Hydrolysis of salts of strong acids and strong bases

In hydrolysis of salt when both the acid and the base are either strong of weak, the solution is neutral in nature.

Titration

A titration is a technique where a solution of known concentration is used to determine the concentration of an unknown solution. Typically, the titrant (the know solution) is added from a burette to a known quantity of the analyte (the unknown solution) until the reaction is complete.

Titrate and Titrant

The solution to be titrated is called titrate and the solution with which the titration is to be done is called the titrant.

Volumetric analysis

Volumetric analysis is a widely-used quantitative analytical method. As the name implies, this method involves the measurement of volume of a solution of known concentration which is used to determine the concentration of the analyte.E.g the acid-base titration between HCl (strong acid) and NaOH.

Equivalence point

The equivalence point, or stoichiometric point, of a chemical reaction is the point at which chemically equivalent quantities of acid and base have been mixed. In other words, the moles of acid are equivalent to the moles of base. It can be found by means of an indicator, most often phenolphthalein.

Indicator

Chemical indicator, any substance that gives a visible sign, usually by a colour change, of the presence or absence of a threshold concentration of a chemical species, such as an acid or an alkali in a solution. An example is the substance called methyl yellow, which imparts a yellow colour to an alkaline solution.

Ostwald's theory of acid-base indicators

The colour change of any indicator is due to its ionisation. The unionised form of indicator has different colour than its ionised form.
An indicator is either a weak acid or base, so its ionisation is highly affected in acids and bases. If an indicator is a weak acid, its ionisation would be very much low in acids due to common H^+ ions while it is fairly ionised in alkalies. In the same way, if the indicator is a weak base, its ionisation is large in acids and low in alkalies due to common OH^- ions.

Volumetric analysis

Any method of quantitative analysis in which the amount of a substance is determined by measuring the volume that it occupies the volume of a second substance that combines with the first in known proportions, more correctly called titrimetric analysis is called volumetric analysis

Solubility equilibrium

Solubility equilibrium is a type of dynamic equilibrium. It exists when a chemical compound in the solid state is in chemical equilibrium with a solution of that compound. The solid may dissolve unchanged, with dissociation or with chemical reaction with another constituent of the solvent, such as acid or alkali.

Solubility product

It is defined as the product of molar concentration of its ion in a saturated solution, each concentration raised to the power equal to the number of ions produced on dissociation of one molecule of the electrolyte.

Application of common ion effect and solubility product

If the ionic product exceeds the solubility product of a sparingly soluble salt, the excess ions will combine resulting in the formation of precipitate.

Applicaiton of solubility product

K_{sp} is constant for a particular temperature irrespective of the source of ions.

Application of common ion effect and solubility

The separation and identification of various basic radicals into different groups is based on solubility product principle and common ion effect.

Henderson equation

$$pH = pK_a + \log \frac{[base]}{[acid]}$$

From above equation Henderson equation is explained.

Application of common ion effect and solubility

Fractional precipitation is a technique of separating two or more ions from a solution by adding suitable reactant that precipitates first ion, then another. We can control the factors which ion has to be precipitated.

Buffer solutions

A buffer solution is defined as a solution which resists any change in its pH value even when small amounts of the acid or the base are added to it. e.g Ammonium acetate acts as a buffer.

Types of buffer solutions

Solutions of single substances
Solutions of mixtures
Acidic buffer
Basic buffer

Preparation of acidic buffer

An acidic buffer solution is prepared as a combination of weak acids and their salts (sodium salts, etc.) eg. solution of acetic acid containing sodium acetate.

Importance of buffer solutions

In biological purposes:Blood acts as a buffer solution by keeping the pH of body constant.
In industrial processes:All industries use buffers in one process or the other. Major industries, which employ buffers are paper, dyes and drugs industries.
In analytical chemistry:Buffers find extensive use in analytical chemistry, both in qualitative and quantitative analysis. Buffers are used in the removal of interfering radicals such as phosphate, oxalate.
In agriculture:The soils get buffered due to the presence of salts such as carbonates, bicarbonates, phosphates. The choice of fertilizers depends upon pH of the soil.

Difference between dissociation and ionization

Ionization is the process that involves the formation of ions, where as dissociation is the process of breaking up of a moiety into its constituents atoms, molecules and ions.

Classical concepts of acids and bases

Acid is a substance whose aqueous solution shows the following properties:

Conducts electricity
Reacts with active metals like zinc, magnesium
Turns blue litmus red
Has sour taste

Base is a substance whose aqueous solution has the following properties:

Conducts electricity
Turns red litmus blue
Has a bitter taste
Has a soapy touch

Arrhenius concept of acids and bases

The Arrhenius acid-base concept classifies a substance as an acid if it produces hydrogen ions H^+ or hydronium ions in water. A substance is classified as a base if it produces hydroxide ions OH^- in water.

The Arrhenius concept of acids and bases was able to explain a number of phenomenon like neutralization, salt hydrolysis, strength of acids and bases etc.
Limitations of Arrhenius concept:
(a) For the acidic or basic properties, the presence of water is absolutely necessary.
(b) The concept does not explain acidic and basic character of substances in non-aqueous solvents.
(c) The neutralisation process is limited to those reactions which can occur in aqueous solutions only, although reactions involving salt formation do occur in absence of solvent.

(d) It cannot explain the acidic character of certain salts in aqueous solution.

Understand the ionization of electrolytes

An electrolyte is a substance that produces an electrically conducting solution when dissolved in a polar solvent, such as water. The dissolved electrolyte separates into cations and anions,which disperse uniformly through the solvent. Electrically, such a solution is neutral. If an electrical potential (voltage) is applied to such a solution, the cations of the solution would be drawn to the electrode that has an abundance of electrons, while the anions would be drawn to the electrode that has a deficit of electrons.

Common ion effect

It states that if the concentration of any one of the ions is increased, then, according to Le Chatelier's principle, some of the ions in excess should be removed from the solution, by combining with the oppositely charged ions. Some of the salt will be precipitated until the ion product is equal to the solubility product.