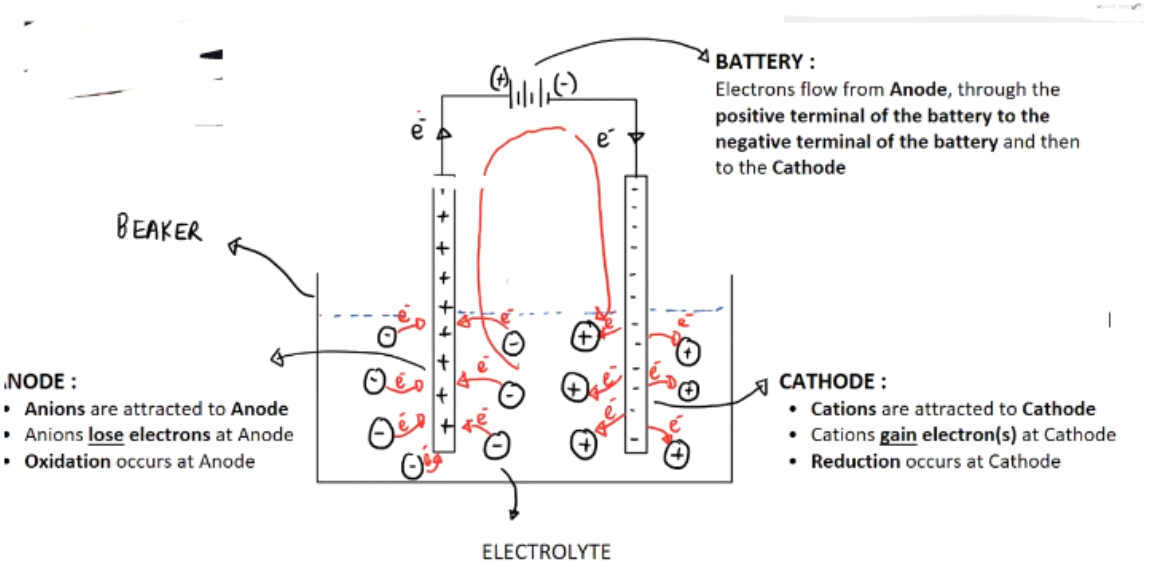
ELECTROLYSIS #4

HOW DOES ELECTROLYSIS WORK ?

The process of electrolysis involve three things:

- The external circuit as in the power supply
- Reactions at the electrodes
- Reactions in the electrolyte



NOTE:
When the cations and the anions gain or lose electron(s) at the electrodes, they form **atoms** or **molecules**. So, we say the cations and the anions are **discharged**.

Electrolysis Of Molten Ionic Compounds -

Ionic compounds are sometimes called Binary compounds. A binary ionic compound which contains **only two elements**, mainly a metal cation and a non-metal anion.

When a binary ionic compound is heated, melted and undergoes electrolysis, a metal and a non-metal elements are formed as products.

1. Electrolysis Of Molten Sodium Chloride - $NaCl(l)$

$2Cl^- \rightarrow Cl_2$ atom

$Cl^- \rightarrow 1e^-$

$2Cl^- \rightarrow$

IONS PRESENT	Na^+, Cl^-
CATIONS	Na^+
ANIONS	Cl^-
EQUATION AT CATHODE	$Na^+ + e^- \longrightarrow Na$ (REDUCTION)
EQUATION AT ANODE	$2Cl^- - 2e^- \longrightarrow Cl_2$ (OXIDATION)

$\Rightarrow 2Cl^- \longrightarrow Cl_2 + 2e^-$

2. Electrolysis Of Molten Potassium Iodide - $KI(l)$

IONS PRESENT	K^+, I^-
CATIONS	K^+
ANIONS	I^-
EQUATION AT CATHODE	$K^+ + e^- \longrightarrow K$ (REDUCTION)
EQUATION AT ANODE	$2I^- - 2e^- \longrightarrow I_2$ (OXIDATION)

$\Rightarrow 2I^- \longrightarrow I_2 + 2e^-$

3. Electrolysis Of Molten Lithium Bromide -

↳ $LiBr(l)$

IONS PRESENT	Li^+ , Br^-
CATIONS	Li^+
ANIONS	Br^-
EQUATION AT CATHODE	$Li^+ + e^- \rightarrow Li$ (REDUCTION)
EQUATION AT ANODE	$2Br^- - 2e^- \rightarrow Br_2$ (OXIDATION)
	$\Rightarrow 2Br^- \rightarrow Br_2 + 2e^-$

