CHEM 121 – Worksheet 21 – Fall 2015

Monday Name: __________________________

Wednesday Name: _______________________

Directions: Standard directions.

1) If a solution of 0.5 M HOAc dissociates as follows: HOAc + H₂O ⇌ H₃O⁺ + OAc⁻, what is the final [H₃O⁺] in the solution? \( K_a \) for HOAc = \( 1.8 \times 10^{-5} \).

2) What is the pH of the above solution?

3) What is the \( K_b \) for HOAc?

4) If a solution of 0.25 M HA dissociates as follows: HA + H₂O ⇌ H₃O⁺ + A⁻, what is the final [H₃O⁺] in the solution? \( K_a \) for HA = \( 5.4 \times 10^{-7} \).
5) What is the pH for the above solution?

6) What is the $K_b$ for HA?

7) If a solution of 1.3 M $H_2M$ dissociates as follows: $H_2M + 2H_2O \rightleftharpoons 2H_3O^+ + M^{2-}$, what is the $[H_3O^+]$ of the solution? $K_a$ for $H_2M = 2 \times 10^{-8}$.

8) What is the pH of the above solution?

9) What is the $K_b$ for $H_2M$?
10) Prove that $K_a K_b = K_w$.

11) Mark the pH with "A" for Acidic, "B" for Neutral or "C" for Alkaline or Basic:

A) 2.5    B) 6.8    C) 10    D) 12    E) 7.0    F) 9.4

G) 6    H) 14    I) 3.5    J) 4    K) 1.5    L) 13.6

12) Calculate the $[H_3O^+]$ for all of the above pH's in #11.
13) Determine the equivalent weight for the following compounds; name the compounds:

A) HCl  
B) Ba(OH)₂  
C) MgSO₄  
D) AlF₃  
E) SrCl₂  
F) LiOAc  
G) H₂SO₄  
H) H₃PO₄

14) 20 g NaOH are dissolved in 1 L H₂O. What is the N of the NaOH solution?

15) 25 g HCl are dissolved in 500 mL of water. What is the N of the HCl solution?
16) 30 g Sr(OH)$_2$ are dissolved in 750 mL water. What is the N of the Sr(OH)$_2$ solution?

17) 150 g H$_2$SO$_4$ are dissolved in 750 mL water. What is the N of the H$_2$SO$_4$ solution?

18) 75 g BaSO$_4$ are dissolved in 3 L H$_2$O. What is the N of the BaSO$_4$ solution?

19) A solution of HA and A$^-$ is at a pH of 6.4. If the [HA] = 0.4 M and the [A$^-$] = 0.25 M, what is the pK$_a$ for HA?

20) A solution of HB and B$^-$ is at a pH of 8.5. If the [HB] = 0.05 M and the [B$^-$] = 0.15 M, what is the pK$_a$ for HB?
21) A solution of HC and C\textsuperscript{-} is at a pH of 7. If the [HC] = 0.5 M and the [C\textsuperscript{-}] = 0.5 M, what is the pK\textsubscript{a} for HC?

22) A solution of HA and A\textsuperscript{-} is at a pH of 12. If the [HA] = 0.01 M and the [A\textsuperscript{-}] = 0.75 M, what is the pK\textsubscript{a} for HA?

23) A solution of HA and A\textsuperscript{-} is at an unknown pH. The K\textsubscript{a} for HA is 7.2·10^{-8}. If [HA] = 0.5 M and [A\textsuperscript{-}] = 0.125 M, what is the pH of the solution?

24) Define Arrhenius acids and bases.

26) Define Lewis acids and bases.

27) Describe the 5 forms of hydrates and give examples where possible.

28) Identify from which acids the following salts were obtained; name the salt:

A) K₂SO₄
B) LiCl

C) AlPO₄
D) MgSO₄

E) Al₂(SO₄)₃
F) BPO₄
29) Define buffers and what the effective range of a buffer is.

30) What is the effective indicator range of an acid-base indicator?

31) Draw and label a titration curve for a monoprotic acid.
32) Draw and label a titration curve for a diprotic acid.

33) Draw and label a titration curve for a tri-protic acid.
34) Draw, label and illustrate how you’d use the first derivative to determine the 3 pK values for a triprotic acid. You may need colored pencils to make this legible.

35. Using the following titration curve of a triprotic acid:
Determine the following:

A) How many endpoints are there in this titration?

B) At approximately what volume is each endpoint?

C) What is the approximate value for $pK_1$?

D) What is the approximate value for $pK_2$?

E) What is the approximate value for $pK_3$?