

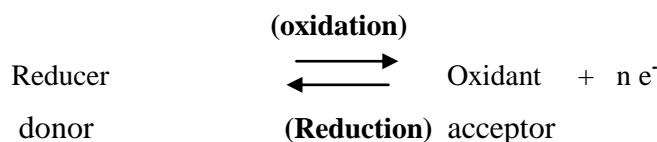
TP N°V: Titration by the Oxidation-Reduction Method

Case: Manganometry

I. Generalities:

Oxidation-reduction reactions are electron exchange reactions involving electron acceptors and donors. Oxidants have the ability to capture electrons, while reducers can donate electrons. In the human body, oxidation-reduction reactions provide energy for its natural activities. These reactions require either O₂ or H₂. If the substances in the body react with or bind to O₂, oxidation occurs, or if they react with or bind to H₂, reduction occurs (or releases O₂).

Oxidants and reducers are used in disinfecting tissues contaminated with blood (hospitals) or dyes, treating infections, wounds such as Dakin, hydrogen peroxide, bleach. The reaction defining the relationship between a reducer and an oxidant is:

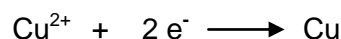


In these reactions, the reducer oxidizes by gaining electrons, while the oxidant reduces by losing electrons. **Examples:**

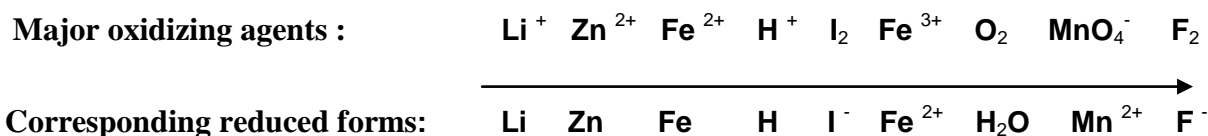
- The transition of iron "Fe" into a solution corresponds to an oxidation.



- The deposition of copper "Cu" from a solution of Cu²⁺ ions corresponds to a reduction.



Below are the oxidation-reduction couples and their classification in ascending order.:

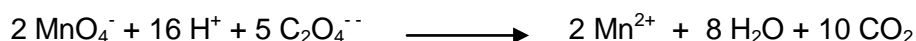
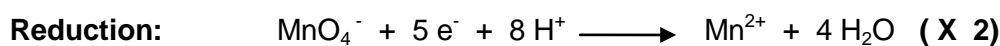
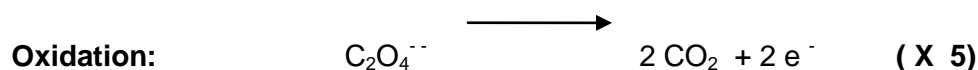


II. Main objective of the first experiment (Manganometry):

Determine the normality of a solution of FeSO₄.

1. **Principle:** The normality of FeSO₄ is determined using the oxidation reaction with potassium permanganate KMnO₄ in an acidic medium. However, it is essential to first determine the normality of KMnO₄ (since it is unstable, and as it has been prepared a week ago, it is preferable to determine its normality).

2. **KMnO₄ titration:** Determination of the normality of the KMnO₄ solution in an acidic medium in the presence of oxalic acid (H₂C₂O₄, 2 H₂O). It is an oxidation-reduction reaction, and its balanced equation is:



3. Procedure:

- Place potassium permanganate (KMnO₄, oxidizing agent) in the burette. Place 10 ml of oxalic acid (H₂C₂O₄, N1= 0.1N) and 20 ml of sulfuric acid H₂SO₄ (10%) in the Erlenmeyer flask. Heat the mixture to around 60 °C as the reaction is slow, and heat catalyzes the reaction (the color disappears rapidly).
- Allow a few drops of KMnO₄ to flow, shake, and wait until they are decolorized. Continue adding a few drops until an excess drop produces a persistent pale pink color (does not disappear).

4- Manganometric titration of FeSO₄:

Procedure:

- Acidify (add an acid) 10 ml of FeSO₄ with 20 ml of H₂SO₄ solution.
- Proceed to the titration, which, unlike the titrations of oxalic acid, should be done cold.
- Add the KMnO₄ solution (concentration determined in 3) until a pale pink color is obtained due to the addition of a single excess drop of KMnO₄. Repeat the experiment twice.