Chem 111

Lecture 12

Announcements

- OWL: Completion during grace period, sometimes doesn't show → should show after two weeks

- Exams

- Oct 11: Holiday no class
- Oct 12: Monday Schedule

Homework

- Finish Reading Chapter 4
- Start Reading Chapter 5
- OWL online homework

Recap

- Oxidation Reduction reactions
- Oxidation Numbers

Limiting Reactant

Making Sandwich: 10 slices of bread, 8 slices of bologna

2 Bread + 1 Bol. →

2 Bread + 2 Bol. →

Same thing happens with Reactions:

$2H_2 + C \rightarrow CH_4$

$2H_2O_2 \rightarrow 2H_2O + O_2$

Let's Practice

How much H_2SO_4 can be formed from 5.0 mol of SO_2, 2.0 mol of O_2 and unlimited amount of water:

$$SO_2 + O_2 + H_2O \rightarrow H_2O$$

Concentration

Molarity is defined as the number of moles of solute in a liter of solution.

$$Moles = \frac{moles\ of\ solute}{volume\ of\ solution\ in\ L}$$

Use [X], short hand for concentration
Moles in 2 L of 0.2 M HNO_3

$$0.2\ M\ HNO_3 = \frac{0.2\ mol\ HNO_3}{1\ L\ soln}$$

Dilution

When you add more solvent to a solution, you lower its concentration a process called **dilution.**

Moles solute before dilution = Moles solute after dilution

Moles = Molarity x Liters (volume)

$M_{initial}V_{initial} = M_{final}V_{final}$

Let's Practice

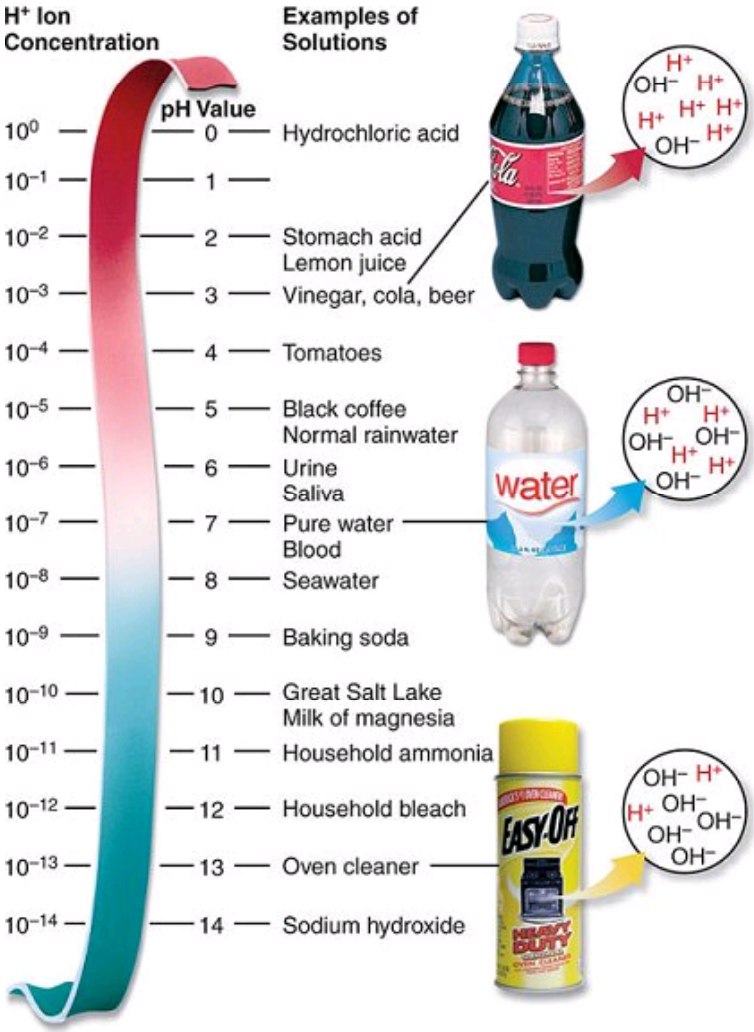
$M_{initial}V_{initial} = M_{final}V_{final}$

How much 3.0 M H_2SO_4 would be required to make 450 mL of 0.1 M H_2SO_4.

pH

Concentration of H^+ (*aq*) tends to be small. So chemist developed the pH scale.

