

Electroplating

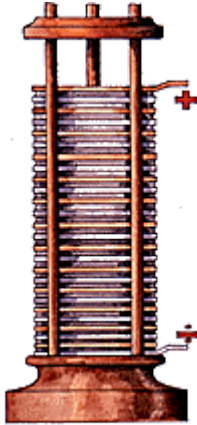
Aims:

- Describe how to electroplate an object
- To be able to decide which electrolyte and anode and cathode to use

What is Electroplating?

- An electrochemical process where metal ions are transferred from a solution and are deposited as a thin layer onto surface of a cathode.
- The setup is composed DC circuit with an anode and a cathode sitting in a bath of solution that has the metal ions necessary for coating or plating
- Electroplating can enhance;
 - Chemical properties---increase corrosion resistance
 - Physical properties---increase thickness of part
 - Mechanical properties---increase tensile strength and hardness

History



- In 1800 Alessandro Volta created the “voltaic pile”
- Was the first galvanic cell able to produce a steady flow of electrical current
- Stack of copper and zinc discs separated by cloth soaked in saline solution (electrolyte)

Electroplating is used to coat one metal onto another to make it look better or to prevent corrosion.

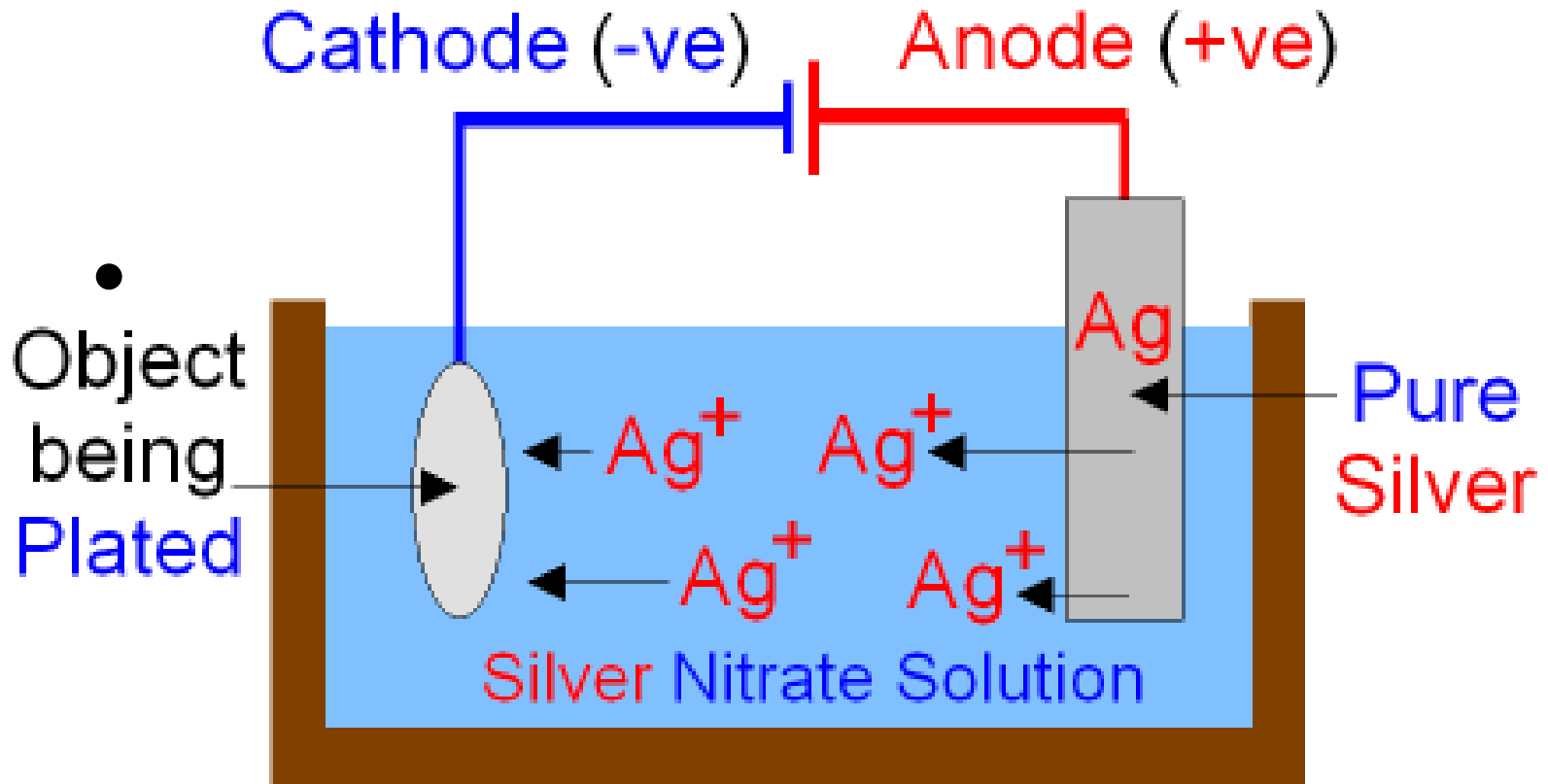
Most metals can be plated.

