Announcements

- HW 5 and Quiz 9 results posted
- I will be incommunicado until late Monday night
- Quiz results were again excellent with two caveats
- On Question 1, a significant number of people missed "with a brief explanation **based solely upon relative position in the EC Series**" and just answered "yes" or "no"
- What's wrong with the following combination:
  - The reduction of HNO_2 to NO by Sn^{2+}
  - $Sn^{2+} + 2e- => Sn(s)$
- Pulldown lists of Eo s have been added to the pages

Latimer Diagram

- The Latimer Diagram for Mn

$$MnO_4^- \xrightarrow{0.564} MnO_4^{2-} \xrightarrow{0.274} MnO_4^{3-} \xrightarrow{4.27} MnO_2 \xrightarrow{0.95} Mn^{3+} \xrightarrow{1.51} Mn^{2+} \xrightarrow{-1.18} Mn$$

1.507

1.70

A few more Comments on LeChatelier

- Consider the following generic redox rxn
- $2A(aq) + 3B(aq) + 6H^+(aq) \Leftrightarrow C(aq) + 2D(aq) + 3H_2O$
- When the reaction is not at equilibrium:
  - what is the sign of E when the reaction is ocurring L to R
  - R to L
- If the system is at equilibrium(E=0), what is the sign of the potential resulting from each of the following:
- addition of C
- decrease in V
- increase in the pH

Concentration Cells

- A concentration cell derives its potential from the difference in concentration between the right and left sides. Your text, sec 18.7 describes the pH meter-a similar application.
- $M|M^+(aq, L)||M^+(aq, R)|M$

- The cell reaction is $M^+(aq, R) => M^+(aq, L)$
- Nernst equation: $E = E^o - (RT/nF) \ln Q$
- But $E^o = 0$! (Do you see why?)
- $Q = [L]/[R]$
- So for a conc. cell, $E = - (RT/nF) \ln ([L]/[R])$
- Recall that the potential doesn't change much for relatively large changes in Q. Thus, **extremely small concentrations** can be detected.
- If one of the electrodes is designed such that the concentration is 1.00M, the resultant potential can easily be converted into a concentration
   - $E = - (0.0257/n) \ln[L]$ if([R]=1.00)
- A cell is designed such that [R]=1.00M. If n=2 and the measured potential is 0.10V what is [L]?
   - $-0.10(2/.0257)=\ln[L]$ $[L]=4.2*10^{-5}$

Organic Chemistry

- The study of carbon based compounds is called organic chemistry-someone obviously feels that carbon is the critical element in life.

- What are the characteristics of carbon that make it uniquely suited as the basis for highly complex compounds? Why wouldn't silicon do?

Ground Rules

- There's a fairly well accepted general methodology for discussion of organic chemistry which is almost mandated by the breadth of the field.
  - One first divides the topic into categories based upon particular compound type and functional groups
  - Each compound type is addressed with emphasis on topics such as:
    - structure and properties
    - nomenclature
    - preparation
    - reactions
  - Simultaneously general categories such as mechanisms and reaction types which are not compound limited are discussed.
- We are going to be doing a very brief introductory survey of a smidgen of the above.

Hydrocarbons

- Compounds which contain only C and H are called hydrocarbons. You're familiar with many of these:
  - CH_4-methane-natural gas
  - C_3H_8-propane
  - C_2H_2-acetylene
  - C_6H_6-benzene

- There is no limit to the length of the carbon chain. In polyethylenes, for example, it can be many thousands of carbons long.

- The grouping is often divided into compounds with only C-C bonds (alkanes), those with 1 or more C=C bonds (alkenes), those with one or more CC triple bonds (alkynes). The categories saturated, unsaturated, cyclics and aromatics are also commonly used.

- Saturated hydrocarbons contain only single bonds and do not have any rings: CH_4, C_2H_6, C_3H_8, C_4H_{10},….$C_{14}H_{30}$. These are all alkanes. However, depending on the perspective used, not all alkanes are unsaturated.

- What is the relationship between the number of carbons and the number of hydrogens for a saturated hydrocarbon?

- Properties. Since the interactions are London forces, their strength is largely a function of size (carbon count) and structure (linear have greater contact area than branched)

- Naming-see Table 23.1-know up to octane. Not going to be concerned with branched compounds-you'll get that in OChem.

- Reactions of saturated hydrocarbons. What is the most obvious thing you can do with a compound containing only C and H?

- This property is also a quick test of whether a compound is organic. $CBrF_3$ is used as a fire suppressant in "Halon" systems. Why doesn't it burn?

- $CH_4 + Cl_2$ +light $=> CH_3Cl$ text p. 999

Functional Groups

- In principle, introducing any element other than C or H to a hydrocarbon will introduce new chemistry (functionality).

- Your text has a short list of Functional Groups-Table 23.1
- We'll return to this area later

Sites of unsaturation in hydrocarbons

- A saturated hydrocarbon will follow the formula C_nH_{2n+2}
- An unsaturated site requires the removal of 2 Hs
  - a double bond or a ring is a single unsaturation
  - a triple bond equals two unsaturations
- For a hydrocarbon of formula CnHx, what equation permits the determination of the number of unsaturations?
- For the formula C_7H_{10} what are the possible combinations of unsaturations?
- If saturated, there would be 2*7+2=16 Hs. Thus, 6H's "are missing" and this corresponds to 3 unsaturated sites. These could be distributed as follows:
  - 3 double bonds
  - 2 double bonds and a ring
  - 1 double bond and a triple bond
  - 1 double bond and 2 rings
  - 3 rings (not likely with only 7 carbons)
  - 1 ring and a triple bond (triple bond not likely to be in the ring)
  - How many different possible structures would this be?

Some more naming

- alkenes and alkynes are named by changing the suffix as appropriate and preceding the name with the number indicating the position of the multiple bond. Be careful about counting. Both of the following are 2-pentene
  $H_3CCH=CHCH_2CH_3$ $H_3CCH_2CH=CHCH_3$
- cyclic compounds use "cyclo" before the hydrocarbon root as in cyclobutane
  - simple cycloalkenes with a single double bond do not require numbers to specify the location.