Name: _____

ACID/BASE EQUILIBRIA

HONORS CHEMISTRY 2005.1.0
TEXTBOOK PG 573 – 641

1. The $[H^+]$ in a particular aqueous solution is 1.0×10^{-4} M. Calculate the $[OH^-]$ for this solution.

2. The $[OH^-]$ in a particular aqueous solution is 1.0×10^{-5} M. Calculate the $[H^+]$ for this solution.

3. Calculate the pH and pOH of a solution with a $[H^+] = 3.68 \times 10^{-8}$ M.

4. Identify the Bronsted-Lowry acid and Bronsted-Lowry base in each of the following equations.

   i) $HCl_{(aq)} + H_2O_{(l)} \rightarrow Cl^-_{(aq)} + H_3O^+_{(aq)}$

   ii) $NH_{3(aq)} + H_2O_{(l)} \rightarrow OH^-_{(aq)} + NH_4^+{}_{(aq)}$

5. Identify the conjugate bases for each of the following acids.
   i) NH_4^+
   ii) H_3PO_4
   iii) H_2O

6. Calculate the pH of a 0.710 M KOH solution.

7. The chemical equation which describes how HCl dissociates in aqueous solution is,

$$HCl_{(aq)} \rightarrow H^+_{(aq)} + Cl^-_{(aq)}$$

   The initial concentration of HCl is 0.100 M. In the space provided below (**ICE** Table), enter the initial concentration of HCl, H^+ and Cl^-. Based on the measured pH of this solution, calculate and enter the equilibrium concentration of H^+.

$$HCl_{(aq)} \rightarrow H^+_{(aq)} + Cl^-_{(aq)}$$

8. The chemical equation which describes how $HC_2H_3O_2$ dissociates in aqueous solution is,

$$HC_2H_3O_{2(aq)} \rightleftharpoons H^+_{(aq)} + C_2H_3O_2^-{}_{(aq)}$$

   In the demonstration performed earlier, the initial concentration of $HC_2H_3O_2$ is 0.100 M. In the space provided below (**ICE** Table), enter the initial concentration of $HC_2H_3O_2$, H^+ and $C_2H_3O_2^-$. Based on the measured pH of this solution, calculate and enter the equilibrium concentration of H^+.

$$HC_2H_3O_{2(aq)} \rightleftharpoons H^+_{(aq)} + C_2H_3O_2^-{}_{(aq)}$$

a. Calculate the change in $[H^+]$.

b. Using the balanced chemical equation and the calculated change in $[H^+]$, calculate the change in $HC_2H_3O_2$ and $C_2H_3O_2^-$.

c. Calculate the equilibrium concentration of $HC_2H_3O_2$ and $C_2H_3O_2^-$.

d. Estimate the equilibrium constant for the dissociation of $HC_2H_3O_{2(aq)}$.

9. Calculate the pH of a solution which is 0.53 M $HC_6H_4NO_2$ (nicotinic acid).
$K_a = 1.4 \times 10^{-5}$

10. Calculate the pH and pOH in each of the following aqueous solutions. In each case, indicate whether the solution is acidic or basic.

a) $[H^+] = 1.4 \times 10^{-3}$ M

b) $[OH^-] = 2.08 \times 10^{-7}$ M

c) $[H^+] = 7.11 \times 10^{-11}$ M

d) $[H^+] = 4.0$ M

11. Predict the product of the neutralization reactions,

$$HCl_{(aq)} + NaOH_{(aq)} \rightarrow$$
$$HC_2H_3O_{2(aq)} + NaOH_{(aq)} \rightarrow$$

12. Predict the products when $KCN_{(s)}$ is added to water. Will the pH of the solution formed when the salt is added to water be greater or less than 7?

13. Calculate the pH of a solution which is 0.245 M NH_3 and 0.245 M NH_4NO_3.

14. A titration is performed by adding 0.600 M KOH to 40.0 mL of 0.800 M HCl.

i)Calculate the pH before addition of any KOH.

ii)Calculate the pH after the addition of 5.0 mL of the base.

15. Determine the pH for a solution containing the following substances.

a) 0.600 M $HC_3H_5O_3$ and 0.600 M $NaC_3H_5O_3$

16. A titration is performed by adding 0.400 M KOH to 40.0 mL of 0.300 M HCl.

a. Calculate the volume of base needed to reach the equivalence point.

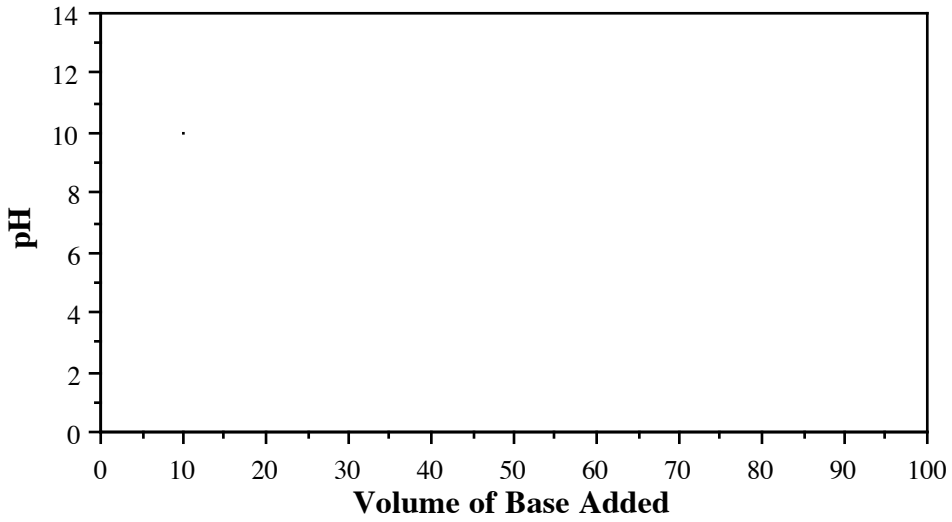
b. Calculate the pH at the equivalence point.

17. Using the designated space below sketch the titration curve for each of the following cases.

a) 50.0 mL of 0.100 M HCl and 0.100 M NaOH

b) 50.0 mL of 0.00100 M HCl and 0.00100 M NaOH

Plot both curves on the graph below.



18. a. Define the term *buffer*.

b. Describe the characteristic behavior of a buffer when a small amount of acid is added.

c. Write a chemical equation which describes the chemical reaction which occurs when a strong acid is added to a solution containing the general buffer HA/A^-.

d. Describe the characteristic behavior of a buffer when a small amount of base is added.

e. Write a chemical equation which describes the chemical reaction which occurs when a strong base is added to a solution containing the general buffer HA/A^-.

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