**Thermochemistry**

**Heat transformations take place everyday in both living organisms and machines. Cars, for examples, convert gasoline into energy to propel the car forward. Heat is also lost in the process. In living organisms, the process of cellular respiration converts simple sugars into cellular energy, carbon dioxide, and water. Again, heat is lost in the process. The study of heat transformation is called Thermochemistry.**

**Thermochemistry is the study of energy changes involved in chemical reactions. These changes can be physical (ie. melting ice), chemical (rusting iron), and nuclear (nuclear fusion reactions in the Sun).**

**All energy transformations are governed by the 1st Law of Thermodynamics, which states that the total energy of the universe is constant.**

**Glossary of Thermodynamic Terms**

1. **Thermal energy – energy available from a substance as a result of its motion of its molecules. Unit for measuring energy is the Joule (J).**
2. **Chemical system – the set of reactants and products undergoing energy transformations.**

**Open systems allow both energy and matter to move in or out.**

**Closed systems allow energy to move in and out.**

**Isolated systems neither energy nor matter can move in or out.**

1. **Surroundings – all matter around the system that is capable of absorbing or releasing thermal energy.**

**Example: cellular respiration involves the burning of glucose with oxygen to form carbon dioxide and water. These molecules are the chemical system, while the fluid in the cell is the surroundings.**

1. **Heat – amount of energy transferred between substances. When a reaction occurs, heat is transferred between substances.**
2. **Exothermic – a chemical system that releases energy to its surroundings.**
3. **Endothermic – a chemical system that absorbs energy from its surroundings.**
4. **Temperature – the average kinetic energy of the particles in a sample.**

**Calories vs Joules**

**In early research, the energy to raise the temperature of one gram of water one degree Celsius was defined as one Calorie. A kilocalorie is the energy to raise the temperature of one kilogram of water one degree Celsius.**

**Joule is the SI metric unit and is the standard unit for any form of erengy. A Joule (J) is the energy involved when a force of one Newton (N) acts through a distance of one meter.**

**One calorie is equal to 4.184 J. One kilocalorie is equal to 4184 J or 4.184 kJ. Thus to raise the temperature of 1.0 kg of water by 1.00 C requires 4184 J or 4.184 kJ of energy.**