

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 Cu²⁺ and enters the solution to travel to the pure copper cathode.

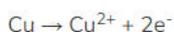


At the cathode

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



Concentration of electrolyte remains constant because for each copper atom oxidized to Cu²⁺ one copper ion is reduced to a copper atom at the cathode, therefore the number of Cu²⁺ per unit volume remains constant.



- 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***

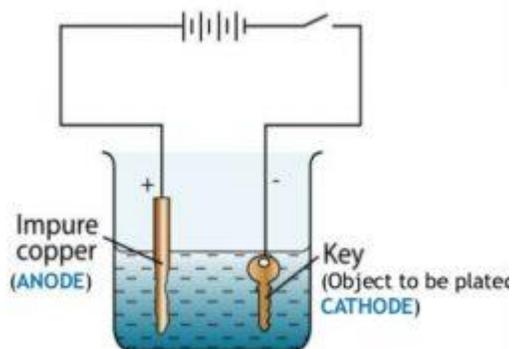
*Electrolyte: **aqueous salt soln of metal.***

(use nitrates because all of nitrates are soluble)

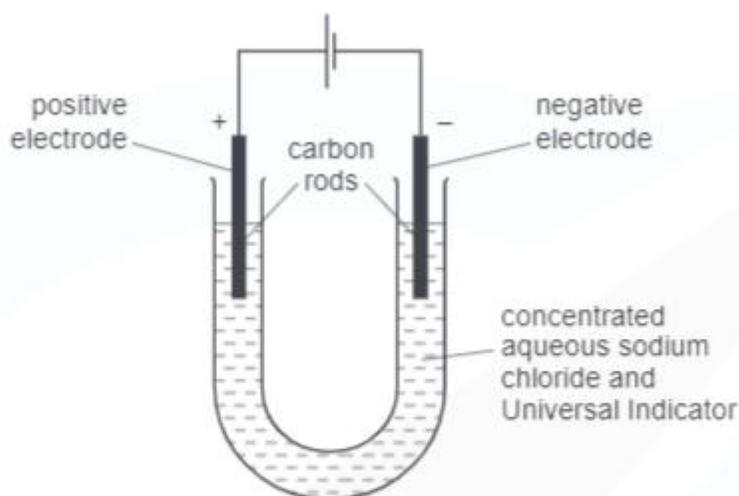
Uses of electroplating

*1-Silver and gold is used to electroplate ornaments or cutlery which are made of metal alloys, making it more **attractive and expensive.***

*2-metal parts of electronic components are often metal plated to ensure the contacts will be **free of 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

