Electrochemical Cells

- a chemical reaction produces electricity
- exothermic
- spontaneous
- *E* (cell potential) is +

Electrolytic Cells

- electricity causes a reaction to occur
- endothermic
- nonspontaneous
- *E* (cell potential) is –

ALL REDOX REACTIONS OCCUR BETWEEN THE STRONGEST OXIDIZING AGENT (SOA) AND THE STRONGEST REDUCING AGENT (SRA)

The following method can be used to predict redox reactions:

Step 1: List all of the chemical species present.

Step 2: Identify the SOA and write its half reaction and E^o value *(**reduction** ½ reaction)*

Step 3: Identify the SRA and write its half reaction and E^o value *(**oxidation** ½ reaction)*

Step 4: Write a balanced net ionic equation from the half reactions and calculate E^o .

Step 5: Determine the voltage *produced* or minimum voltage *needed.*

Example:

An electric current is passed through an aqueous solution of nickel(II) nitrate using inert electrodes. Predict the anode and cathode reactions, write a balanced equation for the overall reaction, and determine the voltage required for the reaction.

<u>Method:</u> <u>Answer:</u>

Step 1: List all of the chemical species present.

Step 2: Identify the SOA and write its half reaction and E^o value .
*(ie. **reduction** half reaction)*

Step 3: Identify the SRA and write its half reaction and E^o value .
*(ie. **oxidation** half reaction)*

Step 4: Write a balanced net ionic equation from the half reactions and calculate E^o .

Step 5 Determine the voltage *produced* or minimum voltage *needed.*

For each of the following electrolytic cells, write the half reactions, the overall reaction, and determine the minimum voltage needed for a reaction to occur.

1. Electrolysis of aqueous sodium sulfate

2. Electrolysis of aqueous sodium chloride

3. Electrolysis of aqueous potassium iodide

4. Electrolysis of aqueous copper(II) sulfate