

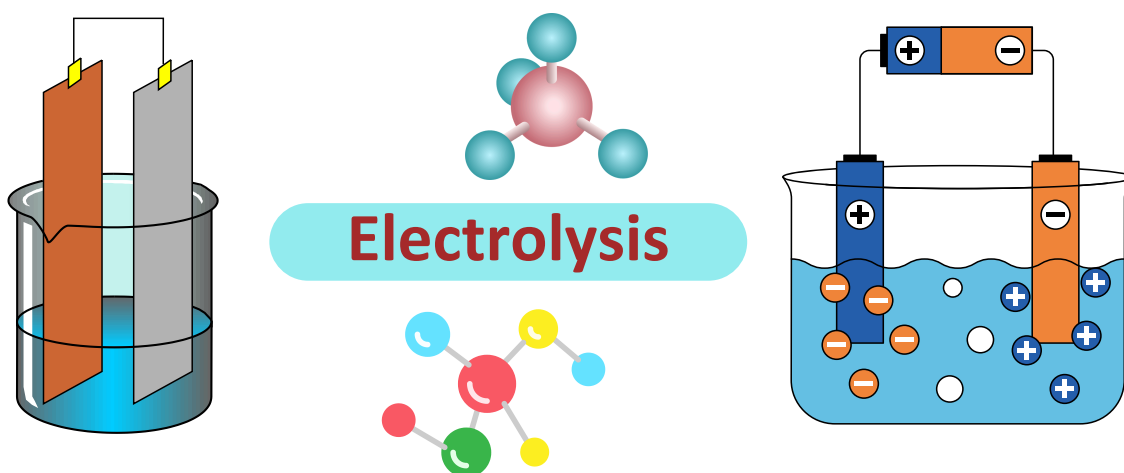
Electrolytic Processes - GCSE Chemistry

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1. Introduction

- The Electrolytic processes are basically a **method in which we use electricity to decompose a ionic compound/solution into its constituent elements.**
- The apparatus in which the process occurs is called **Electrolytic cell**, it involves **electrodes, battery and an electrolyte(ionic compound).**



- The process of Electrolysis is used in processes like **Electroplating, Water Electrolysis and Purifying Metal etc.**

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2. Electrolyte

- An Electrolyte is a substance that produces ions when dissolved in water (or in molten state).
- Electrolytes conduct electricity through movement of ions. Electrolytes are crucial in various applications.

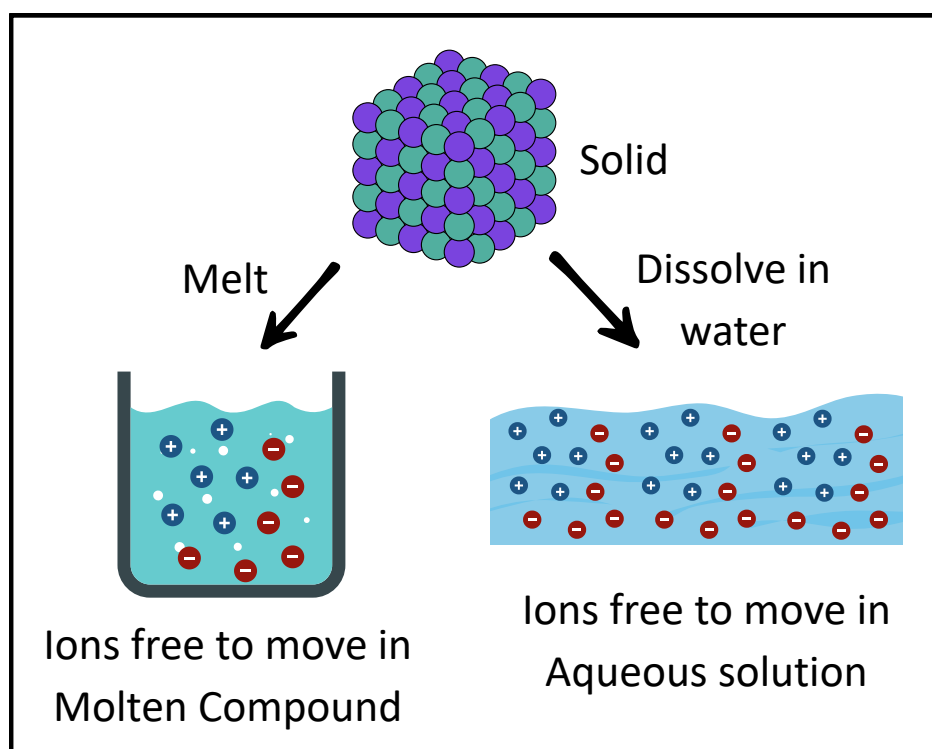
Characteristics of Electrolyte -

- **Ionisation/Dissociation:** When electrolytes are in solution or when they melt they ions become free to move.
- **Conductivity:** The free ions of electrolytes in solution or molten state carry electricity.
- **Electrolysis:** They allow electrochemical reaction (Example: Decomposition by electric current)