4. Electrolysis Of Molten Lead (II) Bromide

↳ $PbBr_2(l)$

IONS PRESENT	Pb^{2+} , Br^-
CATIONS	Pb^{2+}
ANIONS	Br^-
EQUATION AT CATHODE	$Pb^{2+} + 2e^- \rightarrow Pb$ (REDUCTION)
EQUATION AT ANODE	$2Br \rightarrow Br_2 + 2e^-$ (OXIDATION)

5. Electrolysis Of Magnesium Nitride liquid -

↳ Mg_3N_2

IONS PRESENT	Mg^{2+}, N^{3-}
CATIONS	Mg^{2+}
ANIONS	N^{3-}
EQUATION AT CATHODE	$Mg^{2+} + 2e^- \rightarrow Mg$ (REDUCTION)
EQUATION AT ANODE	$2N^{3-} - 6e^- \rightarrow N_2$ (OXIDATION)

$\Rightarrow 2N^{3-} \rightarrow N_2 + 6e^-$

6. Electrolysis Of Aluminium Oxide liquid -

↳ Al_2O_3 (l)

IONS PRESENT	Al^{3+}, O^{2-}
CATIONS	Al^{3+}
ANIONS	O^{2-}
EQUATION AT CATHODE	$Al^{3+} + 3e^- \rightarrow Al$ (REDUCTION)
EQUATION AT ANODE	$2O^{2-} - 4e^- \rightarrow O_2$ (OXIDATION)

$\Rightarrow 2O^{2-} \rightarrow O_2 + 4e^-$

Electrolysis Of Aqueous Solutions Of Compounds -

Aqueous solutions of compounds means it is a mixture of the compound in water. For instance, an aqueous solution of Sodium Chloride is a mixture of Sodium Chloride and Water.

In an aqueous solution, more than one type of cations and one type of anions are present. During electrolysis, **only one type of cation and one type of anion** is **preferentially discharged** over the other. This is known as **Selective Discharge Of Ions**.

During the electrolysis of an aqueous solution, if the electrodes are **inert / unreactive**, the ions discharged at the electrode depends on three factors:

1. Selective Discharge Of Cations
2. Selective Discharge Of Anions
3. Effect Of Concentration Of The Selective Discharge Of Anions

1. SELECTIVE DISCHARGE OF CATIONS -

The more reactive a metal, the greater its tendency to form its positive ion. Thus, during electrolysis,

- Ions of the **more** reactive metals, such as Potassium and Sodium, will remain as positive ions and will not get attracted and discharged at the Cathode.
- Ions of the **less** reactive metals, such as Copper and Silver and also the ion of Hydrogen will not remain as positive ions and will get attracted and discharged at the Cathode.

The ease of discharge of cations thus depends on the position the metal (producing the cation) in the reactivity series :

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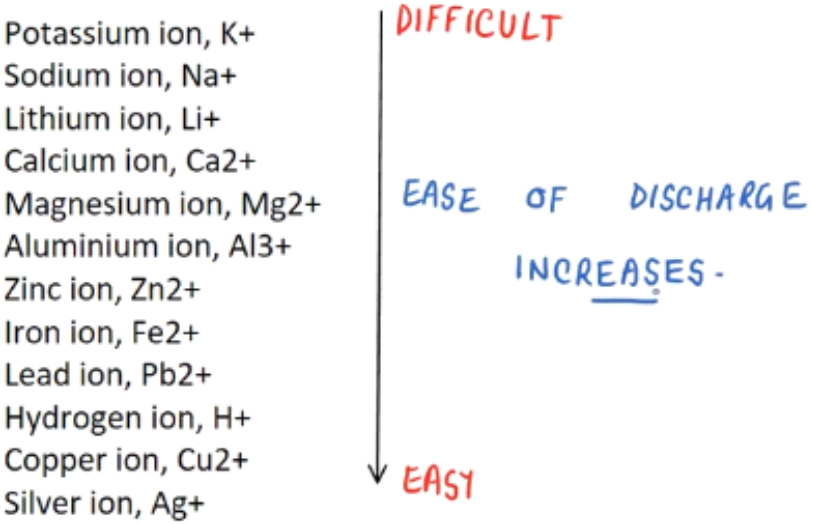

2. SELECTIVE DISCHARGE OF ANIONS -

The ease of discharge of anions will depend on the <u>position of the anion in the following list</u> :