Chapter 12 – Electrochemistry

Know the difference in voltaic vs electrolytic cells

Know how to write half-reactions for both oxidations and reductions.

Know how to combine 2 half-reactions to give an overall cell reaction. (electron balance?)

Know how to draw a picture of both a voltaic and an electrolytic cell if given the shorthand notation.

anode | anodic solution || cathodic solution | cathode

where the "|" are phase changes and "||" is a salt bridge.

What is a salt bridge and what is it used for?

Which electrode is the anode? the cathode?

What's the sign convention used for the cathode and anode?

What's the significance of the SHE?

What's an inert electrode? Used for what? Pt in the SHE, graphite in a dry cell

How do electric current and electron flow relate? they are opposite in direction

Know what standard conditions are and how it is symbolized (same as always).

How to use the Nernst Equation to get cell potentials at non standard conditions.

$$E = E^0 - \frac{RT}{nF}\ln Q \qquad E = E^0 - \frac{0.0257}{n}\ln Q \qquad E = E^0 - \frac{0.05916}{n}\log Q$$

How to convert between ΔG, E, and K.

$$\Delta G^0 = -nFE^0 \qquad \Delta G^0 = -RT\ln K \qquad nFE^0 = RT\ln K$$

Calculations, how to get:

- Number of grams of metal for a given electrolytic deposition. $\frac{I \cdot t}{F \cdot n} = mol\ of\ rxn$
- Number of liters of gas formed during an electrolysis.
- E^0 for any half-reaction (look up in table).
- E^0 for any overall cell reaction. $E^0_{cell} = E^0_{red} + E^0_{ox}$ or $E^\circ_{cell} = E^\circ_R - E^\circ_L$
- E for any half-reaction (non std conditions, use Nernst) "n" here is the # of e^- in the 1/2 rxn
- E for any overall cell reaction. (E_{cell} for non standard conditions, use Nernst) "n" here is the # of total e^- cancelled out in the whole rxn.
- How to calculate K (or K_{sp}) for a reaction using electrochemical data. The key is to find the 2 half-reactions that add up to equal the overall K_{sp} reaction. Remember, all K_{sp} reactions are just dissociations: $MX(s) \rightarrow M^+ + X^-$
- What is corrosion? What are some methods of protecting against corrosion?
- General concepts of batteries - see class notes for this.
- What's the difference in a primary, secondary, and fuel cell?
- What is the reaction for a lead storage battery? On discharge? Recharge?
- What would make one battery capable of delivering more current than another if they have the same potential (voltage)?

Chapter 13 – Chemical Kinetics

Refer to equation sheet that is available on our web site for formulas.

- Know how to express (show) the rate of a reaction in terms of ANY of the reactants or products. This also means being able to calculate one rate from another.
- What FOUR factors affect reaction rates?
- Know how to obtain the rate law and value of k by the method of initial rates. (those tables of data)
- Know how reaction order relates to concentration for 0, 1st, and 2nd order reactions.
- Know how to calculate for different variables in the integrated rate law equations
  - Know how to calculate the **concentration** of a reactant (or product) at a particular time (t).
  - Know how to calculate the value of the **rate constant** (k) using the proper integrated rate equation.
  - Know how to calculate the **time** (t) required to reach a particular final concentration.
  - Know how to calculate the **half-life** (what is it?) for a particular reactant.
  - Can you calculate the concentration of a PRODUCT after a given amount of time? You should be able to.
- What should you **PLOT** to get a straight line for 0, 1st, and 2nd order kinetics?
- Know the criteria for an **effective collision**. (see collision theory)
- Know how to interpret and write a plausible **Reaction Mechanism** for a chemical reaction. What are **elementary steps**?
- Know **transition state theory** and how it relates to a **potential energy diagram**.
- Be able to interpret information from a potential energy diagram: values for ΔH, (or ΔU) and $E_{a,f}$ and $E_{a,r}$, ...
- How do catalysts affect reactions? How is this represented on a potential energy diagram?
- Arrhenius Equation: Know relationship (equation) between k_1, T_1, k_2, T_2, and E_a :

  do know this version $k = Ae^{-E_a/RT}$ although we use this version the most…

  $$\ln\frac{k_2}{k_1} = \frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$ be able to calculate any 1 of the 5 variables in this equation.

- Know how a catalyst works. How does it affect a potential energy diagram? What is the difference in a homogeneous and a heterogeneous catalyst? Do a catalyst affect thermodynamic state functions? What are catalysts in living systems called?