

1st Law of Thermodynamics

- Aka the Law of conservation of energy, Gibbs in 1873 stated energy cannot be created or destroyed, only transferred by any process
- The net change in energy is equal to the heat that flows across a boundary minus the work done BY the system
 - **$\Delta U = q + w$**
 - Where q is heat and w is work
 - Some heat flowing into a system is converted to work and therefore does not augment the internal energy

Directionality from the 2nd Law

- For any spontaneous irreversible process, entropy is always increasing

$$dS > \frac{dq}{T}$$

- How can a reaction ever proceed if order increases?? Why are minerals in the earth not falling apart as we speak??

NEED FOR THE SECOND LAW

- The First Law of Thermodynamics tells us that during any process, energy must be conserved.
- However, the First Law tells us nothing about in which direction a process will proceed spontaneously.
- It would not contradict the First Law if a book suddenly jumped off the table and maintained itself at some height above the table.
- It would not contradict the First Law if all the oxygen molecules in the air in this room suddenly entered a gas cylinder and stayed there while the valve was open.