**CH40S** **Acid-Base Equilibria Review**

1. Given 1.0M solutions of the following three acids:
   HX ($Ka=1.0x10^{-10}$) HY ($Ka= 1.0x10^{-8}$) HZ ($Ka=1.0x10^{-6}$)
   Which would have the greatest $[H_3O^+]$?

2. What is the difference between the terms:
   a. Strong and weak
   b. Concentrated and dilute

3. Can you have a concentrated solution of a weak acid? Explain.

4. Use the Bronsted-Lowry definition to define the following as strong or weak acids or bases:
   ***HBr*** ***$O^{2-}$*** ***$ClO_4^-$*** ***$H_2O_2$*** ***$SO_4^{2-}$*** ***OH***

5. Sodium bicarbonate ($NaHCO_3$) is sometimes taken in an attempt to neutralize excess stomach acid (HCl). Write the balanced reaction between these two compounds, and determine which side of the reaction is favoured.

6. Complete the following reaction
   ***$H_2S + NH_3 \rightarrow$ _____ + _____***
   a. Which is the stronger acid in equilibrium?
   b. Are reactants or products favoured at equilibrium?

7. Describe the process of titration as completely as possible.

8. When bromothymol blue indicator (HBb) is added to water, the following equilibrium exists:
   ***$H_2O + HBb \leftrightarrow H_3O^+ + Bb^-$***
   Explain what happens to the equilibrium when:
   a. NaOH is added.
   b. HCl is added

9. Calculate the concentration of all species, pH and %dissociation in a 0.50mol/L solution of $H_2S$.

10. A 0.75mol/L solution of the weak acid HX has a pH of 3.50. Determine the Ka.

11. Calculate the concentration of all species and pH of a $4.0x10^{-3}$mol/L solution of $HClO_4$.

12. The pH of a solution of a weak base BOH is 8.6. If the base is 0.948% dissociated in solution, calculate the original concentration of the base BOH.

13. What volume of 0.00250mol/L $H_3PO_4$ is needed to neutralize 20.0mL of 0.0050mol/L $Ca(OH)_2$?

14. Calculate the volume of 2.5mol/L $H_2SO_4$ acid required to neutralize a solution made with 2.5g NaOH.

15. The neutralization of 0.900g of an unknown monoprotic acid required 30mL of 0.150mol/L NaOH. Find the molar mass of the acid.

16. Find the hydronium and hydroxide ion concentration if the pH of a solution is 4.6

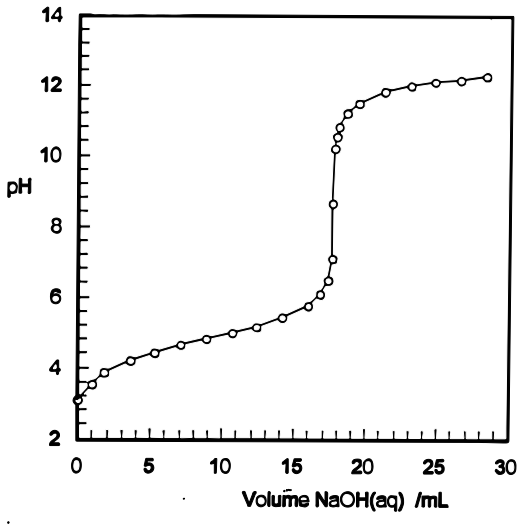
17. The Ka of an acidic solution is $3.4 \times 10^{-6}$. If 0.15mol/L is initially used, and only 0.06% dissociated, find the $[H_3O^+]$, and the pH

18. The initial concentration of an acid HA is equal to 2.0mol/L. If the equilibrium concentration of $H^+$ ions is $6.5 \times 10^{-4}$mol/L, what is the percent dissociation?

19. If 0.44mol/L of an acid HA is initially used, and the $[H_3O^+]$ is $2.0 \times 10^{-5}$mol/L, what is the Ka of the acid?

20. A 0.25mol/L HA solution has a Ka of $3.0 \times 10^{-8}$. What is the $[H^+]$ concentration, the pH and the pOH?

21. A student massed a 0.399 g sample of an unknown monoprotic acid, added about 50 mL of water, and then titrated the resulting mixture with a standard 0.1026 mol/L solution of sodium hydroxide. The graph below shows the titration curve obtained.




Calculate the molar mass of the acid.

22. Consider the following anions reacting with each other:

$$HCO_3^- + H_2PO_4^- \leftrightarrow \_\_\_\_\_ + \_\_\_\_\_$$

a) Complete the Brönsted-Lowry acid-base equilibrium for the reaction.
b) Does the equilibrium above favour reactants or products? ***Explain.***

23. A 0.75 mol/L solution of an unknown weak acid, $H_2X$, has a pH of 3.50. Determine the $K_a$.

24. For a 0.50 mol/L $HNO_2$ solution, calculate the:
    a) $[H_3O^+]$
    b) the pH
    c) the % dissociation

25. Calculate the pOH of a 0.0025 *M* solution of $CO_3^{2-}$ ($k_b = 2.1 \times 10^{-4}$)

26. Calculate the volume of 5.2 *M* magnesium hydroxide solution needed to neutralize 655.0 mL of 0.35 *M* sulphurous acid solution.

27. Calculate the mass of NaOH needed to prepare 2.0 L of a solution with a pH of 12.00.

28. Define and give examples of a:
    a) Arrhenius acid/base
    b) Lowry Bronstead acid/base
    c) Lewis acid/base