Announcements

- Turn on the Clicker (the red LED comes on).
- Push “Join” button followed by “20” followed by the “Send” button (switches to flashing green LED if successful).

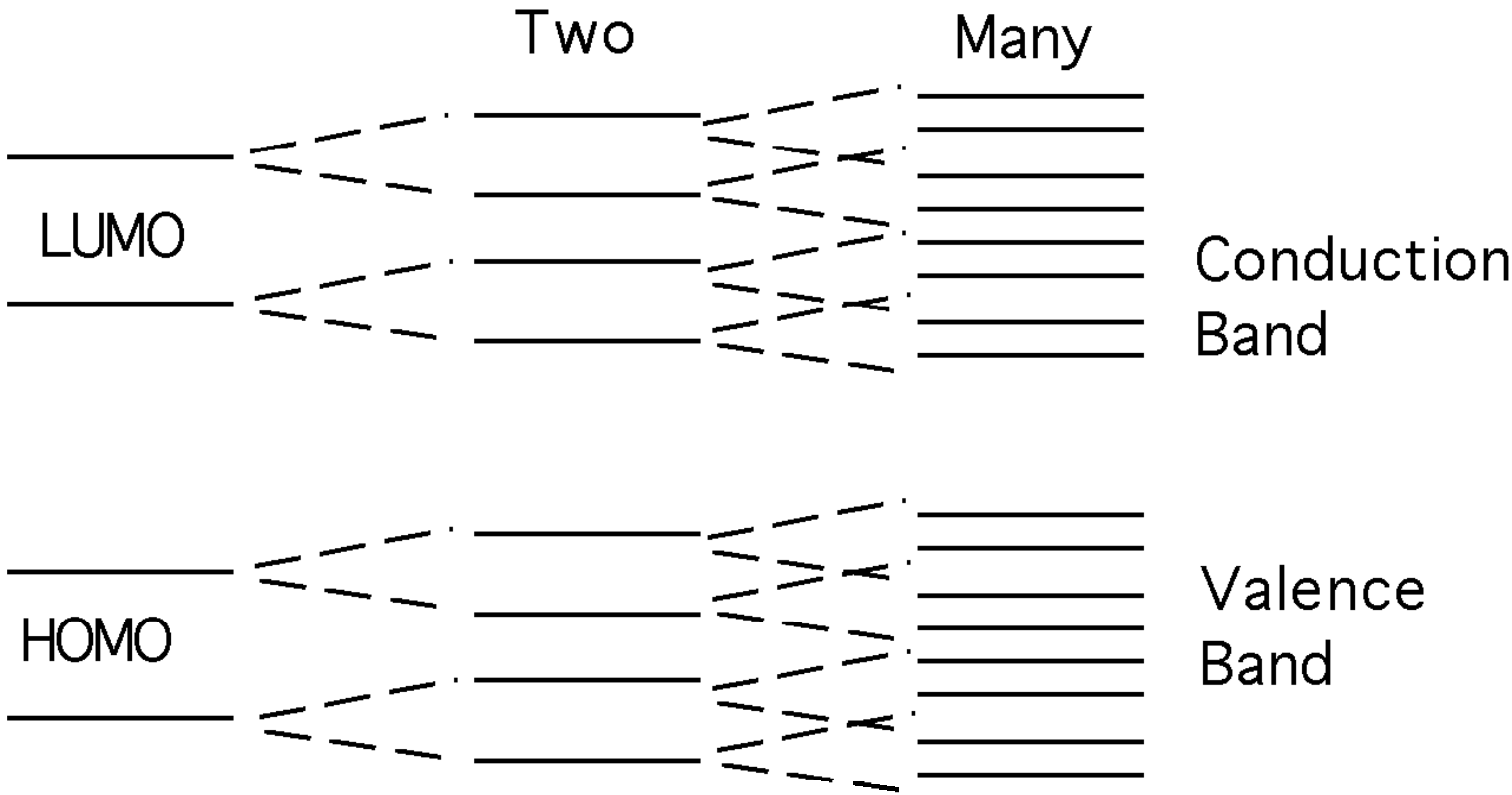
- Last Exam Thursday.
- Review in discussion tomorrow.

