

| SOLUTION | HALF-EQUATION AT THE CATHODE |
|---|--|
| Lead (II) Bromide (PbBr ₂) | $\text{Pb}^{2+} + 2\text{e}^{-} \rightarrow \text{Pb}$ |
| Sodium Chloride (NaCl) | $2\text{H}^{+} + 2\text{e}^{-} \rightarrow \text{H}_2$ |
| Dilute Sulfuric Acid (H ₂ SO ₄) | $2\text{H}^{+} + 2\text{e}^{-} \rightarrow \text{H}_2$ |
| Copper (II) Sulfate (CuSO ₄) | $\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{Cu}$ |
| Hydrochloric Acid (HCl) | $2\text{H}^{+} + 2\text{e}^{-} \rightarrow \text{H}_2$ |

Purification of copper using active metal electrodes

Electrodes used

Impure copper electrode (anode)

pure copper electrode (cathode)

Solution used acidified copper sulfate (blue colour)

At the anode

Copper gets oxidized to Cu⁺² and enters the solution to travel to the pure copper cathode.

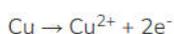


At the cathode

Copper ions get reduced to be deposited at the cathode to form pink copper atoms.



Concentration of electrolyte remains constant because the rate at which copper anode giving away Cu²⁺ ions is same as Cu²⁺ ions Change in to Cu and deposited at cathode.



- The mass of the anode decreases due to loss of atoms and the impurities fall to the bottom of the cell as sludge
- Copper collects on the cathode causing its mass to increase

Exam Tip

To help you remember the definitions of oxidation and reduction use OIL RIG

Oxidation Is Loss (of electrons) Reduction Is Gain (of electrons)

Electroplating

Electroplating is the process of depositing metals from solution as a layer on other surfaces such as metal .

*Object plated: **cathode***

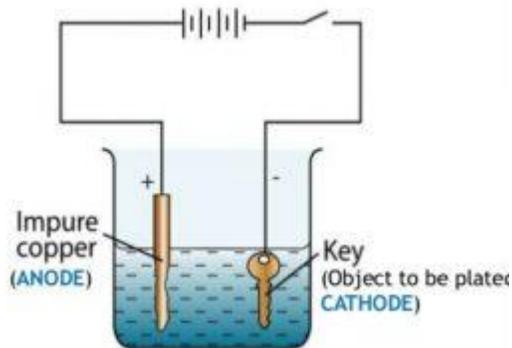
*metal used in plating: **anode***

*Electrolyte: **aqueous salt soln of metal.***

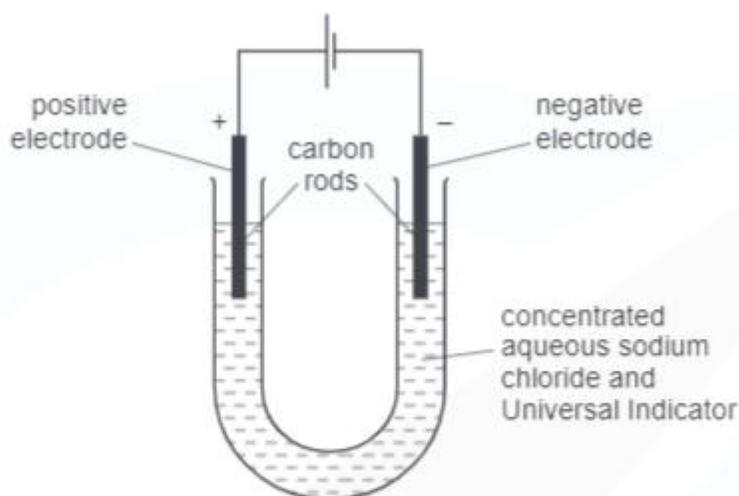
(use nitrates because all of nitrates are soluble)

Uses of electroplating

- 1.It improves appearance and make it more shiny and presentable.
- 2.It resists corrosion



The diagram shows the electrolysis of concentrated aqueous sodium chloride.



What is the colour of the Universal Indicator at each electrode after five minutes?

| | colour at anode (+ electrode) | colour at cathode (- electrode) |
|---|-------------------------------|---------------------------------|
| A | blue/purple | red |
| B | red | blue/purple |
| C | red | colourless |
| D | colourless | blue/purple |

Sodium hydroxide is at Cathode

- ✓ During the electrolysis of concentrated aqueous sodium chloride, positively charged hydrogen ions are attracted to the negative cathode where they are reduced to form hydrogen gas.
- ✓ At the anode, the Cl^- ions are oxidized to form chlorine gas.
- ✓ The ions that remain in solution are Na^+ ions and the OH^- ions.
- ✓ These produce an alkaline solution so at the cathode the colour is blue/purple.
- ✓ At the anode the solution is surprisingly colourless. This is because chlorine gas is a powerful bleaching agent and removes the colour from the universal indicator in solution, which initially would be red but fades after a few minutes as bleaching occurs.
- ✓ A, B and C are incorrect as these colours do not match with the correct results.

Electrolysis of concentrated aqueous sodium chloride