Types of electrolytes -

Type	Description	Example
Strong Electrolyte	Completely dissociate ions	$\text{HNO}_3, \text{HCl}, \text{NaCl}$
Weak Electrolyte	Partially dissociate into ions	$\text{CH}_3\text{OOH}, \text{NH}_4\text{OH}$
Non Electrolyte	Do not conduct electricity	Ethanol

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Example of Electrolytes with free ion movement

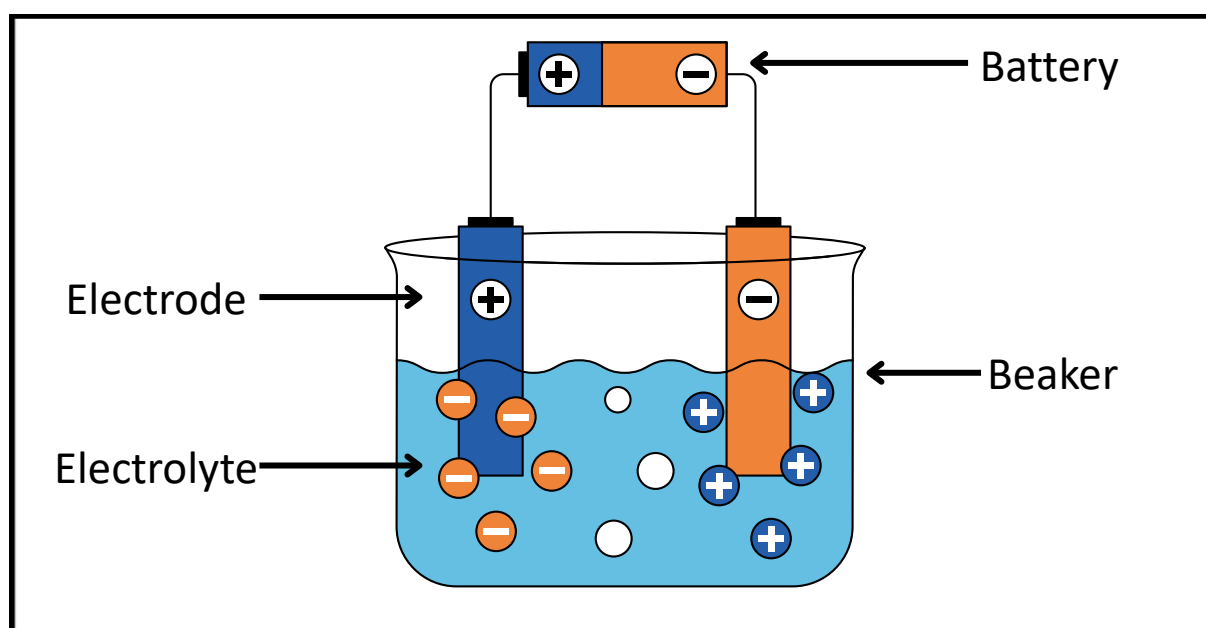
Electrolyte	Solution/Molten state	Description	Ions formed
NaCl	Aqueous/Molten	Strong Electrolyte	Na^+ , Cl^-
CH_3COOH	Aqueous	Weak Electrolyte	CH_3COO^- , H^+
HCl	Aqueous	Strong Acid	H^+ , Cl^-
KNO_3	Aqueous	Used in fertilizers and explosives	K^+ , NO_3^-

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2. Basics of Electrolysis

- Electrolytes are **main components of batteries** as they contain **electrodes that carry ions**, Electrolytes are also used in **Electroplating**.