- Don't forget to check out of lab and get your artwork, lab notebook and goggles.
- Get enough sleep this week.

Review

- Al forms a dense protective oxide that prevents deterioration of the underlying metal.
- Ceramics = a compound or mixture of compounds that have been transformed by heating.
  - Most commonly made from kaolinite clays
  - Usually hard and heat resistant
- Semiconductors = materials that conduct electricity poorly.
  - Conductivity increases with increasing temperature.
  - Properties changed by doping (introducing small amounts of impurities, p-type vs. n-type doping)
  - Explanatation = Band theory

Band Theory



- In metals band gap ≈ 0, so electrons in conduction band.
- In insulators (most ceramics, glass, etc.) band gap is large.
- In semiconductors band gap is small enough that thermal energy can excite electrons into the conduction band.

17_18.jpg

Cellulose and Starch

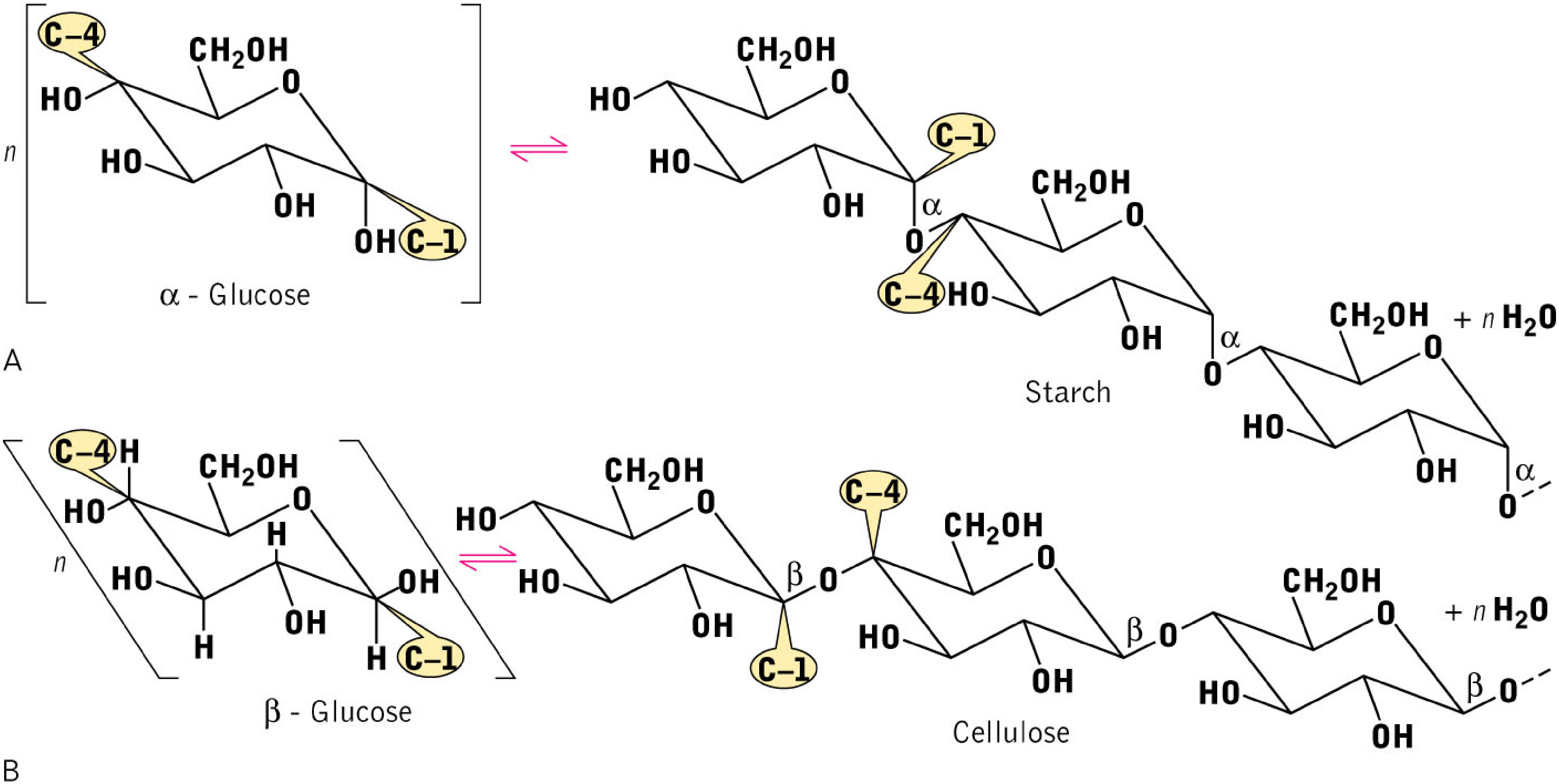
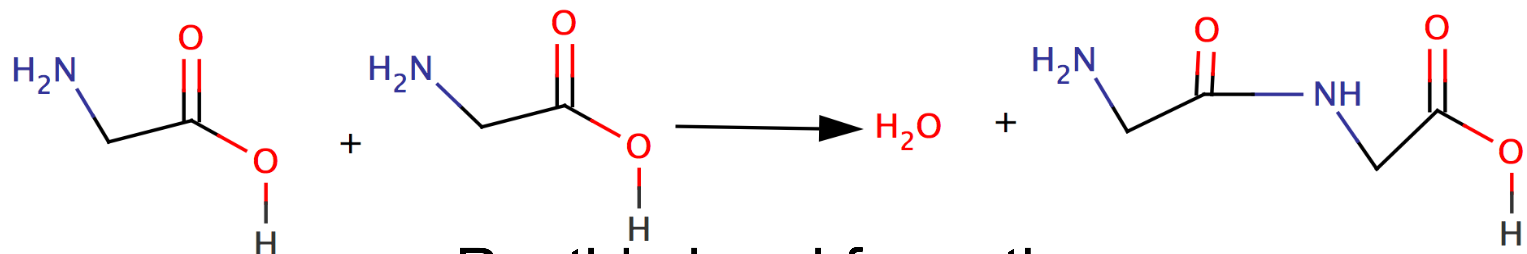


