ΔH	ΔS	ΔG	spontaneous
-	+	always -	yes
+	-	always +	no
+	+	either + or -	sometimes
-	-	either + or -	sometimes

Spontaneity —>

* **The First Law of Thermodynamics**
  * The energy of the universe is constant.
  * In a chemical rxn, energy is neither created nor destroyed.

- this does not tell us why a chemical reaction occurs
- the energy doesn't disappear it just gets transformed form one form to another
- this helps us understand that the net energy is not changing

spontaneous change - a change that occurs in a system under specified conditions without a continuous input of energy from the surroundings

^-- this is the chemical definition

Examples of Spontaneous Processes:

* Water freezes when T = 0°C and P = 1 atm.
* A candle burns. (Some spontaneous processes need a little push to get them going - needs to be lit by match)

- if something is spontaneous than the reverse of that is not spontaneous (aka the reverse does require energy)
- these examples are spontaneous but the reverse of them does require energy

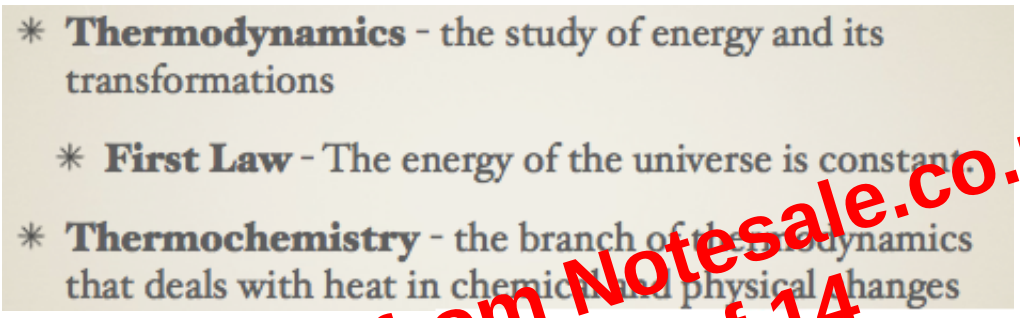
* **nonspontaneous change** - occurs only if surroundings supply *continuous* energy
  * CO_2 and H_2O do not spontaneously produce wax and O_2
  * A change can only be spontaneous in one direction under a given set of conditions

7. combine
    1. 2Cu + O2 --> 2CuO ∆H=-310kJ
9. answer
    1. -310kJ

Thermochemistry —>

Potential Energy:

- All matter contains potential energy that comes from position
- Chemical Potential energy is energy due to position on the molecular or even atomic level
- In a rection electrons can release or gain potential energy
- when energy is produced in a reaction the reactants have more potential energy at the start and so they give some of it to the product



^-- first law also says that matter is neither created nor destroyed

blue water also as energy

Graphing Energy:

- going from N2+O2 --> 2NO you will have a curve that starts low has a little bump and then ends higher because it is releasing energy

Energy Transfer