**ACP Unit 4 Learning Objectives**

Chapter 10

10.1 *(Energy, Temperature and Heat)*

You will be able to explain the 1st Law of Thermodynamics.

Thermodynamics - the study of energy

The 1st Law of Thermodynamics (*Law of Conservation of Energy*) states that "*Energy can be neither created nor destroyed in a chemical reaction; Energy can only be converted from one form to another.*"

You will be able to explain the general properties of energy.

(E) Energy - the ability to do work or to produce heat

Potential Energy - the energy due to position or composition

Kinetic Energy - the energy due to the motion of the object and depends on

the mass of the object (m) and the velocity (v)

(W) Work - amount of force (F) acting over a distance (D)

You will be able to explain the difference between temperature and heat.

(T) Temperature - a measure of the random motions (average kinetic energy) of the molecules in a substance [unit is ○C degrees Celsius]

(Q) Heat - the flow of energy between two objects due to a temperature difference

between the objects [unit is calories or joules]

You will consider the direction of energy flow as heat. You will explain the differences between an exothermic and endothermic process.

Exothermic process - energy is released from the system into the surroundings

Endothermic process - energy is absorbed from the surroundings into the system

- ∆H = heat energy flows out of system to surroundings = Exothermic

+ ∆H = heat energy flows into system from surroundings = Endothermic

10.2 *(The Flow of Energy)*

You will be able to explain how energy flow affects internal energy.

∆E = change in internal energy; sum of kinetic and potential energy of object

∆E = Q + W Q = heat W = work

You will be able to explain how heat is measured.

(s) specific heat capacity = the amount of energy required to change the

temperature of a mass of one gram of a substance by one Celsius degree

(c) calorie - amount of heat energy required to raise the temperature of one gram

of water by one Celsius degree

(C) 1 food calorie = 1 kilocalorie (1000 calories)

\*In chemistry, the unit to measure heat energy is the Joule (J)

1 calorie = 4.184 Joules

10.3 *(Energy of Chemical Reactions)*

You will be able to explain how to measure the heat energy (enthalpy) of a chemical reaction.

(∆H) Enthalpy = heat energy flow of a system at constant pressure

∆Hreaction  = ∆Hproducts -  ∆Hreactants

You will be able to explain how to measure the enthalpy of a chemical reaction using a calorimeter and Hess's Law.

Hess's Law - in a chemical reaction, the enthalpy change from reactants to products can be calculated by the sum of a series of steps

∆Hreaction  = ∆H1 + ∆H2 + ∆H3 ...

\* Reversing a reaction will reverse the sign of ∆H

\* The magnitude (size) of ∆His proportional to quantities of reactants and products - use the coefficients from the balanced equation (stoichiometric ratios)

10.4 *(Energy in the Real World)*

You will be able to explain how the quality of energy changes as it is used.

You will be able to identify the energy resources in our world, and the impact of humans on these energy resources. Compare non-renewable energy (fossil fuels, petroleum, natural gas, coal) versus renewable energy sources (solar, wind, hydroelectric, biofuel)

You will be able to explain how energy is a driving force for natural processes and chemical reactions.

The 2nd Law of Thermodynamics states that "*The state of entropy of the entire universe will always increase over time."*

(S) Entropy = measure of disorder or randomness; the driving force for natural processes is an increase of entropy in the system; "matter spread" and "energy spread"

Equations to understand:

∆E = Q + W

W = F x D

Q = s m ∆T ∆T = Tfinal - Tinitial

s = Q/ m ∆T

∆Hreaction  = ∆H1 + ∆H2 + ∆H3 ...

∆E = change in internal energy

∆H= change in heat flow (enthalpy)

Q = heat energy

W = work

s = specific heat capacity (measured in Joules/gram ○C)

m = mass of sample in grams

∆T = change in temperature in Celsius degrees

H2O s = specific heat capacity of water = 4.184 Joules/gram○C

1 calorie = 4.184 Joules

Chapter 17

17.1 and 17.2 *(Reaction Rates and Equilibrium)*

You will be able to understand the collision model of chemical reactions and how equilibrium is established.

You will be able to explain how a catalyst speeds up the rate of a chemical reaction by lowering the activation energy.

You will identify conditions that affect reaction rates, including: nature of reactants; concentration or pressure; temperature; and surface area.

You will use Le Chatelier's Principle to predict shifts in chemical equilibrium.