

LABORATORY 3

I. ACID-BASE NEUTRALIZATION, TITRATION

Acid-base neutralization is a process in which acid reacts with base to produce water and salt. The driving force of this reaction is formation of a low-energy and stable covalent bond in water, together with the second product, mostly ionized salt. The "neutralization" term does not mean neutral pH, but the state in which the same mole numbers of both acid and base have been mixed. To detect the moment of neutralization, we use an **indicator**, which for example, can change its color when neutralization is reached. If the reacting partners differ in their dissociation degree, a hydrolyzing salt is formed, and the pH of the "neutralized" solution can be less than 7.0 (for strong acid mixed with weak base) or above 7.0 (for strong base mixed with weak acid). Salts, formed after reactions between alkali or alkaline earth metals bases (NaOH, KOH, Ba(OH)₂) and strong acids (HCl, HI) do not undergo hydrolysis.

Acid-base titration

When strong acid and strong base react each other or any of the strong partner reacts with the weak one (acid or base), an essentially irreversible quantitative reaction takes place. The **titration** is a measurement of the reactant solution concentration. The titration process is stepwise addition from a burette (drop by drop) a standardized solution (solution with known concentration) of base (or acid) to Erlenmeyer conical flask containing known volume of acid (or base) solution, in the presence of proper indicator. To calculate the concentration of the examined solution we use the formula:

$$C_1 \times V_1 = C_2 \times V_2$$

$$C_1 = \frac{C_2 \times V_2}{V_1}$$

C₁ - unknown concentration of acid (or base) in the Erlenmeyer flask

C₂ - known concentration of standardized base (or acid) solution in the burette

V₁- volume of the acid (or base) solution in the Erlenmeyer flask

V₂- volume of the standardized base (or acid) solution added from the burette to the Erlenmeyer flask

The titration process can be illustrated with **titration curve**, which is a function of pH change in the titrated solution, as the result of moles number added from the burette.

The **equivalence point** is defined as the pH value, in which equal mole numbers of acid and base have been mixed. For titration of 0.1 M strong acid (in the Erlenmeyer flask) with 0.1 M strong base (in the burette), pH of the mixture rises quickly to pH near 7.0 with sharp slope.

The shape of the titration curve of a weak acid with a strong base is different. When we mix strong base with weak acid, for example NaOH with acetic acid, a sodium acetate hydrolyzing salt is formed and, with acetic acid still present in the Erlenmeyer flask, a buffering mixture is formed. The buffering capacity of the mixture,

Experiment 5 Acid Base Neutralization And Titration

S Marginson



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