Dougherty Valley • AP Chemistry

Electrochem: Application of Thermodynamics

S-92

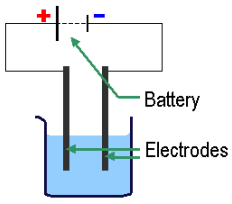
STUDY LIST From Paul Groves

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



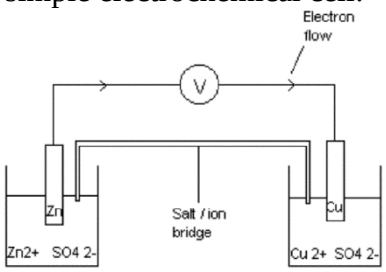
I can…

- ☐ 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: $2\ H_2O(l) + 2\ e^- \rightarrow H_2(g) + 2\ OH^-$
  (+) anode: $2\ H_2O(l) \rightarrow O_2(g) + 4\ H^+ + 4\ e^-$
- ☐ 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 Coulomb = 1 amp·1 sec.
- ☐ State that 1 Faraday ($\mathcal{F}$) = 1 mole of electrons = 96,500 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°) and which chemical is the cathode (larger E°).
- ☐ State that standard conditions are 25°C, solutions are 1 M, and gases are 1 atm.
- ☐ Calculate the voltage of a standard cell as the difference in the two E° values. (not like Hess)
- ☐ State that the anode is the (–) electrode because the chemicals are being oxidized (losing 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.)