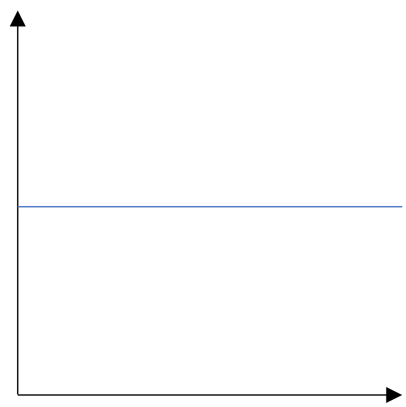
CH14

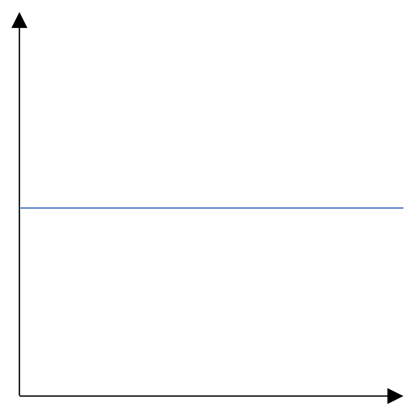
I. pH and % dissociation calculation of acid, base, and salt, buffer -- *Check out pH calculaion summary in CH13*

II. Tiration: **pH = -log([H_3O^+]); pOH = -log([OH^-]); pH = 14-pOH = 14+log([OH^-])**

	Strong acid				Strong base			
Strong acid (SA)								
Strong base (SB)								
Weak acid (WA)								
Weak base (WA)								

Titration curve





Calculation

Zone	**T/A: SB/SA**	**T/A: SA/SB**	**T/A: SB/WA**	**T/A: SA/WB**
1	[H_3O^+] = $[HA]_0$	[OH^-] = $[BOH]_0$	[H_3O^+] = $\sqrt{[HA]_0 \times K_a}$	[OH^-] = $\sqrt{[BOH]_0 \times K_b}$
2	[H_3O^+] = $\frac{(C\times V)_{HA}-(C\times V)_{BOH}}{V_{HA}+V_{BOH}}$	[OH^-] = $\frac{(C\times V)_{BOH}-(C\times V)_{HA}}{V_{HA}+V_{BOH}}$	[H_3O^+] = $K_a\frac{[HA]_{eq}}{[A^-]_{eq}}$	
3	pH = 7		[OH^-] = $\sqrt{[A^-]_0 \times K_b}$	[H_3O^+] = $\sqrt{[B^+]_0 \times K_a}$
4	[OH^-] = $\frac{(C\times V)_{BOH}-(C\times V)_{HA}}{V_{HA}+V_{BOH}}$	[H_3O^+] = $\frac{(C\times V)_{HA}-(C\times V)_{BOH}}{V_{HA}+V_{BOH}}$	[OH^-] = $\frac{(C\times V)_{BOH}-(C\times V)_{HA}}{V_{HA}+V_{BOH}}$	[H_3O^+] = $\frac{(C\times V)_{HA}-(C\times V)_{BOH}}{V_{HA}+V_{BOH}}$

III. Acid-base indicator: use pH at e.p. to choose the proper indicator or BMOMR, SBBPR, APPAY

indicator	Acid color	Base color	pH (color changing)	Good for
Methyl orange	Red	Yellow	3.2-4.4	Strong acid (titrant) + weak base (analyte)
Methyl red	Red	Yellow	4.2-6.5	
Bromthymole blue	Yellow	Blue	6.0-7.6	Strong acid + Strong base (titrant or analyte)
Phenol red	Yellow	Red	6.8-8.4	
Phenolphthalein	Colorless	Red	8.2-10.0	Strong base (titrant) + weak acid (analyte)
Alizarin Yellow	Yellow	Red	10.1-12.0	

CH14

14.I

1. Calculate the pH when 0.99 g of C_6H_5COONa (FW = 144.1 g/mol) is added to 32 mL of 0.50 *M* benzoic acid, C_6H_5COOH (FW = 122.1 g/mol). Ignore any changes in volume. The K_a value for C_6H_5COOH is 6.5 x 10^{-5}. (**3.82**)

2. A buffer consists of 0.49 *M* $KHCO_3$ and 0.42 *M* K_2CO_3. Given that the *K* values for H_2CO_3 are, K_{a1} = 4.5 x 10^{-7} and K_{a2} = 4.7 x 10^{-11}, calculate the pH for this buffer. (**10.26**)

14.II

3. Determine the volume in mL of 0.551 *M* $HBr_{(aq)}$ needed to reach the half-equivalence (stoichiometric) point in the titration of 44.37 mL of 0.703 *M* $NH_{3(aq)}$. The K_b of ammonia is 1.8 x 10^{-5}. (**28.2**)

4. Determine the pH at the equivalence (stoichiometric) point in the titration of 30.77 mL of 0.116 *M* morphine(aq) with 0.231 *M* $HCl_{(aq)}$. The K_b of morphine is 1.6 x 10^{-6}. (**4.66**)

5. A buffer that contains 0.15 *M* of an acid, HA and 0.27 *M* of its conjugate base A^-, has a pH of 4.83. What is the pH after 0.021 mol of NaOH are added to 0.79 L of the solution? (**4.94**)

6. The pH of 0.50 *M* acetic acid is 2.52. Calculate the change in pH when 1.59 g of CH_3COONa (FW = 82.03 g/mol) is added to 49.9 mL of 0.50 *M* acetic acid, CH_3COOH. Ignore any changes in volume. The K_a value for CH_3COOH is 1.8 x 10^{-5}. (**2.12**)

14.III

7. Which indicator would be the best to use for a titration between 0.30 *M* NH_4Cl with 0.30 *M* KOH? You will probably need to consult the appropriate table in the book.

A. phenol red, color change at pH 6-8

B. bromothymol blue, color change at pH 6-8

C. methyl red, color change at pH 2-4

D. alizarin yellow R, color change at pH 10-12

E. thymol blue, color change at pH 8-10