Anoka-Hennepin Secondary Curriculum Unit Plan

Department:	Science	Course:	IB Chemistry 12 (H)	Unit Title:	Energetics/Thermodynamics	Grade Level(s):	12
Assessed Trimester:	Trimester A	Pacing:	Trimester A	Date Created:	6/23/2014	Last Revision Date:	

Course Understandings: *Students will understand that:*

- Problems can be solved and knowledge gained in a systematic way: solutions to one problem can create new questions and problems.
- Chemistry is recognized as significant in its application to other disciplines and the world.
- Ideas are expressed symbolically, numerically, and graphically.
- Behavior and properties of materials are organized, classified, and predicted utilizing periodic trends.
- Mathematical relationships are interpreted and manipulated to model the real world.
- The basic building blocks combine and recombine in a variety of ways to make all matter from the simple to the complex.
- The laws of chemistry predict outcomes that impact and apply to daily life.

DESIRED RESULTS (Stage 1) - WHAT WE WANT STUDENT TO KNOW AND BE ABLE TO DO?

Established Goals

- Know that enthalpy changes for chemical reactions can be determined by measuring the effect a chemical reaction has on the temperature of its surroundings.(IB 5.1)
- Know that in chemical transformations energy can neither be created nor destroyed (the first law of thermodynamics).(IB 5.2)
- Know that an energy change always occurs when bonds are broken as well as when bonds are formed. (IB 5.3)
- Know that Hess's Law can be applied to changes involving ionic compounds.(IB 15.1)
- Know that a reaction is spontaneous if the overall transformation leads to an increase in total entropy (system plus surroundings) and the direction of spontaneous change always increases the total entropy of the universe at the expense of energy available to do useful work. This is known as the second law of thermodynamics.(IB 15.2)

Transfer

Students will be able to independently use their learning to: (product, high order reasoning)

- Create an experiment that would allow the energy content of a variety of foods or fuels to be determined.

Meaning

Unit Understanding(s):

Students will understand that:

- Total energy is conserved in chemical reactions.
- The enthalpy change for a reaction that is carried out in a series of steps is equal to the sum of the enthalpy changes for the individual steps.
- Bond-forming releases energy and bond-breaking requires energy.
- Enthalpy of solution, hydration enthalpy and lattice enthalpy are related in an energy cycle.
- Entropy (*S*) refers to the distribution of available energy among the particles. The more ways the energy can be distributed the higher the entropy.
- Gibbs free energy (*G*) relates the energy that can be obtained from a chemical reaction to the change in enthalpy (ΔH), change in entropy (ΔS), and absolute temperature (*T*).
- Change of state relates to change in entropy for a substance.
- The value off ΔG is related to position of equilibrium.

Essential Question(s):

Students will keep considering:

- What criteria do we use in judging discrepancies between experimental and theoretical values? Which ways of knowing do we use when assessing experimental limitations and theoretical assumptions?
- Hess's Law is an example of the application of the conservation of energy. What are the challenges and limitations of applying general principles to specific instances?
- Entropy is a technical term which has a precise meaning. How important are such technical terms in different areas of knowledge?

Acquisition

Knowledge - Students will:	Skills - Students will:
● Know heat is a form of energy. ● Know temperature is a measure of the average kinetic energy of the particles. ● Know chemical reactions that involve transfer of heat between the system and the surroundings are described as endothermic or exothermic. ● Know average bond enthalpy is the energy needed to break one mol of a bond in a gaseous molecule averaged over similar compounds. **Reasoning - Students will:** ● Sketch and evaluate potential energy profiles in determining whether reactants or products are more stable and if the reaction is exothermic or endothermic. ● Discuss the bond strength in ozone relative to oxygen in its importance to the atmosphere. ● Relate size and charge of ions to lattice and hydration enthalpies. ● Predict whether a change will result in an increase or decrease in entropy by considering the states of the reactants and products. ● Apply ^{0}= ^{0} - ^{0} in predicting spontaneity and calculation of various conditions of enthalpy and temperature that will affect spontaneity..	● Calculate the heat change when the temperature of a pure substance is changed using ● Calculate H for reactions using H^0f data.. ● Be able to gather enthalpy data through calorimetry. ● Apply Hess's Law to calculate enthalpy changes. ● Construct a Born-Haber cycles for group 1 and 2 oxides and chlorides and use it to calculate the energy changes that occur when these compounds form. ● Calculate entropy changes (ΔS) from given standard entropy values ($S°$).

Common Misunderstandings	Essential new vocabulary
● It is possible for mathematics to get in the way of some students' understanding of the chemistry of this chapter. ● Students often think heat and temperature are the same thing. ● Students often describe entropy with the word disorder.	● entropy ● enthalpy ● free energy ● heat ● exothermic ● endothermic ● kinetic energy ● potential energy ● spontaneity