

Name: _____

Electrochemistry	Objectives
20. Electrochemistry	-explain what happens at each electrode during the electrolysis of: <ul style="list-style-type: none"> •copper sulfate solution with copper electrodes •acidified water with inert electrodes -describe the extraction of copper by displacements using scrap iron -describe and explain ionic movement as observed during teacher demonstration -describe the following electrolytic processes: purification of copper, chrome and nickel plating. Give one everyday application of chrome and nickel plating e.g. cutlery -arrange the electrochemical series of metals in order of their ease of oxidation (reactions, other than displacement reactions, not required)

Defⁿ: **Electrolysis** is the use of electricity to carry out a chemical reaction.

Electrolysis is carried out using a battery, electrodes and an electrolyte.

Battery: Provides energy for the reaction to occur.

Electrolyte: Aqueous solution containing dissolved ions so that it can conduct electricity

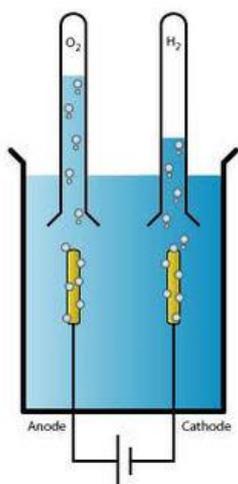
Electrodes: Anode: Positively charged electrode (connected to positive terminal of battery)

Cathode: Negatively charged electrode (connected to negative terminal of the battery)

Electrodes are usually made of carbon or platinum as they are inert (unreactive).

Main events that occur during electrolysis:

1. Anode attracts negative ions (anions) from the electrolyte.
2. The energy from the battery allows the anions to lose electrons to the anode. [OXIDATION of the anions]
3. The cathode attracts positive ions (cations) from the electrolyte.
4. The energy from the battery allows the cations to gain electrons from the cathode [REDUCTION of the cations]



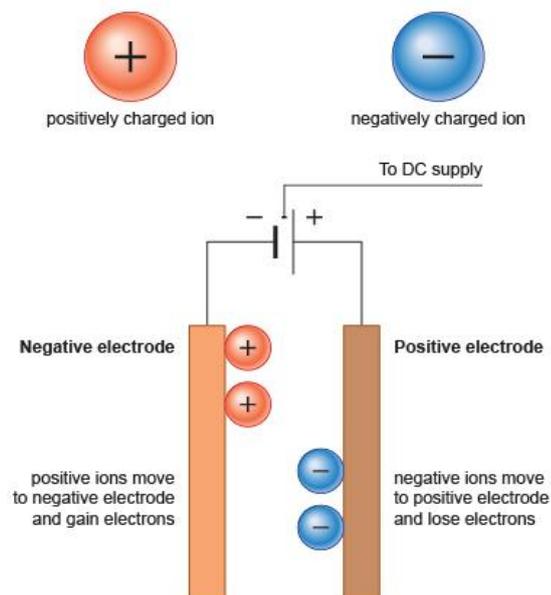
Experiment 1: Using electrolysis on acidified water using inert electrodes

Small amount of H₂SO₄ added to the water to allow it to conduct electricity

Observation: 1 volume of oxygen gas produced at the anode.

2 volumes of hydrogen gas produced at the cathode.

Overall: $\text{H}_2\text{O} \rightarrow \text{H}_2 + \frac{1}{2}\text{O}_2$

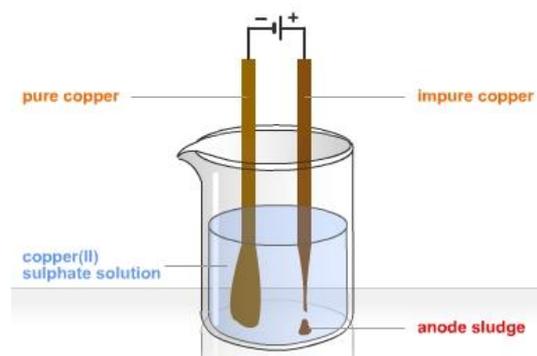


Experiment 2: Using electrolysis on a solution of copper (II) sulphate using copper electrodes.