Fig. 12.18



Peptide bond formation.

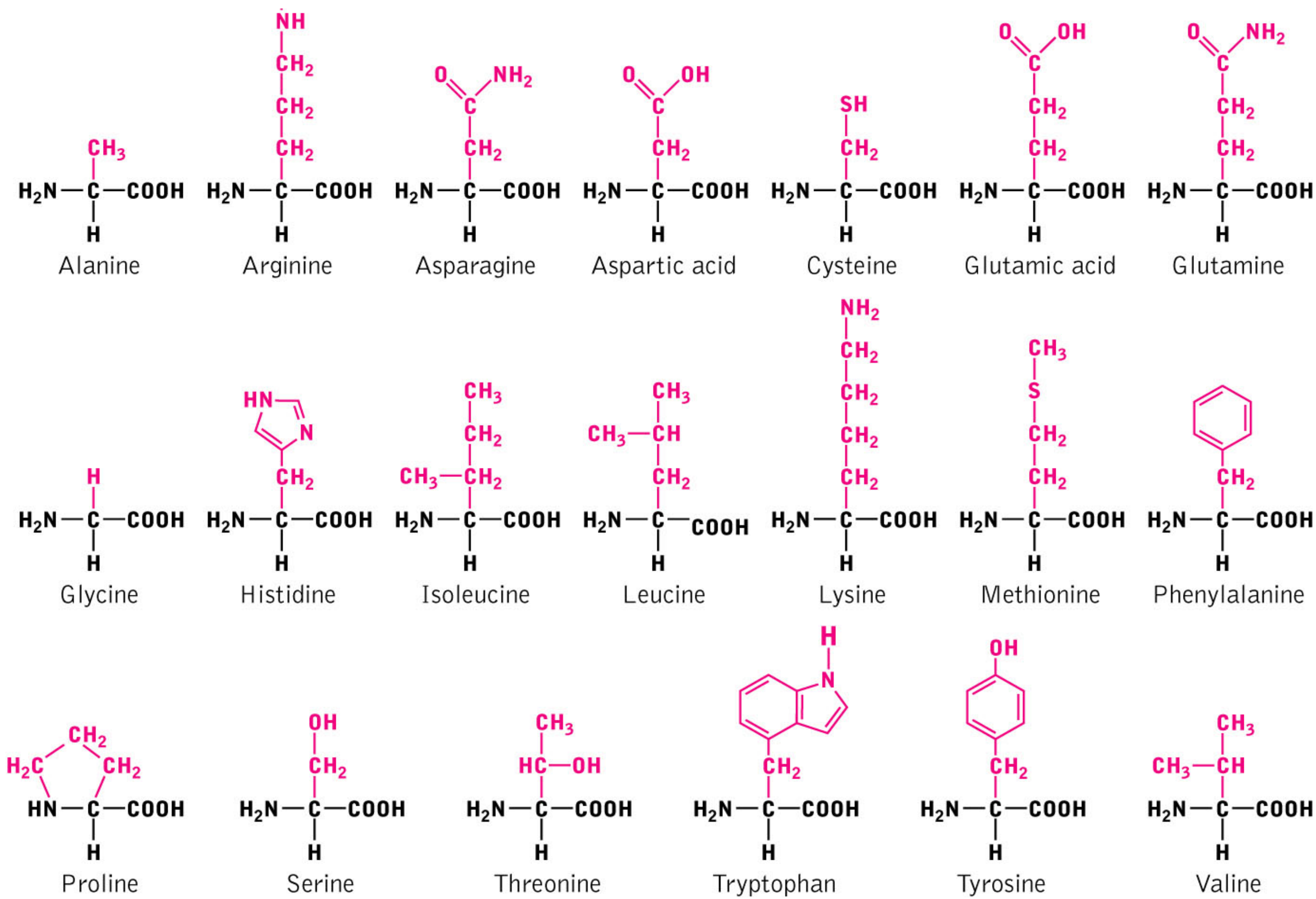


Figure 13.10

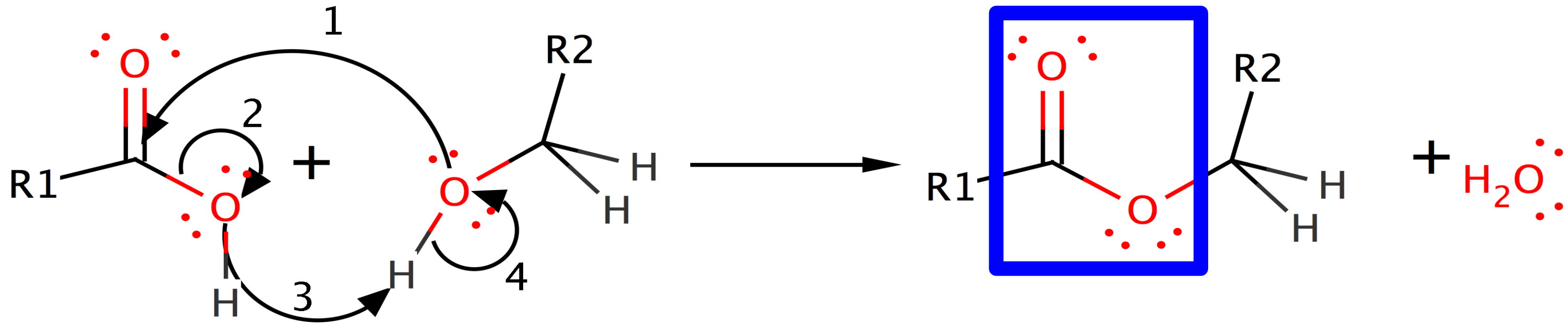
Silk

Fig. 18.18

Wool

Fig 18.19

The reaction at right is catalyzed by H+ (left out for clarity). Arrows represent electron pairs forming bonds or bonds forming electron pairs.



- Condensation polymers release H_2O while forming.
- HO– or H_2N– can be the source of the linking atom and one of the hydrogens used to form the water.
- Look for the boxed linkages to recognize condensation polymers.

