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NEUTRALIZATION CURVE OF WEAK ACID VS STRONG BASE

BY, LIPSA SAMAL

ASST. PROF (PA & QA), SPLS, CUTM



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NEUTRALIZATION CURVE OF WEAK ACID VS STRONG BASE

- The neutralization of 100mL of 0.1M acetic acid (ethanoic acid) with 0.1M sodium hydroxide solution will be considered here.
- The pH of the solution at the equivalence point is given by,

$$(\text{pH} = \frac{1}{2} \text{PKw} + \frac{1}{2} \text{PKa} - \frac{1}{2} \text{pc} = 7 + 2.37 - \frac{1}{2} (1.3) = 8.72)$$

- For other concentrations, we may employ the approximate Mass Action expression: $[\text{H}^+] \times [\text{CH}_3\text{COO}^-] / [\text{CH}_3\text{COOH}] = K_a$

$$\text{or, } [\text{H}^+] = [\text{CH}_3\text{COOH}] \times K_a / [\text{CH}_3\text{COO}^-]$$

$$\text{or } \text{pH} = \log[\text{Salt}] / [\text{Acid}] + \text{pKa}$$



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- The concentration of the salt (and of the acid) at any point is calculated from the volume of alkali added, due allowance being made for the total volume of the solution.
- The initial pH of 0.1 M acetic acid is computed, the dissociation of the acid is relatively so small that it may be neglected in expressing the concentration of acetic acid.
- Hence from the above equation,

$$[\text{H}^+] \times [\text{CH}_3\text{COO}^-]/[\text{CH}_3\text{COOH}] = 1.82 \times 10^{-5}$$

$$\text{or } [\text{H}^+]^2/0.1 = 1.82 \times 10^{-5}$$

$$\text{or } [\text{H}^+] = \sqrt{1.82 \times 10^{-5}} = 1.35 \times 10^{-3}$$

$$\text{or pH} = 2.87$$



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• **When 50mL of 0.1M alkali have been added,**

$$[\text{Salt}] = 50 \times 0.1/150 = 3.33 \times 10^{-2}$$

$$\text{and } [\text{Acid}] = 50 \times 0.1/150 = 3.33 \times 10^{-2}$$

$$\text{pH} = \log(3.33 \times 10^{-2}/3.33 \times 10^{-2}) + 4.74 = 4.74$$

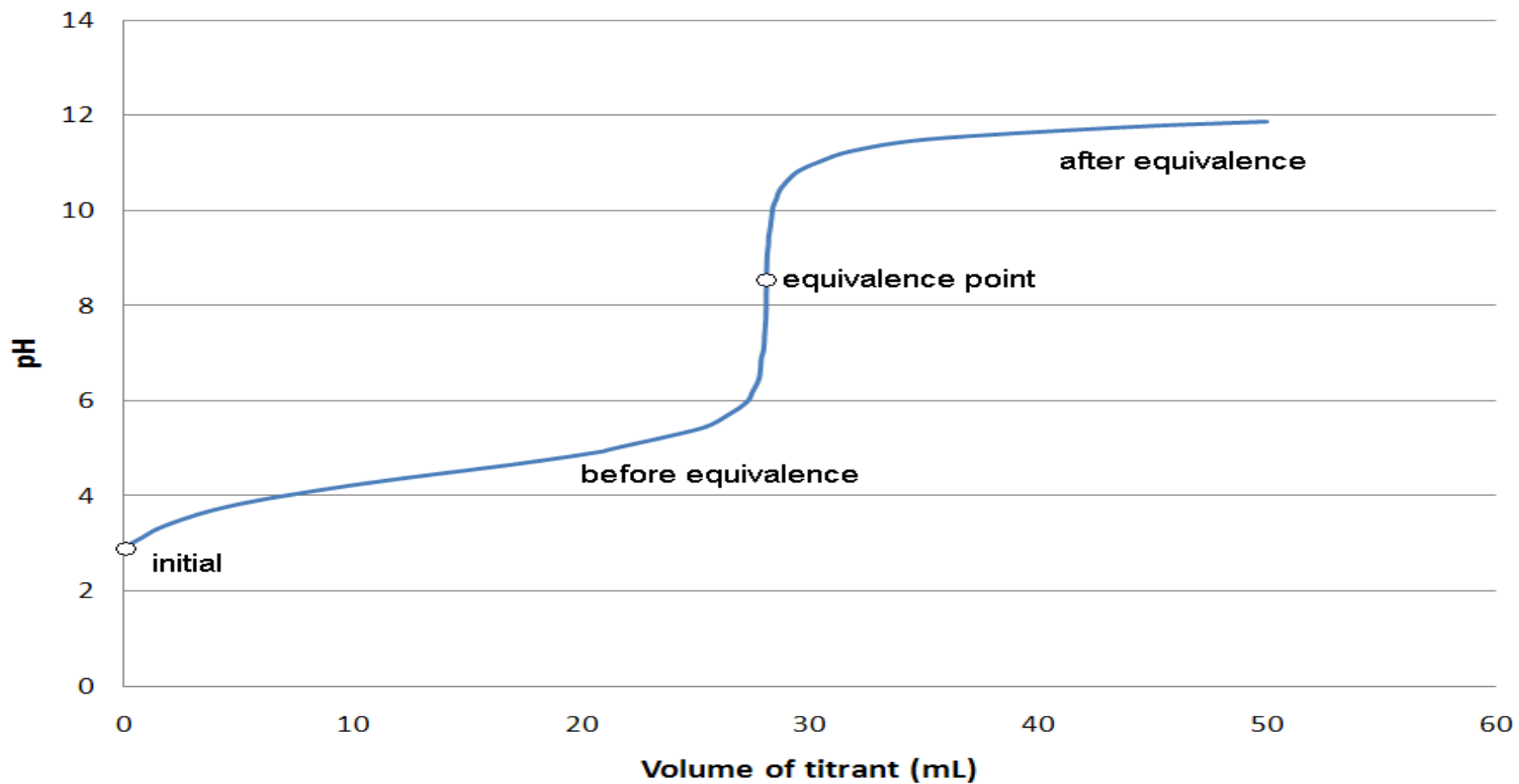
- **The pH values at other points on the titration curve are similarly calculated.**
- **After the equivalence point has been passed, the solution contains excess of OH⁻ ions which will repress the hydrolysis of the salt; the pH may be assumed, due to the excess of base present, so that in this region the titration curve will almost coincide with that for 0.1M hydrochloric acid.**



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Titration of a weak acid with a strong base





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THANK YOU