COULOMETRY

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INTRODUCTION

Coulometry method of analysis are the base on measurement of quantity of electricity that passed through a solution an electrochemical reaction.

The coulometry method are the mainly base on the measurement of quantity Of electricity.

The sample which is to be determined undergoes the reaction at electrod which is measure at the electrod.

The completion of the reaction is indicated by the decrease in the current to zero.

This can be measured by the coulometer.

PRINCIPAL

The main principal involved in the culometry is the measurement of the quantityOf the electricity.

Which is directly proportional to the chemical reaction at the electrode. This is given by faraday low.

Q=nFNA.....(1)

Where, n is the number of electrons per mole of analyte.
F is Faraday's constant (96487Cmol-1)
N is the moles of analyte.

Coulometer

TYPES OF COULOMETRY

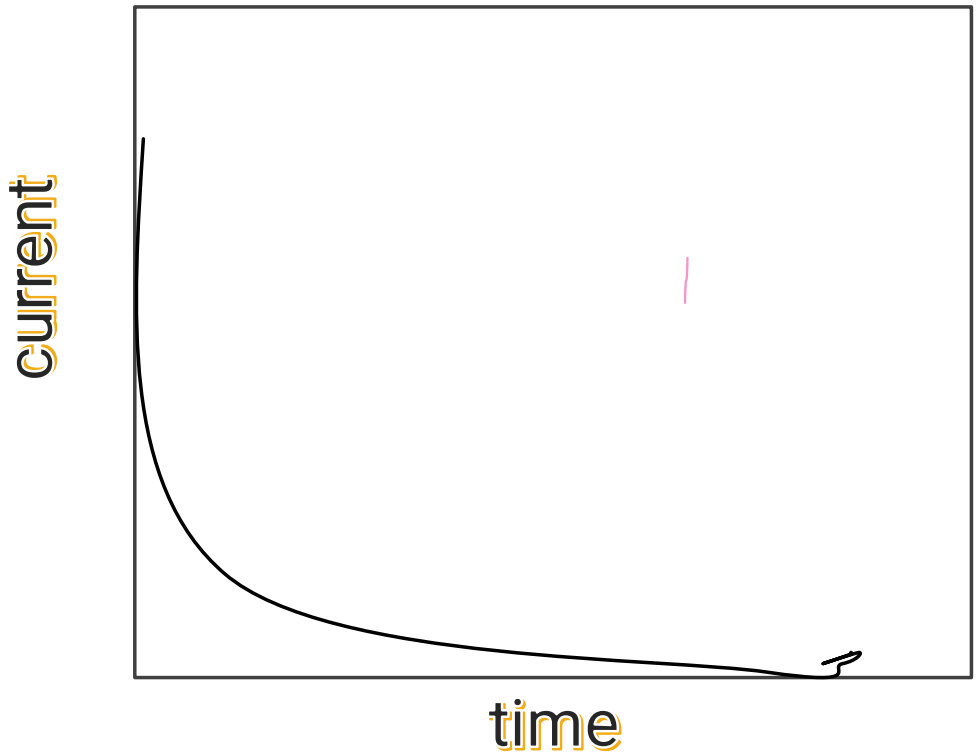
- POTENTIOSTATIC COULOMETRY
- COULOMETRIC TRITRATION

POTETlnOSTATIC COULOMETRY

An electrochemical technique where the total coulmbs of electricity required
To complete (fully oxidise or fully reduce the sample in)
an electrochemical reaction is measured whilst the potential of the working
Electrode is held at a constant value.

❖ The resulting corrent- versus time profile for controlled Potential coulometry is shown in the Figure below.

❖ Integrating the area under the curvefrom (t = 0 to t= te) gives The



❖ The controlled potential coulometry the current decreases over time.

❖ As a result, the rate of electrolysis becomes slower and complete electrolysis Of the analytemay required a long time.

