

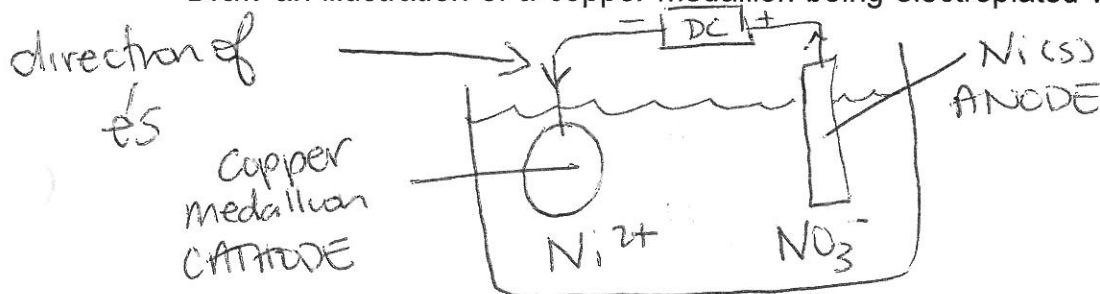
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Chemistry 12  
 Electrochemistry Lesson #13 a  
**ELECTROPLATING and ELECTROREFINING**

**ELECTROPLATING** is the process in which a metal is reduced or "plated out" at a "cathode".

The CATHODE is made out of the material receiving the metal plating.  
 The ELECTROPLATING SOLUTION contains ions of metal which are to be "plated" onto the CATHODE.  
 The ANODE is generally made of the metal that is to be plated, but it may also be an inert material. eg. C or Pt

Draw an illustration of a copper medallion being electroplated with Nickel:



Here the MEDALLION is the CATHODE

At the ANODE oxidation is occurring, the oxidation reaction is:



The electrons always flow from ANODE to CATHODE therefore the DC supply is hooked up to supply the CATHODE with electrons.

The **ELECTROPLATING SOLUTION** contains  $\text{Ni}^{2+}$  and  $\text{NO}_3^{-}$  so that:

$\text{Ni}^{2+}$  : THE SUBSTANCE BEING PLATED ON THE MEDALLION

$\text{NO}_3^{-}$  : ANION THAT DOES NOT PPT OUT  $\text{Ni}^{2+}$

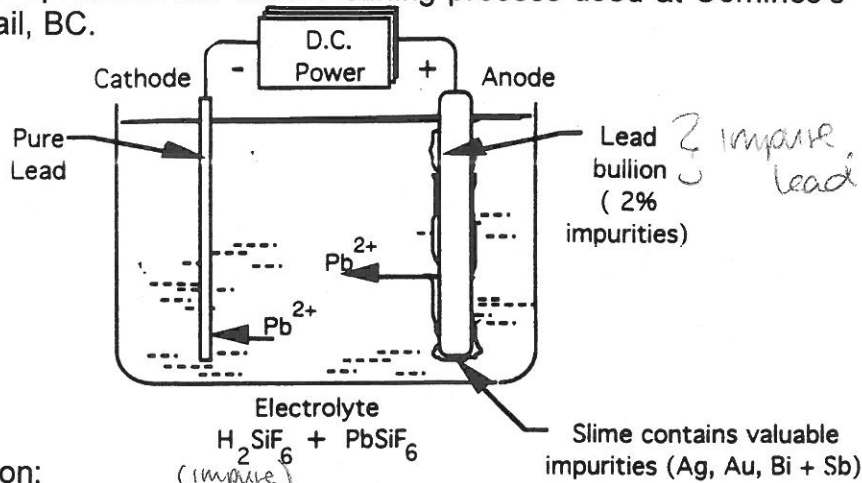
The **CATION**  $\text{Ni}^{2+}$  is attracted to the CATHODE (Cu s)

The **ANION**  $\text{NO}_3^{-}$  is attracted to the ANODE (Ni s)

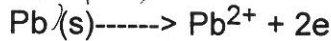
At the cathode the reaction that proceeds is:



**ELECTROREFINING** is the process of purifying a metal.  
 Here is a cell that represents the electrorefining process used at Cominco's lead refinery in Trail, BC.



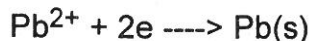
The **ANODE** reaction:



The reaction that prevails is for Pb(s). The reactions with LOWER  $E^\circ$  values dissolve in solution. Those with HIGHER  $E^\circ$  values do not oxidize but make up a Slime at the bottom of the electrolytic cell. Companies such as COMINCO sell the sludge for a profit (notice the presence of Au and Ag).

OXIDIZING AGENT	REDUCING AGENTS	$E^\circ$ (VOLTS)
$\text{Au}^{3+} + 3e^- \rightleftharpoons$	$\text{Au (s)}$ <b>These metals</b>	1.42
$\text{Ag}^+ + e^- \rightleftharpoons$	$\text{Ag (s)}$ <b>do not</b>	0.80
$\text{Cu}^{2+} + 2e^- \rightleftharpoons$	$\text{Cu (s)}$ <b>dissolve</b>	0.34
$\text{Pb}^{2+} + 2e^- \rightleftharpoons$	$\text{Pb (s)}$	-0.13
$\text{Fe}^{2+} + 2e^- \rightleftharpoons$	$\text{Fe (s)}$ <b>These metals</b>	-0.41
$\text{Zn}^{2+} + 2e^- \rightleftharpoons$	$\text{Zn (s)}$ <b>dissolve</b>	-0.76

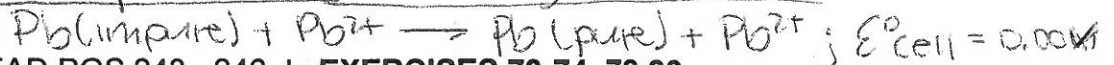
The **CATHODE** reaction:



The  $\text{Pb}^{2+}$  is present in larger amounts in the solution and has the highest  $E^\circ$  value of all ions in solution, therefore it is reduced

	OXIDIZING AGENT	REDUCING AGENTS	$E^\circ$ (VOLTS)
<b>These metals are not present in the solution*</b>	$\text{Au}^{3+} + 3e^- \rightleftharpoons$	$\text{Au (s)}$	1.42
	$\text{Ag}^+ + e^- \rightleftharpoons$	$\text{Ag (s)}$	0.80
	$\text{Cu}^{2+} + 2e^- \rightleftharpoons$	$\text{Cu (s)}$	0.34
	$\text{Pb}^{2+} + 2e^- \rightleftharpoons$	$\text{Pb (s)}$	-0.13
<b>These metals are not deposited</b>	$\text{Fe}^{2+} + 2e^- \rightleftharpoons$	$\text{Fe (s)}$	-0.41
	$\text{Zn}^{2+} + 2e^- \rightleftharpoons$	$\text{Zn (s)}$	-0.76

**OVERALL REACTION:**



**HOMEWORK: READ PGS 243 - 246 do EXERCISES 73-74, 78-80**

**PLO's: W5-W7**

Note: 0.00V is not what is required, a large amount of energy is in fact required as the process occurs at extreme temperatures not @ 25°C