Gibb’s Free Energy Cycle Essay, Research Paper

The second law of thermodynamics states that energy transitions are imperfect. No matter what, energy is lost. In machines an 75% loss of energy is considered average. In biological reactions there is usually a 60% loss. Since all reactions are constantly losing a percentage of the energy they give, it is necessary to have a constant intake of energy to make up for what is lost. This intake of energy helps life to remain ordered. If something disrupts that order, entropy begins to take effect. If entropy reaches its maximum point then death occurs.

Complex molecules such as lipids, proteins, and carbohydrates are highly organized and as a result they have high potential energy. Their potential energy comes from their being held together in exact configurations in bonds. When these bonds are broken in a chemical reaction, some of that energy is set free and becomes obtainable to do something else.

When this occurs, the energy released is known as free energy. The free energy from the reactants frequently changes after the reaction. This change is represented by sG. The G represents Gibbs, the chemist who clarified this procedure.

An example of this would be as follows: (p. 129 in the penguin book) when metabolized by cells in the presence of oxygen, glucose (C6H12O6) is broken down into carbon dioxide and water, or (CO2 and H2O). The difference of free energy between the reactant and its two products is 686 kcal/mole. If the reaction were to be written out it would appear as

C6 H12O 6 + 6O2 O 6CO2 + 6H2O + energy. Here, energy is sG = -686 kcal/mole. It should be noted that when the sG is negative, the products have less free energy than the reactants.

The reaction above was an example of an exergonic reaction. An exergonic reaction is one where the products have less free energy than the reactants. The opposite of an exergonic reaction is an endergonic reaction. An endergonic reaction is when the products have more free energy than the reactants. An example of this type of reaction would be when plants format glucose within them.

Exergonic and endergonic reactions don’t happen by themselves though, they require an outside source of energy to set them off. Each chemical bond has a certain amount of energy holding the bonds together. In order to break that bond there needs to be an input of energy that is at least equal to the amount found within the bond. The energy that is required to break the bond is normally referred to as the energy of activation.

Another way to achieve a chemical reaction is through a catalyst. A catalyst is something that speeds up the reaction without being used up itself. Basically, a catalyst lowers the energy of activation