

2nd Law of Thermodynamics

It is not possible for a heat engine working in a cycle to absorb thermal energy and convert it all to work

This is because molecules move in random motion, can not perfectly transfer random motion to ordered energy ~~random~~ (lifting up a block PE)

Entropy - Spreading out of Energy

Change in Entropy ΔS

T - Temp Q - Heat flow into body

$$\Delta S = \frac{Q}{T} \quad \text{Unit } \frac{\text{J}}{\text{K}}$$

Ex. 1 kg of ice melting @ a constant temp 300K.
To melt the ice, it must gain $3.35 \times 10^5 \text{ J}$. Ice melts @ 273K

$$\text{Gain Entropy of ICE } \Delta S = \frac{Q}{T} = \frac{3.35 \times 10^5}{273} = 1.23 \times 10^3 \text{ J/K}$$

$$\text{Loss Entropy by Room } \Delta S = \frac{3.35 \times 10^5}{300} = 1.12 \times 10^3 \text{ J/K}$$

Entropy has increased

- In any cyclic process, Entropy will either stay same or increase
- Not possible for heat to be transferred from cold body to warm body w/out work done