necessary).(4)

3) Determine the K_a for the following: $HA + H_2O \leftrightarrows H_3O^+ + A^-$

$[HA_0]$ = .05 mM and the pH at equilibrium is 5.95. Complete the 6 steps, Show at least the final equation before plugging in known (3)