ALMUSTAQBAL UNIVERSITY

College of Health and Medical Techniques

Medical Laboratories Techniques Department

Stage : First year students

Subject : Lecture 9A

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VOLUMETRIC (Titration) CALCULATIONS

In titration (a moles of ACID ≡ b moles of BASE)

Then

$$\frac{M_a V_a}{n_a} = \frac{M_b V_b}{n_b}$$

M_a = molarity of the acid **M_b = molarity of the base**

V_a = volume of the acid **V_b = volume of the base**

n_a = No. of moles (acid) **n_b = No. of moles (base)**

Example 1:

The volume needed of a 0.1 M standard solution of HCl on titration of 100 mL of NaOH solution to the end point is 75.8 mL . Calculate the molar concentration of NaOH solution.

Solution:

$$HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$$

$n_a = 1$ $n_b = 1$ **(stiochiometric mole ratios of acid and base)**

$$\frac{M_a V_a}{n_a} = \frac{M_b V_b}{n_b}$$

$$\frac{75.8 \; x \; 0.10}{1} = \frac{M_b \; x \; 100}{1}$$

$$M_b = \frac{75.8 \; x \; 0.10}{100} = 0.0758 \text{ M}$$

Example 2:

20 mL of H_2SO_4 (98 g/mol) was neutralized with 25mL of 0.1M sodium hydroxide solution. The equation of reaction is

$$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$$

Calculate:

(i) conc. of acid in M **(ii) acid content of the solution in grams.**

Solution:

$$\frac{M_a V_a}{n_a} = \frac{M_b V_b}{n_b}$$

$$\frac{M_a x \; 20.0}{1} = \frac{0.10 \; x \; 25}{2}$$

Concentration of H_2SO_4 (M_a) = $\frac{1 \; x \; 0.10 \; x \; 25}{2 \; x \; 20} = 0.0625$ **M**

ii) mass of the acid in the solution(g)

mass (g) = Molarity(M) x Volume (L) x Molar mass (g/mol)

mass (g) = 0.0625 x ($20x10^{-3}$) L x 98 = 0.1225 g

Example 3:

50 mL portion of HCl solution required 29.71 mL of (0.019M) $Ba(OH)_2$ to reach an end point with bromocresol green indicator , Calculate the molarity of HCl .

Solution:

$$\mathbf{Ba(OH)_2 + 2HCl \rightarrow BaCl_2 + 2H_2O}$$

1mole 2 mole 1mole

$$\frac{M_a V_a}{n_a} = \frac{M_b V_b}{n_b}$$

$$\frac{M_{HCl}\, x V_{HCl}}{2} = \frac{M_{Ba(OH)2} \times V_{Ba(OH)2}}{1}$$

$$M_{HCl} = \frac{2[M_{Ba(OH)2} \times V_{Ba(OH)2}\ ]}{V_{HCl}}$$

$$M_{HCl} = \frac{2[0.019 \times 29.71]}{50} = 0.023\ M$$