Common plating metals are gold, nickel
and silver as well as chromium and zinc

- examples of electroplating:

Electroplating Metal	Uses
chromium	water taps, motorcar, and bicycle parts
tin	tin cans
silver	silver-plated sports trophies, plaques, ornaments, knives and forks
nickel	corrosion-resistant layer before electroplating with another metal on top

Silver plating could be done in the cell below



When electricity is passed through the cell silver is dissolved at the anode by oxidation.

Ag⁺ ions go into the silver nitrate solution.



Silver is deposited onto the surface of the object by reduction at the cathode.

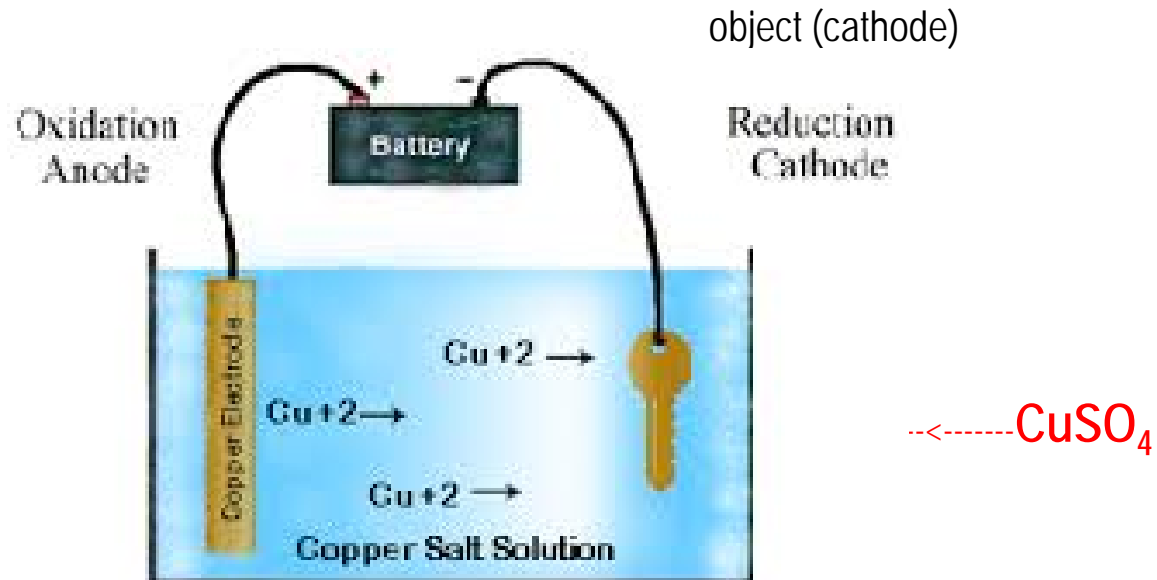


As silver ions move from the anode to the cathode the anode gets smaller as the object becomes silver plated.

This is a redox reaction.

The rate at which the silver ions enter the electrolyte from the anode is the same as the rate at which the silver ions leave the electrolyte at the cathode. The concentration of the silver nitrate solution therefore remains unchanged.

Electroplate a Key with Copper



electroplating with copper

- the electrolyte is CuSO_4 solution
- object is made the cathode; copper is made the anode
- at the anode, copper dissolves



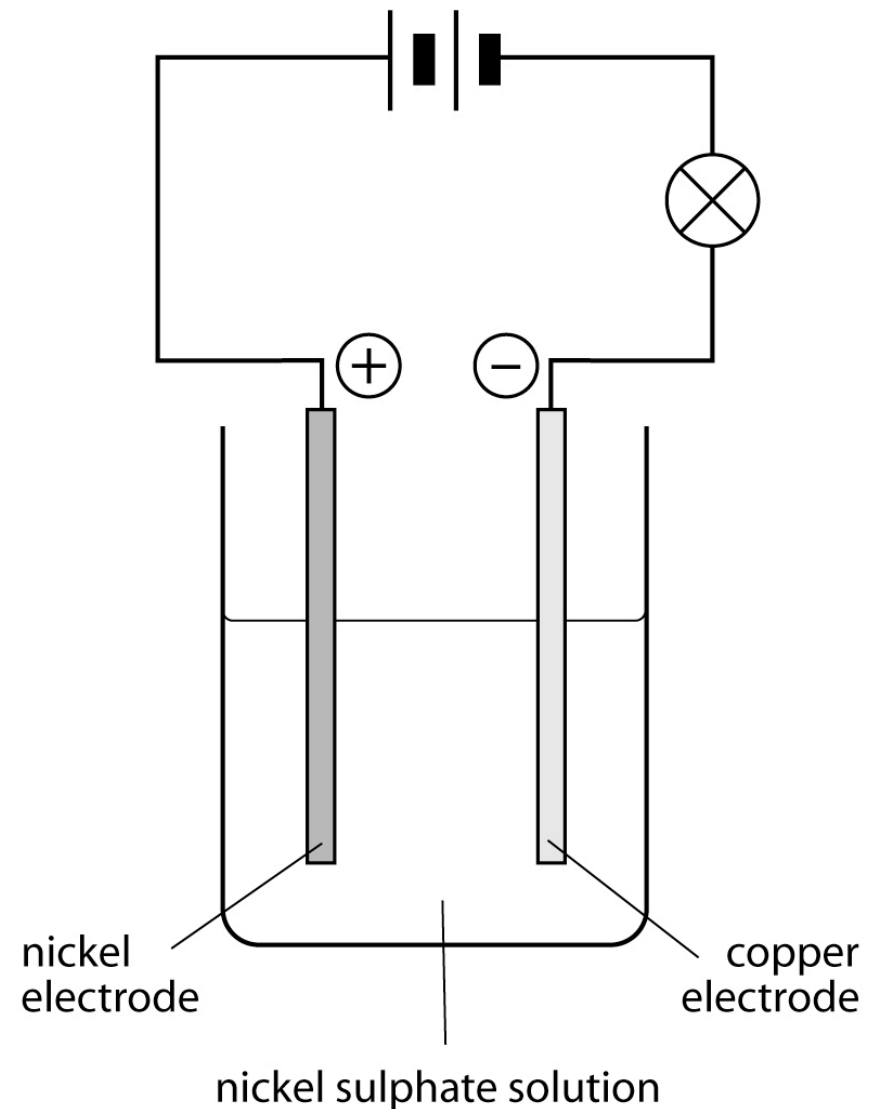
- at the cathode, Cu^{2+} ions are discharged as copper metal and deposited on the object



