

# THERMOCHEMISTRY

*The study of energy and its interconversions.*

## Lab's:

[http://www.chemistrycoach.com/Links%20to%20chemistry\\_experiments.htm#Heat,%20Enthalpy](http://www.chemistrycoach.com/Links%20to%20chemistry_experiments.htm#Heat,%20Enthalpy)  
**Calorimetry; Choice I, Determination of a Calorimeter Constant**  
**Calorimetry; Choice III, Heat of Acid/Base Reaction**

## 1.) **Energy and Chemical Energy**

<http://www.chem.queensu.ca/people/faculty/mombourquette/FirstYrChem/thermo1/>

### Background and Concepts (for review):

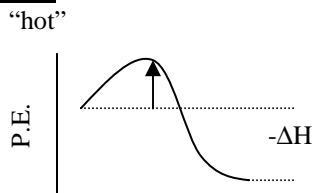
Energy is the ability to do work (force acting over distance) or produce heat. The *Law of Conservation of Energy* states that energy can be converted from one form to another, but neither be created nor destroyed. The energy of the universe is constant. Energy is classified as either potential (due to position) or kinetic (due to motion). Temperature is an index of randomness of particles, amount of kinetic energy. Heat is the transfer of energy due to differences in temperature. Also depends on amount of substance and type (specific heat). Heat energy always transfers from higher temperature (kinetic energy) to lower temperature. First Law of *Thermodynamics: The Energy of the Universe is Constant.*

**State Function (property):** Does not depend on the actual amounts of heat (ex. friction) and work (movement), the total amount of energy is always the same. Only present state matters. Not the past where it came from. Therefore going from one state function to another state function is independent of the pathway. *Energy is a state function, but heat and work are not state functions.*

**Does not depend on how it was achieved. Ex. The temperature of the room is 25°C**

**Chemical Energy:** The universe is divided into two parts: the system (the focus of study -reactants and properties) and the surroundings (everything else).

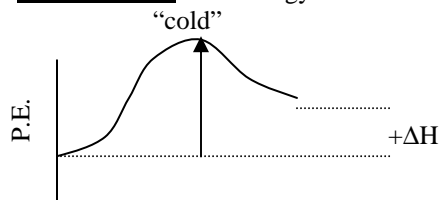
**Exothermic:** Heat is released from the system. **Endothermic:** Heat energy is absorbed by system



### **Exothermic**

Products have lower PE than reactants.

Reactants have stronger bonds.



### **Endothermic**

Products have greater PE than reactants.

Products have stronger bonds. Energy came from surroundings.

Energy of a system:  $\Delta E = q + w$  ( $\Delta E$ = change in systems energy,  $q$ = heat,  $w$ = work)  
Signs, + or – indicate the direction of energy flow. In to, “done on” (+) or out of (-) system.

**Work in chemistry only with gases:**

Gas expansion;  $w$  is negative (work done on surroundings) and  $\Delta V$  is positive

Gas contraction;  $w$  is positive (surroundings are doing work on system) and  $\Delta V$  is negative

$P$  is for the external pressure acting on the gas.

$$w = -P_{\text{atm}}\Delta V$$
$$\Delta V = V_{\text{final}} - V_{\text{initial}}$$

$$\Delta E = w + q$$

In order to convert from L·atm to Joules; 1 Latm= 101.3 J



**sign convention**

Note the sign convention

**P. 233 Ex. 6.1, 6.2, 6.3**

**Homework Practice: P.266 #18, 19, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30**