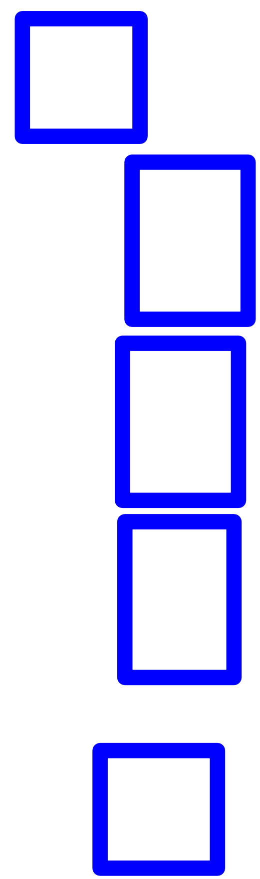
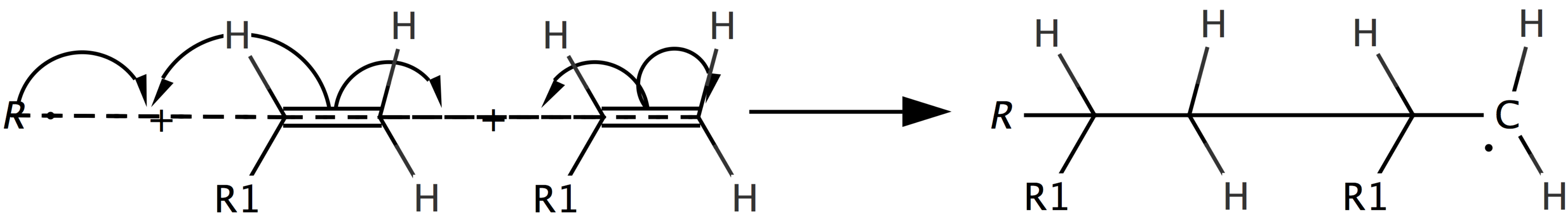


Table 18.2



In above cartoon arrow represent motions of single electrons.

- Addition polymerization releases no by products.
- Radical (unpaired electron) propagates down the chain
- Look for polymers with no amide or ester linkages, just C–C bonds.

Table 18.2

Review

- Voltaic Cells
- Assigning Oxidation #'s (oxidation states)
- Redox Reactions and Balancing them.
- Energetics of Redox Reactions $\Delta G = -nFE$
- Standard half-cell reduction potentials
  - $E^{o}_{cell} = E^{o}_{red} + E^{o}_{oxid}$
  - $E^{o}_{cell} = E^{o}_{cath} - E^{o}_{anode}$
  - $E^{o}_{cell} = |E^{o}_{1} - E^{o}_{2}|$

Review

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- Concentration dependence of cell potential (Nernst equation)

$$E_{cell} = E^o_{cell} - \frac{RT}{nF}\ln Q$$

- to calculate E_{cell}. $at\ 25\ {}^oC\ E_{cell} = E^o_{cell} - \frac{0.0592}{n}\log Q$
- K_{eq} can be calculated given E^o_{cell} because Q = K_{eq} when E_{cell}=0.
- Total energy capacity of batteries in terms of moles (or grams) of reagent available.

Review

- Total energy capacity of batteries in terms of moles (or grams) of reagent available or used versus coulombs (charge) passed or amp-hours.
- Electrolysis and recharging batteries.
  - Any pair of reactions where $|E_1-E_2|$ less than $V_{applied}$ can go.
  - RXN with highest E^o_{red} in a pair will go in reverse as an oxidation.
  - Pair with the smallest potential difference is the most likely.
  - RXNs that use species(reactants) in low concentration are not very likely.
  - Reduction of alkali metal ions (K^+, Na^+, etc) to metal is unlikely since the metals reoxidize with water to form $M^+ + OH^- + H_2(g)$
  - RXNs that produce gases have an **overpotential,** so go very slowly without a significantly larger potential difference than the one expected from reduction potentials.
- Fuel cells and low emission vehicles.

Review

- Metals
  - Physical properties –Work hardening
  - Electronegativities
  - Refining/Smelting (oxidize to oxide then reduce with CO)
- Al processing
  - Separate from ore with NaOH
  - Acidify and heat to get Al_2O_3
  - Electrolytically reduce dissolved in molten cryolite (Na_3AlF_6)
- Alloying
  - Usually makes metal harder
  - Substitutional versus Interstitial Alloys
  - Can reduce corrosion (Ni and Cr w/Fe)

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