Redox Titration.

It is contitative method of analysis in which volume of sample solution is determined by titrating it against standard oxidising or reducing agent use in redox indicator is called as oxidation reduction reaction.

most general defination of Oxid^n, Red^n reactions are :-

1) Oxidation →
A process which involves the loss of one or more electrons by an atom, molecules or ions.

2) Reduction →
A process which involves the gain of one or more electrons by an atom, molecules or ions.

* The species which causes the oxidation to occurs is called as oxidizing agent or oxidant.

* The species which is oxidized is called the reducing agent or reductant.

* Example of Redox reaction →

1) Electron transfer →
When zinc metal is

Introduced in solution of cupric ions

$$Zn^{*}_{(s)} + Cu^{+2}_{(aq)} \longrightarrow Zn^{2+}_{(aq)} + Cu_{(s)}$$

In this reaction, cupric ion is oxidant & metallic zinc is reductant

2) Oxygen atom transfer →

$$FeO + CO \longrightarrow Fe + CO_2$$

The reaction results in a transfer of an oxygen atom from ferrous oxide (FeO) to carbon monoxide (CO) which form iron and CO_2 respe.

3) Hydrogen atom transfer →

The reactant that H-atoms becomes oxidised and the species gaining hydrogen is reduced.

The hydrogination of ethylene gas ($CH_2=CH_2$) to ethane (CH_3-CH_3) is an example of this type of reaction.

$$CH_2=CH_2 + H_2 \longrightarrow CH_3-CH_3$$

VIMP

* Types of redox titration →

1) Dichromatometry → (Potasium dichromate titrn)

Principle →

Ferrous ammonium sulphate or Mohr's salt is a stable salt with $FeSO_4$ as a active constituent.

① Acidic potassium dichromate solution is a strong oxidizing agent and is rapidelly reduced by ferrous ion at the ordinary temperature to green chromic acid when add to ferrous ammonium sulphate solution containing dil. H_2SO_4

② In this reaction Ferrous ammonium sulphate is oxidised to Ferric sulphate while ammonium sulphate remains unreacted.

VIMP

③ N-phenyl anthranilic acid is used as an indicator.

The slight excess ammount of dichromate will oxidised the indicator when all the ion (Fe^{2+}) have been converted to Fe^{3+} ion resulting in colour change from green to purple.

Application →

① It can be used in acidic as well as alkaline solution.

② It is stable towards ~~titre~~ light.

2) Iodine titration →

★ V.Imp Define

a) Iodimetry →

The determination of reducing agent by direct titrations with Std. iodine solution is called Iodimetry.

principle →

Standard solution of iodine may be prepared from accurately weighing the pure reagent. It is simple to make the Sol^n from the reagent great product and then pto standardized it.

Iodine is slightly soluble in water, but it forms a soluble dry iodide ion insolution of iodide.

$I_2 + I \longrightarrow I_3$

The use of iodide in the solution both increases the solubility of the iodine & decreases its volatility, thus controling to the solubility of the iodide solution.

Define ★ V.V.IMP b) Iodometry →

Indirect determination of oxydizing agents by titrations of libreted iodine from iodide like potassium iodide with Standard $Na_2S_2O_3$ is called iodometric titrations.

principle →

In iodometry, the formation of iodine takes place as a result of hydrogen iodide (HI) as a oxidising agent.

The HI is obtained directly in the reaction flask by action of dilute hydrochloride or sulphuric acid.

on a sol^n of potassium iodide.

Free iodine is libreated as result of oxidation of potassium iodide in acidic solution.

The libreated iodine is titrated with Std. sol^n of Sodium thiosulphate ($Na_2S_2O_3$)

$$2KI + H_2SO_4 \longrightarrow K_2SO_4 + 2HI$$

$$I_2 + 2Na_2S_2O_3 \longrightarrow 2NaI + Na_2S_4O_6$$

Sodium tetrathionate

Q explain in starch is an indicator in iodine titration

In iodometric and iodimetric titration [Starch solution] is used as indicator.

* Starch Soln gives blue or violet colour with free iodine.

At the end point blue or violet colour disappear when iodine is completely change to iodide.

c) Ceriometry → (ceric sulphate titration)

* oxidation, reduction titration involving ceric sulphate as an oxidizing agent are called as Ceriometry titration.

Ceric sulphate is a powerful oxidant and can be used only in acidic Soln.

In neutral solution Ceric hydroxide or basic salt precipited.

Ceric salts have intence yellow colour & end point detection can be possible without any indicator in hot solution.

Application →

Cerric salts are versatile of oxidising agent & can be used in almost all determination involving $KMNO_4$, $K_2Cr_2O_7$ & other oxidising agent.

V.IMP
What is d) Bromatometry → (Potassium bromate titration)

① [Potassium bromate alone can be used for analysis of organoarscenicals] ② [The organoarsenical like carbarasone is converted to trivalent or inorganic arsenic compound, by digestion with Sulphuric acid and potassium Sulphate]

③ The arsenite ~~thus obtaine~~ reducess potassium bromate uniformely to bromide.

④ [At the end point when all the Stronger reducing agent like arsenide have been oxidised] a slight access of potassium bromate sol^n oxidises bromine from bromide.

e) Iodatometry → (Potassium iodate titration)

Potassium iodate can also be used as oxidising agent for estimation of iodides, arsenicals and other reducing agents.

The methods of estimation are depending upon the formation of iodine monochloride in the presence of Strong hydrochloric acid.

For analysis molar sol^n of iodate is used in place of normal Solution because the normality various with nature of the reaction.