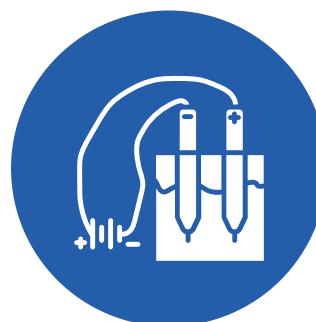
Equipment



- The Equipment of Electrolytic cell consist of -
Electrolyte : Ionic compound(a Solution or Molten compound)
Electrode : A conductor that carries current into and out of substance

Types of electrolysis -

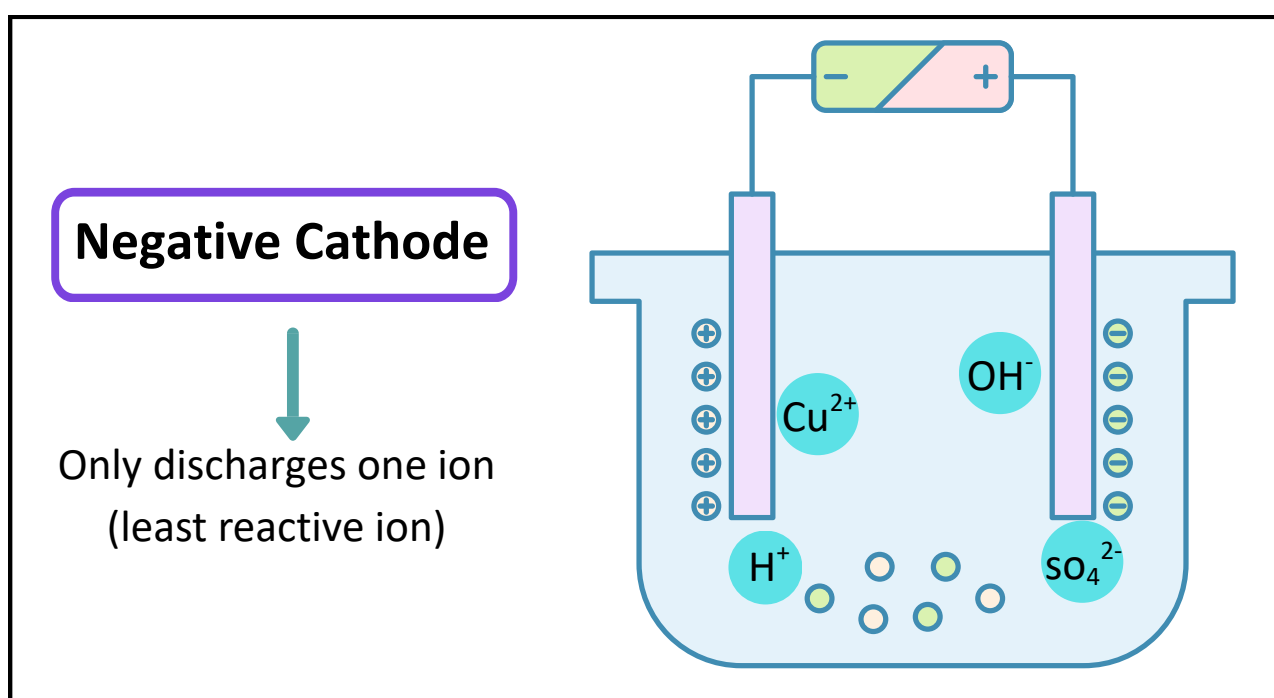
1. Molten Electrolysis
2. Aqueous Electrolysis
3. Water Electrolysis
4. Electrolytic Refining
5. Electroplating



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3. Example of Electrolysis

- Here is an example in which **Electrolysis of Copper Sulphate (CuSO_4) solution** is explained in detail -
- A beaker is taken in which **CuSO_4 (Electrolyte)** and **two electrodes connected with a battery** are present.
- When electricity is passed through battery then the **current flow starts in electrodes**.
- The **solution then starts decomposing into ions** of its constituent elements and the **positive ions Cu^{2+} and H^+ gets attracted towards the negative Cathode**, in a similar way the **negative ions OH^- , SO_4^{2-} gets attracted towards the positive Anode**.



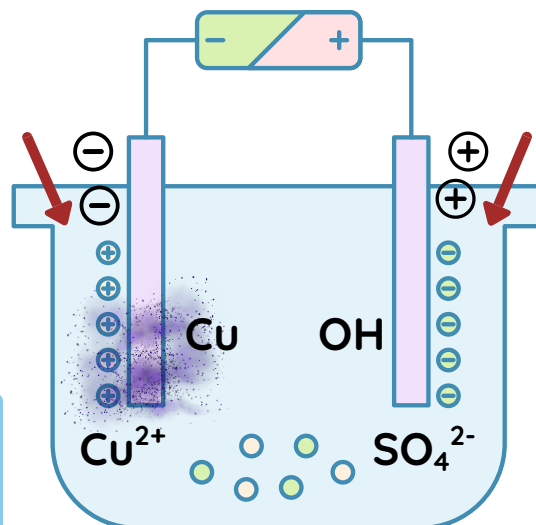
Copper ions get discharged to form Copper metal which deposits at the cathode. Chemical Reaction -



