**Titrations Involving Iodine**: The redox titrations using iodine directly or indirectly as an oxidizing agent are called iodine titrations.



In iodine titrations appearance or disappearance of iodine (I2) indicates the end point. Iodine produces intense blue color with starch (iodostarch complex), so **starch is used as indicator** in iodine titrations.

Iodine titrations are classified into *iodimetric* and *iodometric* titrations based on the analyte being used for the titration.

**Iodimetric titration**: Iodine (I2 or I3-) can act as weak oxidizing agent. If the analyte is a reducing agent, a standard iodine solution is directly titrated against a reducing agent. Iodimetric titrations are used for the determination of reducing agents like thiosulphates, sulphites, arsenites and stannous chloride etc.



**Iodometric titration**: In iodometric titrations we can determine the strengths of oxidizing agents. This method is an indirect method where excess of iodide (KI) solution is added to the oxidizing agent to produce iodine (I2). The amount of iodine liberated from iodide (KI) is equivalent to the quantity of oxidizing agent present in the solution. With this method we can estimate the strength of oxidizing agents like CuSO4, K2Cr2O7, KMnO4, FeCl3, MnO2, H2O2, Br2, Cl2 etc.

The liberated iodine is titrated with a standard sodium thiosulphate solution (hypo).



Sodium thiosulphate is not a primary standard. The exact strength can be determined by primary standards like CuSO4.5H2O, K2Cr2O7 etc.

So the major deference between iodimetric and iodometric titrations are we use a standardized iodine solution in iodimetric titration which involves only one redox reaction between I2 and reducing agent, whereas in iodometric titrations first we add excess iodide solution to one oxidizing agent (analyte) to liberate iodine and liberated iodine is titrated with standard reducing agent like hypo. Hence, two redox reactions take place in iodometric titrations.

**Iodometric determination of Cu2+ present in the unknown solution.**

Reagents provided:

1. Hypo solution
2. KI solution
3. Freshly prepared starch indicator
4. K2Cr2O7
5. Unknown - CuSO4.5H2Osolution

**1) Preparation of primary standard K2Cr2O7 solution**

Prepare N/20 K2Cr2O7 solution in 100 ml distilled water by weighing exact quantity.

**2) Standardization of hypo solution**

a) Rinse and fill the glass stoppered burette with hypo solution.

b) Pipette out 20 mL of K2Cr2O7 solution in a clean conical flask and add 2 ml of 100% KI solution. Then, add 10mL of H2SO4 and shake well. Cover the mouth of conical flask with a watch glass or filter paper and allow the mixture to stand for 2- 5 minutes. Solution turns brown color due to liberation of iodine.

c) Titrate the liberated iodine with hypo solution till the dark brown color of iodine turns into a faint yellow color. Now add 2 ml of starch solution which immediately forms deep blue iodo-starch complex(note: do not add the starch in the beginning of the titration because in the presence of excess iodine it will form a permanent deep blue complex which does not easily loose the iodine).

d) Now add further hypo solution drop by drop and vigorously shake the conical flask till the blue color just disappears and a pale green color is left. This is the end point. Note this burette reading and repeat the titration until two concordant readings are obtained. (End point: Brown---deep blue ----disappearance of blue and pale green is left)

*Table and calculations*

**3) Determination of the strength of Cu2+ present in unknown**

a) Rinse and fill the glass stoppered burette with hypo solution.

b) Pipette out 20 mL of unknown Cu2+solution in a clean conical flask and add 1 ml of 100% KI solution. Mix well and cover the mouth of conical flask with a watch glass or filter paper and allow the mixture to stand for 2- 5 minutes. Solution turns brown color due to liberation of iodine.

c) Titrate the liberated iodine with hypo solution till the dark brown color of iodine turns into a faint yellow color. Now add 1 ml of starch solution which immediately forms deep blue iodo-starch complex (note: do not add the starch in the beginning of the titration because in the presence of excess iodine it will form a permanent deep blue complex which does not easily loose the iodine).

d) Now add further hypo solution drop by drop and vigorously shake the conical flask till the blue color just disappears. This is the end point. Note this burette reading and repeat the titration until two concordant readings are obtained. (End point : Brown---deep blue ----disappearance of blue)

*Table and calculations*