$pH = -\log [H^+]$

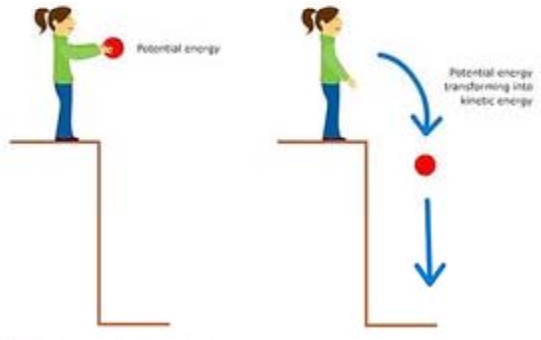


Thermodynamics

The study of energy and its transformations.

Energy is the capacity to do work or to transfer heat.

Kinetic Energy - is the energy of motion
Potential Energy – stored energy



First Law of Thermodynamics: Energy is conserved

Units

SI unit of energy is the **joule (J)**

$$J = \frac{kg \ \ m^2}{s^2}$$

The **calorie** the amount of energy required to raise the temperature of 1 g of water by 1 ^{o}C.

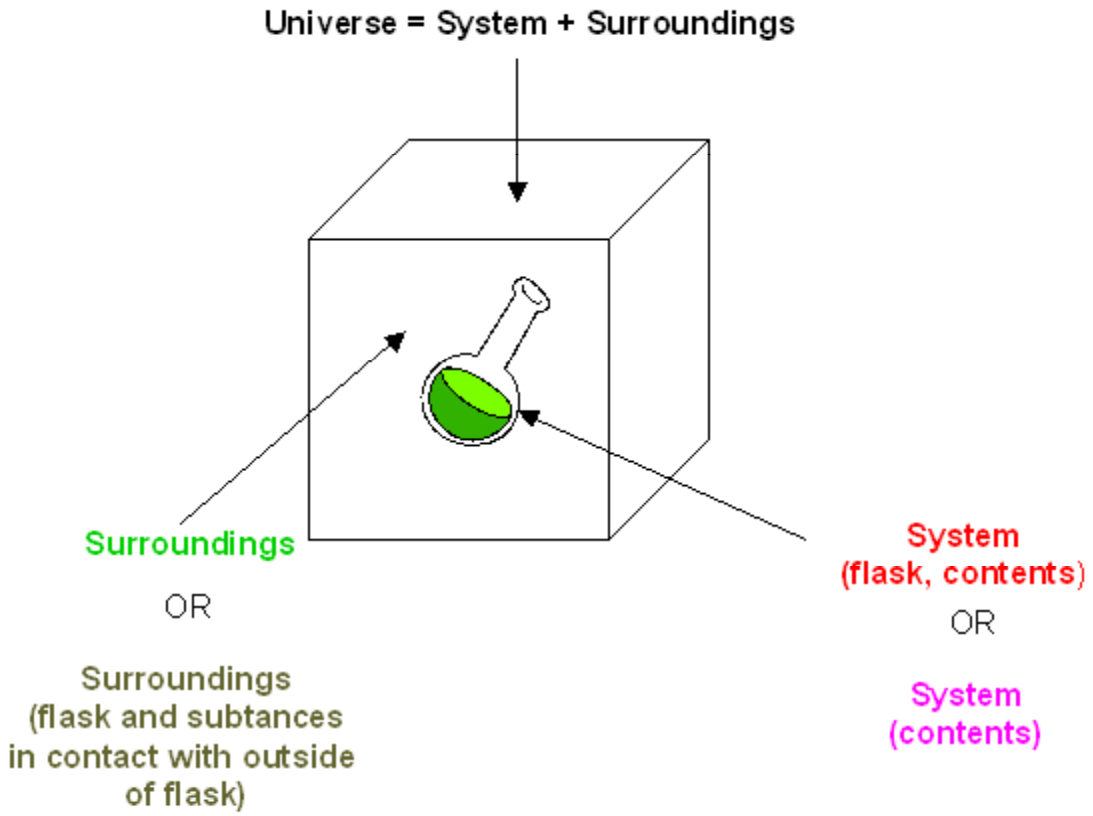
1 cal = 4.184 J (exactly)

Nutritional **Calorie** is different

1 Cal = 1000 cal or 1 kcal

System and Surroundings

System: the portion that we are interested in
Surroundings: everything else



Thermal Equilibrium

Happens when the objects have reached the same temperature.

1. Energy transfer is spontaneous from the object that has higher temperature to an object with lower temperature.
2. Energy transfer continues to happen till thermal equilibrium is reached.
3. Object whose temp. increase gained thermal energy and the object whose temp. decreased lost thermal energy.

Endothermic v Exothermic

Endothermic Process – is a process where the system absorbs heat. Heat flows *into* the system from the surroundings.

Exothermic Process – is a process where the system evolves heat. Heat flows *out of* the system into the surroundings.