PENANG SANGAM HIGH SCHOOL
P.O.BOX 44, RAKIRAKI
LESSON NOTES

Subject: Chemistry **Year/Level:** 12

Week 9

Strand	3 Quantitative Chemistry
Sub Strand	3.2 Oxidation Reduction
Content Learning Outcome	Describe and explain the electrolytic processes in the production of copper metal.

Application of redox reactions

2. Production of Copper

Copper is extracted from its ore (is a rock or mineral that has enough required metal in it to make it worth extracting from)

Sources of copper: **chalcopyrite or copper pyrite** ($CuFeS_2$) being the major source and others are chalcocite (Cu_2S), malachite ($CuCO_3.Cu(OH)_2$), azurite ($2CuCO_3.Cu(OH)_2$) and cuprite (Cu_2O)

After copper is mined from its ores, it is purified through **electrodeposition.**

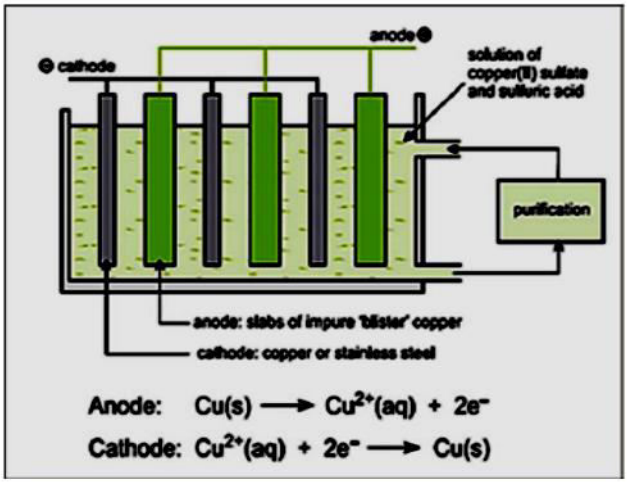
Purification of copper by electrodeposition

The **blister copper anodes** are immersed in an electrolyte containing **copper sulphate and sulphuric acid.**

The name 'blister' copper comes from the fact that this copper has bubbles of sulphur dioxide on the surface.

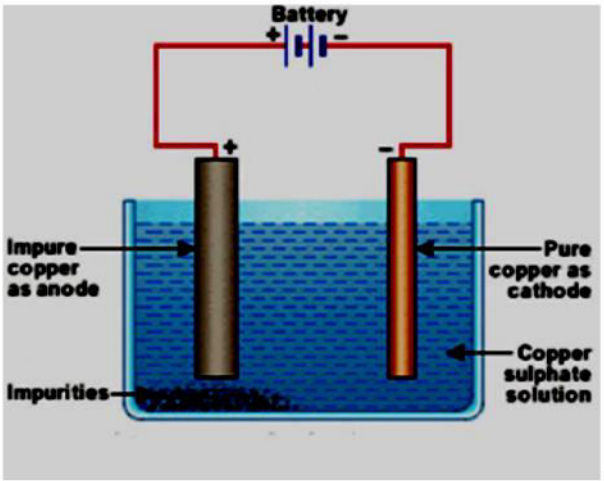
Pure copper cathodes are arranged between the blister copper anodes and a current of over 200 A passes through the solution.

Industrial set-up for refining of copper



Source: http://www.essentialchemicalindustry.org

Laboratory set-up for refining of copper



Source:http://look4chemistry.blogspot.com

When the electric current is passed through the electrolyte ($CuSO_4$), the **Cu^{2+} in the electrolyte is reduced to copper metal (Cu) and gets deposited at the cathode** which is scrapped off.

The **anode dissolves to replace the Cu^{2+}** in the solution.

Summary

- At the anode: $Cu_{(s)} \rightarrow Cu^{2+}_{(aq)} + 2e^-$ } Oxidation
- At the cathode: $Cu^{2+}_{(aq)} + 2e^- \rightarrow Cu_{(s)}$ } Reduction

What happens to the impurities?

- Gold, silver, platinum and tin are insoluble in the electrolyte and so do not deposit on the cathode. They form a valuable **sludge that collects under the anode**.
- Soluble impurities such as iron, arsenic, antimony, bismuth and nickel dissolve in the electrolyte.

Activity

1. List two uses of copper in your daily life.

   _____

2. Explain what do you understand by the term 'blister copper'?

   _____

   _____

3. Name and write the formula of the major source of copper.

   _____

4. What metals are found in the insoluble impurities?

   _____

5. Under which electrode will you find the sludge? _____

6. Name an impurity dissolved in the electrolyte. _____

7. Write down the equations for the reaction occurring at anode and cathode.

   _____

   _____

8. Name the process by which copper is purified. _____