Unit 4.1 Summary

- interaction of light and matter
  - need to understand the relationships between wavelength, frequency and energy
  - need to understand how light can break chemical bonds
- reactivity of ozone
  - Chapman cycle (establishment of steady state concentrations)
  - production of persistent radicals and their interactions with ozone
  - understand the function of catalysts
  - role of CFCs and related materials in ozone depletion
- environmental, biological and political effects of ozone depletion

Unit 4.2 Summary

- energy balance: all of our energy comes from the sun
  - greenhouse effect vs enhanced greenhouse effect
- “global climate change” is a better descriptor of the whole ‘experiment’ we’re currently undertaking with the Earth
  - remember: the planet will be fine no matter what happens
- molecular shapes tell us what molecular vibrations are operative
  - start with Lewis (dot) structures, then consider that electron pairs repel each other
  - infrared radiation
  - there must be a change in dipole for a vibration to contribute to warming
- mass and the mole
  - use balanced chemical equations and unit analysis to determine things like the amount of carbon put into the atmosphere
- carbon cycle
  - natural forcings vs anthropogenic forcings
- data collection and interpretation:
  - difference between correlation and causation
  - scientific arguments about theories versus legal/political coverage of the issues

Unit 4.3a Summary

- Concepts
  - definitions of redox terms
    - oxidation: a compound loses electron(s)
    - reduction: a compound gains electron(s)
  - determination of oxidation state
  - combustion is a redox reaction: check out the oxidation states of the reactants and products
  - galvanic cells and batteries
    - cathode (+): where the reduction takes place
    - anode (-): where the oxidation takes place
    - V = I*R Voltage = Current * Resistance
  - biological redox
    - reactive oxygen species (hydroxyl, superoxide, peroxide)
    - effects on proteins, DNA
  - thermite reaction: exploiting the propensity of some metals (e.g. Aluminum) to oxidize very easily

Unit 4.3b Summary

- Concepts
  - macronutrients
    - fats
    - Proteins
    - carbohydrates
  - Vitamins (hydrophilic, hydrophobic)
  - Minerals (macro: P, S, Cl, Mg, Ca)
  - Essential
    - Amino acids
    - Fats
  - 21 EJ to feed the world (44 GJ/person)
  - Nitrogen cycle (range of oxidation states)
  - Need nitrogen for fertilizer to feed the world

Ozone Layer

What's ozone & where is it?

What's light?

What do O_2 and O_3 do for us in Stratosphere?

Why is UV radiation bad for us?

What do sunscreens do?

What causes Ozone layer destruction?

Where do $Cl^{\bullet}$ come from?

Ozone Layer, cont.

What do CFCs do for us?

What have we/are we doing about them?

Global Warming

What is it?

What type of light is involved?

Which molecules are the major players?

What happens to the molecules?

Carbon Cycle

What puts Carbon in the atmosphere?

What takes Carbon out of the atmosphere?

How much are we talking about?

What are the major greenhouse gases?

What type of light (radiation) is involved?

What makes something a major greenhouse gas?

What are important factors in climate models?

What can we do about global warming?

What are the major fossil fuels? Where is the energy used?

Redox

- Concepts
  - definitions of redox terms
    - oxidation: a compound loses electron(s)
    - reduction: a compound gains electron(s)
  - determination of oxidation state/charge (oxygen takes electrons)
  - combustion is a redox reaction: check out the oxidation states of the reactants and products

    $C_nH_m \rightarrow nCO_2 + H_2O$

    $O_2 \rightarrow H_2O$
  - galvanic cells and batteries
    - cathode (+): where the reduction takes place
    - anode (-): where the oxidation takes place
    - V = I*R Voltage = Current * Resistance
  - biological redox
    - reactive oxygen species (hydroxyl, superoxide, peroxide)
    - effects on proteins, DNA
  - thermite reaction: exploiting the propensity of some metals (e.g. Aluminum) to oxidize very easily

What is a galvanic cell?

What is a battery?

What is a electrolytic cell?

What is the chemistry of galvanic & electrolytic cells

What are anodes and cathodes?

When we say a 9 volt battery what are we saying?

In the following reaction which species is being oxidized?

$2Ni(OH)_2(s) + Cd(OH)_2(s) \rightarrow Cd(s) + 2\ NiO(OH)(s) + 2\ H_2O(l)$

In the above reaction which species is being reduced?

Oxygen more electronegative than most, we say it takes electrons from almost all other elements so O^{2-}, OH^-, other polyatomic anions we've seen

Nitrogen cycle

What is reactive nitrogen?

What are man-made/man-caused sources of reactive nitrogen?

What is the Nitrogen cycle?