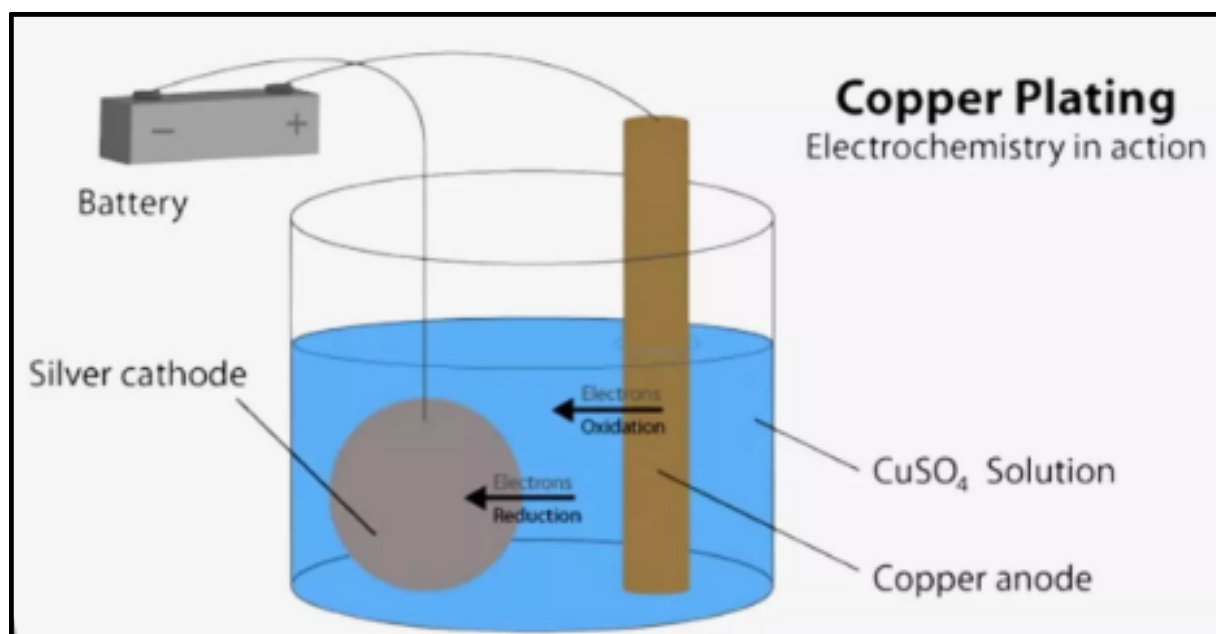
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Negative Anode

If Inert electrode is used then hydroxide ions (OH^-) are discharged to form **Oxygen (O_2)** and **water (H_2O)**



If the Anode is made of Copper it will dissolve in the solution as Cu^{2+} while these ions in the solution deposit at Cathode.



Conclusion

The **Electrolysis of CuSO_4** involves **transfer of Cu^{2+} ions** from solution to **cathode**, where they are reduced and **deposited as copper metal**. If **Inert electrodes** are used then **Oxygen is produced at Anode**. **Sulphate ions remain in solution**. If **copper electrodes are used**, the anode dissolves and form the copper ions in solution.

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4. FAQ's

(1) What is the purpose of Electrodes in Electrolysis?

Answer: Electrolysis is the process in which **electrodes are used to decompose the electrolyte(solution) into ions of its constituent elements.**

(2) Define electrolysis?

Answer: Electrodes are used in an Electrolytic cell as they can conduct electricity(**allow electron flow**). Thus, in brief **electrodes play the role to discharge the ions present in solution by the process of oxidation and reduction.**

(3) Can electrolytic process be used for metal purification?

Answer: Yes, Electrolytic process is **widely used in purifying metals.** Some of the examples include **Copper electrolytic refining, Silver electrolytic refining etc.** This method is widely used for such purpose because it **provides high purity and can remove selective impurities** based on ionic criteria.

(4) Give an example of Electrolytic process.

Answer: Water Electrolysis, Molten Electrolysis(separation of lead from Lead Bromide), Electroplating(Aqueous Solution: Copper plating).

(5) Give examples of different electrolytes used in Electrolysis.

Answer: Inert Electrode like Platinum and Graphite, reactive electrodes like Copper and Zinc.