


# Laws of Thermodynamics

0. Concept of Temperature - Equivalence Relation
1. Energy Conservation (can't win)  PPM 1
2. Entropy (can't break ~~even~~) PPM 2
3. Absolute zero temperature

## Definitions

Thermodynamics - phenomenological description of equilibrium properties of macroscopic systems. (treat system like a black box.)  
do not change with time (scale dependent)

Statistical Mechanics - probabilistic approach to equilibrium properties of a large number of degrees of freedom.

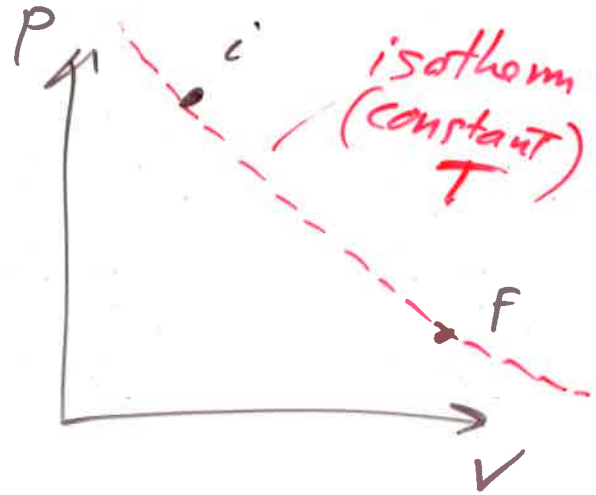
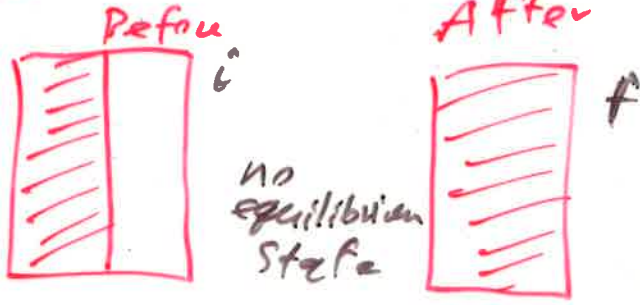
Heat - energy that flows spontaneously from hot to cold.

Adiabatic - (walls) do not allow heat to flow, insulating as opposite to diathermal.

- (processes) "slow" & "reversible"  
system always near equilibrium, "friction loss"

# Non-adiabatic example

## Joule-Kelvin expansion



## Zeroth Law

If two systems (A+B) are each separately in thermal equilibrium with a third system (C), then A+B are in thermal equilibrium with each other.

$$\left. \begin{array}{l} T_A = T_C \\ T_B = T_C \end{array} \right\} \rightarrow T_A = T_B$$



$$\text{Weight}_A = \text{Weight}_C$$