Week 2

Families of Carbon Compounds / Acids and Bases

2.1 Families of Carbon Compounds

10/7:

- Hydrocarbons:

  - Alkanes (C_nH_{2n+2}) and cycloalkanes C_nH_{2n}.
  - Alkenes (C_nH_{2n}).
  - Alkynes (C_nH_{2n-2}).

- Aromatic:

  - Contains a benzene ring.
  - All bonds $\sim 140\,\text{Å}$.
  - All carbons sp^2.
  - Planar.
  - π electrons above and below the ring.
  - Special stabilization.

- Covers drawing dipoles.

- Polar and nonpolar molecules:

  - Dipole = distance $\times$ change between charges.
  - $\mu = r \times Q$
  - $1\,\text{D} = 3.336 \times 10^{-30}\,\text{C m}$.
  - Analyzes molecules by drawing a Lewis structure, drawing a dipole along each bond, and drawing and labeling a net dipole, if applicable.
  - Goes through a number of examples.
  - Acetonitrile is a strong polar solvent.

- **Functional group**: A common arrangement that determines shape, bonding physical and reactivity of organic compounds.

- Families of carbon compounds:

  - Hydrocarbons: Aliphatic, aromatic.
  - Methyl, ethyl, propyl, $R =$ alkyl groups.

- Phenyl: Ph- or ϕ-.
- Benzyl: $\text{Ph}-\text{CH}_2$-, $\text{C}_6\text{H}_5\text{CH}_2$-, Bn-
- Compounds with $\text{R}-\text{Z}$ where Z is a heteroatom.
  - If Z is a halogen X, then the halogroup makes it an alkyl halide or haloalkane.
- Alkenyl halide: $\text{X}-=$.
- Aryl halide: $\text{Ph}-\text{X}$.
- Alcohols or phenols: $\text{R}-\text{OH}$.
- Ether: $\text{R}-\text{O}-\text{R}'$.
- Amines: NH_2R, NHRR', $\text{NRR}'\text{R}''$.
- Thiols or mercathols: $\text{R}-\text{SH}$.
- Carbonyl group: $\text{R}-\text{CO}-\text{R}'$.
- Aldehyde: $\text{R}-\text{COH}$.
- Ketone: $\text{R}-\text{CO}-\text{R}'$.
- Carboxylic acid derivatives:
  - Acid: $\text{R}-\text{COOH}$.
  - Ester: $\text{R}-\text{COOR}'$.
  - Acid chloride: $\text{R}-\text{COCl}$.
  - Acid halide: $\text{R}-\text{COX}$.
  - Amide: $\text{R}-\text{CONH}_2$.
  - Acid anhydride: $\text{R}-\text{COOCO}-\text{R}'$.
- Nitrile: $\text{R}-\text{C}\equiv\text{N}$.
- Acrylonitrile: $=-\text{C}\equiv\text{N}$.

2.2 Discussion Section

- ACS in-text citations should be in superscripts as a list of number with no brackets or parentheses.

- Molecular formulas are $\text{C}_2\text{H}_6\text{O}$, not $\text{C}_2\text{H}_5\text{OH}$ or $\text{CH}_3\text{CH}_2\text{OH}$.

- Make a table if you have a lot of data to put in (make it readable!).

- Distillation:

  - We need a boiling chip and stir bar inside the flask.
  - Vapor comes up from a round-bottomed flask, encounters a rubber stopper and gets diverted through a condenser instead.
  - Make use of countercurrent exchange and increase pressure by inflowing water in the gravitationally lower portion of the condenser.
  - Boiling chip is a coarse material with a lof of micropores inside.
  - The surface energy is reduced when the fluid is inside the micropores; within, it can more easily become a gas.

- As the mole fraction χ of a substance A increases...

- Raoult's law:
$$P_{\text{total}} = \frac{P_A \chi_A}{P_B \chi_B} = \frac{P_A \chi_A}{P_B(1 - \chi_A)}$$

- Dalton's law: The total pressure is equal to the sum of the partial pressures.