PCBs (Polychlorinated Biphenyls) are in the Foods You Love

- PCBs are hazardous chemicals produced commercially since 1929
- POP: persistent organic pollutants family
- Found in transformers and electrical insulation
  - resistant to acids and bases
  - do not dissolve in water
  - stable in both hot and cold temperatures
- Release harmful byproducts when combusted
  - causes cancer, hormonal problems and reproductive complications
- While all of this information was available, production of PCB’s went unchecked for 50 years. Now PCB’s are banned in 120 countries.

- Found mainly in fish
  - PCB’s usually enter our environment by dumping waste into water systems.
  - Though it isn’t soluble in water, it does dissolve in oils and fats, and therefore gets stored in the fats and blubber of fish.
  - The Inuit Eskimos are known to have the highest PCB concentration, due to the amount of fish they eat.
- From eating the fish the PCB get absorbed into our gastrointestinal tract, later depositing themselves into our liver and fat tissue.
  - Studies have shown that the PCB’s have the ability to cross over to the placenta and also into breast milk.
  - Fetuses have experienced problems, such as fetal growth, and neurological deficiencies: slower reflexes, lower I.Q., A.D.D., and reduced memory capacity.

Neutralization and pH

- Acids (H\(^+\)) plus bases (OH\(^-\)) react to form water in a 1:1 mole ratio. Any extra acid or base will determine the pH of the solution.
- 0.5 L of 3 M HCl, how many moles H\(^+\)??
- 0.80 L of 2 M NaOH, how many moles OH\(^-\)?
- What is left after they react ??
- Is the resulting mixture acidic or basic ??
- What is the concentration (molarity) of the remaining acid or base ??

Measuring [H\(^+\)] - the pH scale - the math

- Since [H\(^+\)] values are so small a log format is used
- pH = -log [H\(^+\)]
- [H\(^+\)] = 10\(^{-pH}\)
- pOH = - log [OH\(^-\)]
- [H\(^+\)] x [OH\(^-\)] = 1.0 x 10\(^{-14}\)
- pH + pOH = 14
- pH = 7 neutral, < 7 acidic, > 7 basic
- Table 9-4 for pH of common substances
Common carboxylic acids
- Formic acid - red ants
- Acetic acid - vinegar
- Carbonic acid - carbonated drinks
- Citric acid - fruits
- Oxalic acid - rhubarb, spinach
- Propionic acid - Swiss cheese
- Butyric acid - rancid butter
- Benzoic acid - preservative
- Lactic acid - sour milk, exercise

A little practice
- $[H^+] = 1 \times 10^{-5}$ M, pH = ??
- $[OH^-] = 1 \times 10^{-3}$ M, pH = ??
- pH = 8, $[H^+] = ??$, $[OH^-] = ??$
- $[H^+] = 3.5 \times 10^{-3}$ M, pH = ??
- $[OH^-] = 4.5 \times 10^{-9}$ M, pH = ??

A little practice
- Will a mixture of 1 L 0.2 M HCl and 4 L of 0.06 M NaOH turn phenolphthalein colorless or pink?

Equilibrium, alka-seltzer and Le Chatelier
- Tablets contain citric acid and sodium bicarbonate
- The acid-base reaction that occurs in water:
  \[
  \text{H}^+ + \text{HCO}_3^- \rightleftharpoons \text{H}_2\text{CO}_3
  \]
- The equilibrium with carbon dioxide gas:
  \[
  \text{H}_2\text{CO}_3 \rightleftharpoons \text{CO}_2(\text{gas}) + \text{H}_2\text{O}
  \]
- Le Chatelier: when a stress is placed on a system in equilibrium, the system tends to react in a way to relieve the stress.