Unit 3

Chapter 5 Suggested End of Chapter Problems: 5.2, 5.4, 5.5, 5.7, 5.19, 5.21, 5.23, 5.25, 5.27, 5.35, 5.37, 5.47, 5.49, 5.61, 5.67, 5.69, 5.71, 5.87, 5.92, 5.93, 5.97, 5.107
Chapter 6 Suggested End of Chapter Problems: 6.1, 6.2, 6.3, 6.8, 6.9, 6.11, 6.33, 6.39, 6.41, 6.43, 6.51, 6.53, 6.57, 6.65, 6.69, 6.73, 6.79, 6.89, 6.91, 6.97, 6.103, 6.107, 6.119, 6.121, 6.141, 6.143, 6.145, 6.147, 6.149, 6.155

Thermochemistry: exothermic vs. endothermic reactions
Work
Energy: potential energy vs. kinetic energy, Law of Conservation of Energy (First Law of Thermodynamics), thermal energy, electrostatic potential energy, internal energy
System and surroundings: isolated system, closed system, open system
Enthalpy (H): enthalpy (heat) of formation
Specific heat
Calorimetry and heat capacity
Molar heat of fusion, Molar heat of vaporization
Enthalpy of Reaction (ΔH_{rxn})
Standard state
Hess' Law
Fuel density, fuel values, food value

Gas phase and pressure
Gas laws: Boyle's Law, Charles' Law, Avogadro's hypothesis, Amonton's Law
Gas constant, R = 0.0821 L*atm/K*mol
Ideal gas: occupies 22.4 L at STP: 1 atm, 1 mol at 273 K
Ideal gas law: PV=nRT
Gas laws and stoichiometry of chemical reactions
Density of gases
Dalton's Law and gas mixtures
Partial pressures
Molecular mass/weight of gases
Kinetic-molecular theory of gases
Molecular speeds of gases and kinetic energy: root-mean-square speed
Graham's Law: Effusion and Diffusion
Real gases

Chapter 5 Thermochemistry

5.1

Thermochemical Equation: the chemical equation of a reaction that includes heat as a reactant or product

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(l) + \text{energy}$$

Energy (E): the capacity to transfer heat or do work

Work: a form of energy: the energy required to move an object through a given distance

Thermodynamics: the study of energy and its transformations

Thermochemistry: study of the relation between chemical reactions and energy changes

Heat transfer: the process of heat energy flowing from on object to another

Thermal Equilibrium: a condition in which temperature is constant throughout a material and no heat flows from one point to another

Heat / energy transfer continues until **thermal equilibrium** is reached.

Work: change of energy in which a body is moved through a distance, d, against some force, f.

$$w = f \text{ x } d$$

Potential Energy: energy or system based on its composition or position/location
But independent of path so it is a state function

$$PE = m \text{ x } g \text{ x } h$$

State function: a property of an entity based solely on its chemical or physical state or both, but not on how it achieved that state

Kinetic energy: energy of motion

$$E_{kinetic} = \tfrac{1}{2}mv^2$$

Law of Conservation of Energy: energy is neither created nor destroyed in chemical reactions and physical changes

Thermal Energy: Kinetic energy of atoms, ions and molecules

Electrostatic Energy: energy determined by distance between charged particles and their charges (Fig, 5.7)

$$Eel = q_1q_2/d^2$$

5.2

System: the portion of the universe with which we are concerned

Surroundings: everything else not in system

Universe: system plus surroundings

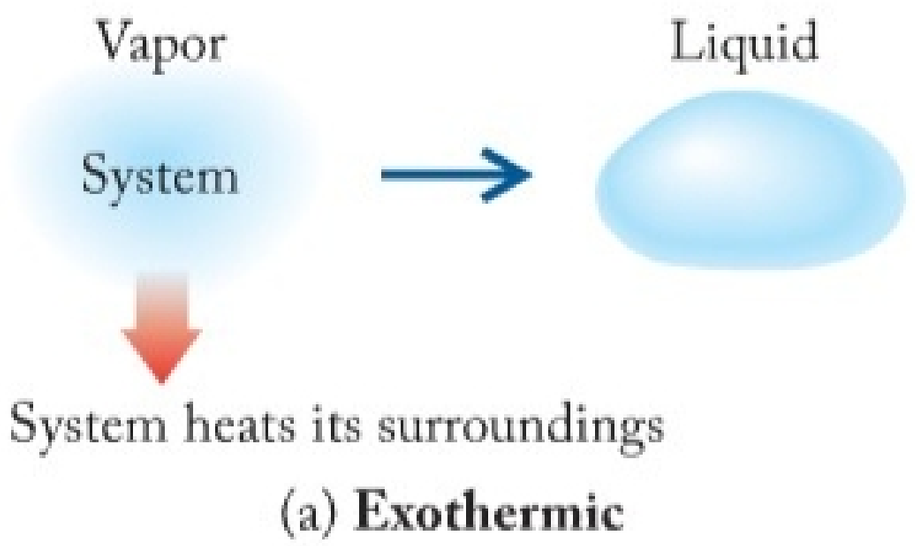
Isolated system: cannot exchange matter or energy (e.g., thermos for short time)

Closed system: can exchange energy but not matter (e.g., cup of soup with lid)

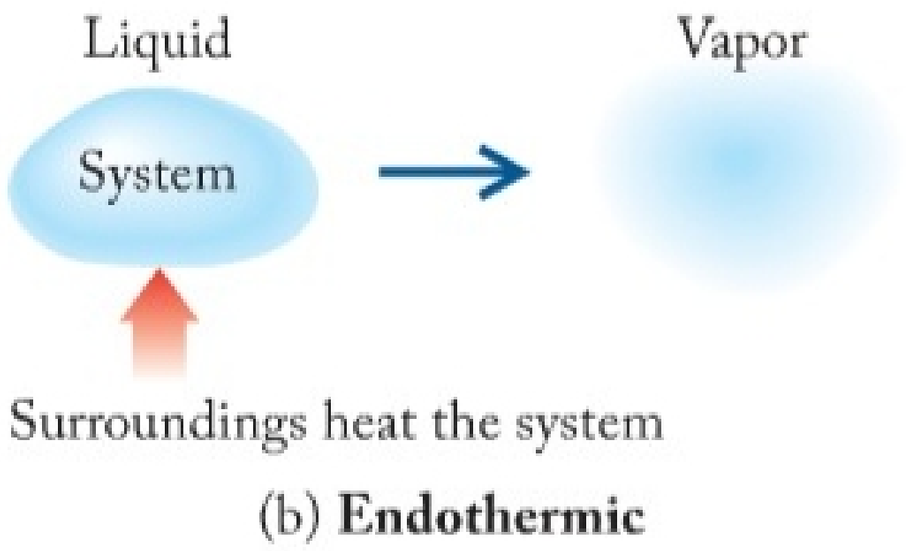
Open system: can exchange either matter or energy or both (e.g., open cup of soup)
Living things are open system (waste, food, heat exchanged)

Exothermic reactions: release heat from system to surroundings, spontaneous (+E), q< 0, condensation, freezing, deposition in change of state

Endothermic reactions: absorb heat from surroundings, not spontaneous (-E), q>0, melting, vaporization, sublimation in change of state



(a) **Exothermic**



(b) **Endothermic**