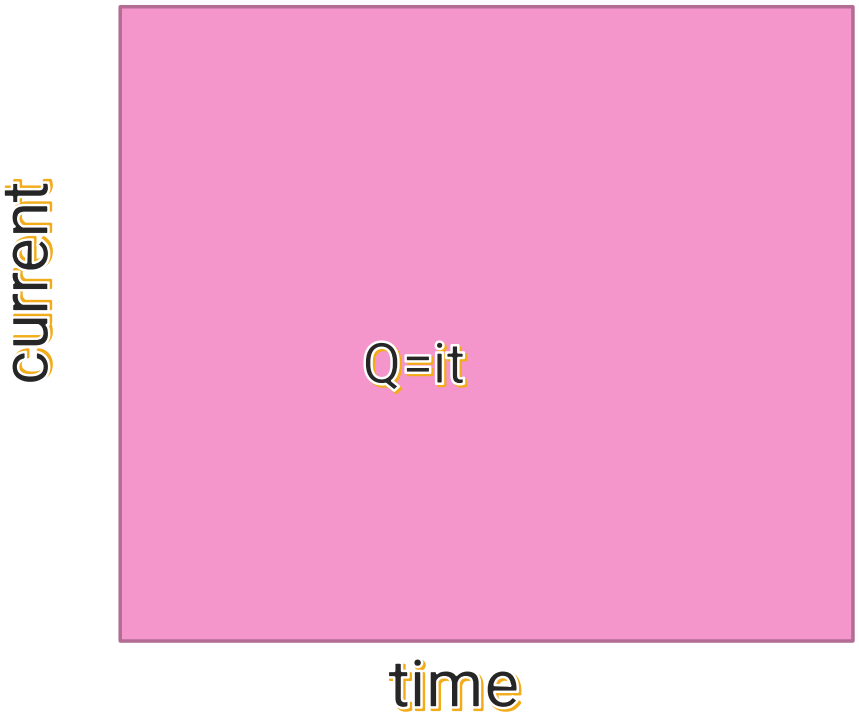
❖ Factors affecting the analysis time:

- Volume of electrochemical cell
- Electrode surface area
- Stirring rate

COULOMETRIC TITRATION

❖ Coulometric titration use a constant corrent system to accurately, Quantify the concentration of a species. In this experiment, the applied Current is equivalent to a titrant.

❖ Current is applied to the unknown solution until al of the unknown species is either oxidized or reduced to a new state, at which point the potential Of the working electrode shifts dramatically.


current
Q=it
time

- The endpoint of the titration can be analytically by using an indicator that is placed in the sample and signals when the system Reaches equilibrium.
- Alternatively, the endpoint can be determined from data Provided by potentiometric, amperometric of conductance Measurments.
- The analysis time is shorter because the current does not decrease Over time. A typical analysis time for controlled- current Coulometry is less than 10 min.

INSTRUMENTATION

1. Gasometric coulometers (hydrogen- oxygen coulometrs)

Hydrogen-oxygen coulometry consists of a glass tube of about 50cm long and a dimeter of 2 cm.

Two platinum sheets of about 1.5 sq.cm. are joined with a stout platinum wire Serve as the electrodes.

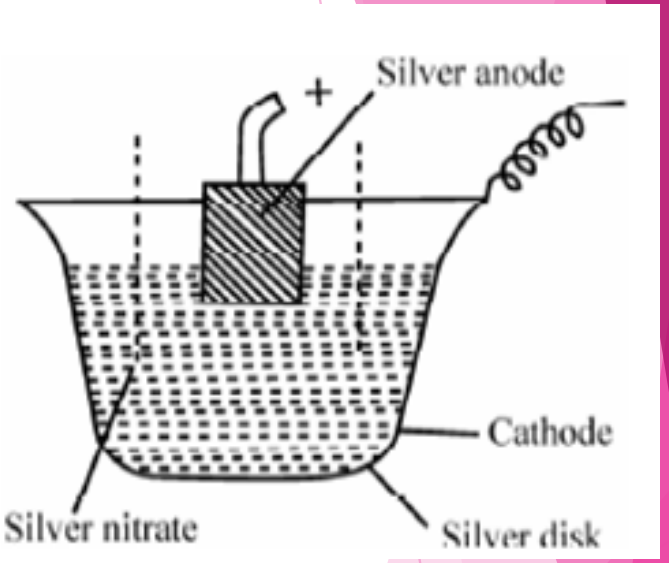
A calibrated tube is connected to the electrolysis tube by means of a preasure Rubber tube and is capable of moving vertically so as to adjust the preassure Of the collected gasses to atmospheric pressure before measuring the volumes Of gases.
A 0.5 solution of potassium sulphate is used as the electrolyte.

❖ SILVER COULOMETER

- A silver coulometer is an example of a gravimetric coulometer in which the Amount of metal deposite at cathode or the amount of metal stripped from an anode is determined.

- A silver coulometer is shown in the most satisfactory either in the cathodic Deposite mode or better still, in the anodic stripping mode in perchloric acid media.

The increase in mass of the cathode gives the amount of silver Deposited. From the mass of the silver



APPLICATIONS

1. Inorganic Analysis

- Determination of several metal ions. Eg. Iron, calcium etc.
- To determine purity of inorganic compound.
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2. Analysis of radioactive materials

- The techniques is widely adopted for the determination of Uranium and plutonium and thus finds extensive use in the nuclear Energy field.

3. Micro analysis

- This technique is especially useful for the determination of small Amounts of analyte (0.01 –lmg) with an accuracy of (+_ 0.5%)

4. Electrolytic determination of organic compounds:

- Controlled potential coulometry offers a new step for the
- Electrolytic determination of organic compounds.