Observation: Cathode becomes smaller.

Anode grows.

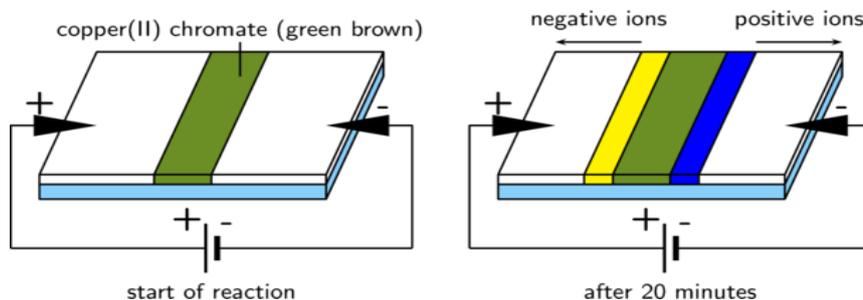
This process is used to purify copper in industry for electronics.



Experiment 3: Showing the movement of ions due to an electric field

Copper Chromate (CuCrO_4) is green in solution. It is made up of Cu^{2+} = blue and CrO_4^{2-} = yellow mixed together.

If put into an electric field, the blue Cu^{2+} is attracted to the negative cathode while the yellow CrO_4^{2-} is attracted to the positive anode.



Electroplating:

Defⁿ: **Electroplating** is where electrolysis is used to put a layer of one metal onto the surface of another.

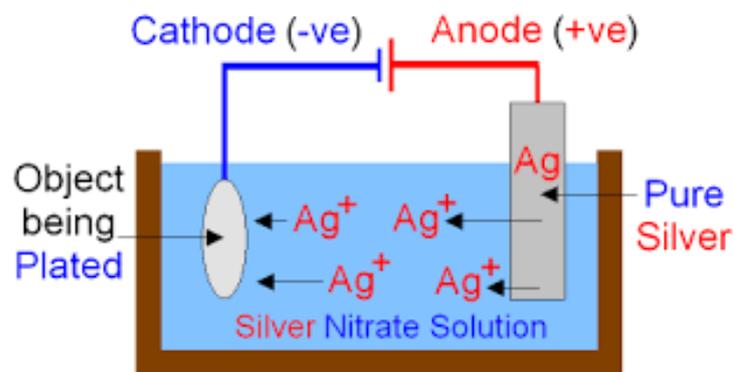
Electroplating is used for plating cutlery, coins and jewellery to make it more attractive. It is also used to plate reactive metals (e.g. Fe) with less reactive metals (e.g. Ni) to prevent corrosion.

Conditions needed for electroplating:

1. The metal to be plated must be the negative cathode.
2. The electrolyte must contain ions of the metal we are plating with.
3. The positive anode must be the metal we want to plate with.

E.g., To plate a nickel (Ni) coin with silver (Ag),

1. The cathode is the coin.
2. The electrolyte must contain Ag ions (in this case, Ag^+ from silver nitrate)
3. The anode is a solid bar of Ag metal.



The Electrochemical Series:

Defⁿ: The **electrochemical series** is a list of elements in order of their standard electric potentials.

In simple English, it is a list of elements. The elements at the top of the list lose electrons more easily than elements further down.

Elements at the top are more reactive than elements further down.

• Please	Potassium (K)	
• Send	Sodium (Na)	
• Lions,	Lithium (Li)	
• Cats,	Calcium (Ca)	
• Monkeys,	Magnesium (Mg)	
• And	Aluminium (Al)	
• Zebras	Zinc (Zn)	
• Into	Iron (Fe)	
• Lovely	Lead (Pb)	
• Hot	Hydrogen (H) (non-metal)	
• Countries,	Copper (Cu)	
• Signed	Silver (Ag),	
• General	Gold (Au)	
• Penguin.	Platinum (Pt)	