

# 21 • Electron Transfer Reactions

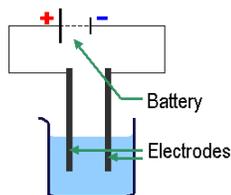
## STUDY LIST

### General Terms

I can...

- Determine the oxidation number of any element.
- State that oxidation number is the charge an atom would have if all of the shared electrons were assigned to the more electronegative atom.
- Identify for any element in a reaction whether it is gaining or losing electrons (LeO GeR).
- Explain that when oxidation occurs, reduction must also occur (RedOx).
- Correctly apply the terms oxidizing agent and reducing agent to a redox reaction.
- State that there are two big topics in electrochemistry, (1) **Electrolysis**—in which electricity (moving electrons) causes chemical change, and (2) **Electrochemical Cells**—in which chemical changes cause a flow of electrons (electricity).

### Electrolysis



I can...

- State that during electrolysis, electricity applied to a solution causes ions to migrate to the electrodes.
- State that an electrode is the part of the conductor that touches the solution.
- State that reduction always occurs at the cathode (red cat).
- State that oxidation always occurs at the anode (an ox).
- Write equations for the reactions that occur at the electrodes when water undergoes electrolysis (memorize how to derive these).  
 (-) cathode:  $2 \text{H}_2\text{O}(\text{l}) + 2 \text{e}^- \rightarrow \text{H}_2(\text{g}) + 2 \text{OH}^-$   
 (+) anode:  $2 \text{H}_2\text{O}(\text{l}) \rightarrow \text{O}_2(\text{g}) + 4 \text{H}^+ + 4 \text{e}^-$

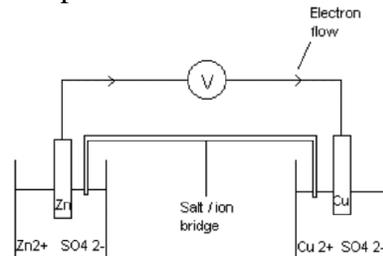
- Explain that during the electrolysis of an ionic solution, either the + ion can be reduced or water can be reduced. In the same way, either the - ion can be oxidized or water can be oxidized.
- Use a reduction potential chart to determine which of two substances is more likely to be reduced or oxidized.
- State that electrical current is measured in Coulombs and  $1 \text{ Coulomb} = 1 \text{ amp} \cdot 1 \text{ sec}$ .
- State that  $1 \text{ Faraday (F)} = 1 \text{ mole of electrons} = 96,500 \text{ Coulombs}$ .
- Use the Faraday, amps and seconds to quantify electrolysis problems.

### Electrochemical Cells

#### (Voltaic Cells & Galvanic Cells)

I can...

- State that oxidization always occurs at the anode and reduction always occurs at the cathode.
- Draw a simple electrochemical cell:



- Use the reduction potential chart to determine which chemical is the anode (smaller  $E^\circ$ ) and which chemical is the cathode (larger  $E^\circ$ ).
- State that standard conditions are  $25^\circ\text{C}$ , solutions are  $1 \text{ M}$ , and gases are  $1 \text{ atm}$ .
- Calculate the voltage of a standard cell as the difference in the two  $E^\circ$  values. (not like Hess)
- State that the anode is the (-) electrode because the chemicals are being oxidized (losing  $\text{e}^-$ 's).
- State that for non-standard cells, changes that drive the reaction forward increase the voltage. (The Nernst equation allows you to calculate this voltage for a non-standard cell.)