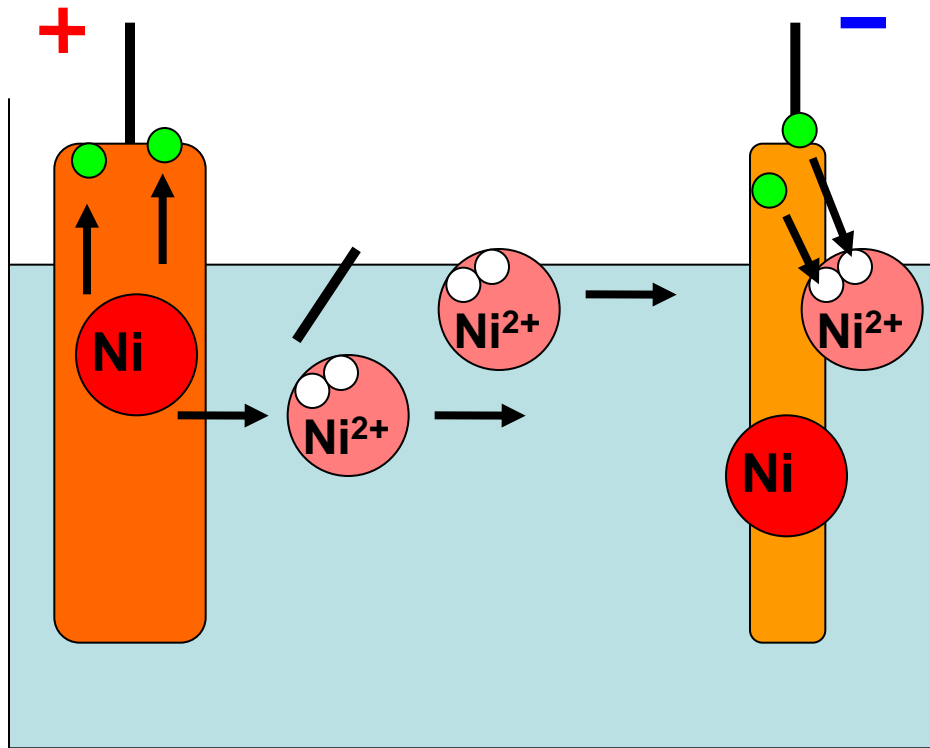
- transfer of copper from anode to the cathode; CuSO_4 solution remains unchanged

Nickel plating

- **Cathode** must be the object you are plating.
- **Anode** must be the metal you are using to coat.
- **Electrolyte** must be a solution containing the metal you want to coat.



METAL THAT
WILL BE USED
TO COAT -
Nickel (ANODE)



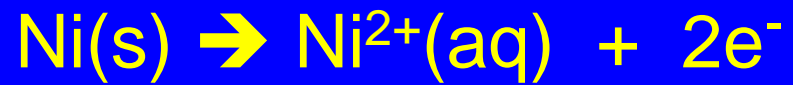
OBJECT TO BE
PLATED - Copper
(CATHODE)

Nickel ions
accept the
electrons. They
then coat the
copper
electrode

Electrolyte – must
contain the metal
which needs to be
coated – NiSO₄

Oxidation Is Loss of electrons, Reduction Is Gain

Anode



Cathode



Many metallic objects can be electroplated in the same way:

- object is made of cathode
- metal used for electroplating is made the anode
- electrolyte is a solution of ions of the metal

Questions

- In each question decide which would be the cathode, anode and electrolyte.
 1. Coating steel with tin.
 2. Coating steel with zinc.
 3. Coating a steel coin with copper.

1. Why does a steel can need to be coated with another metal?
2. How would you choose which metal to use?

