Thermodynamics = concerned w/ heat, temperature, energy, and work

Basics:

Phase Change Diagrams:

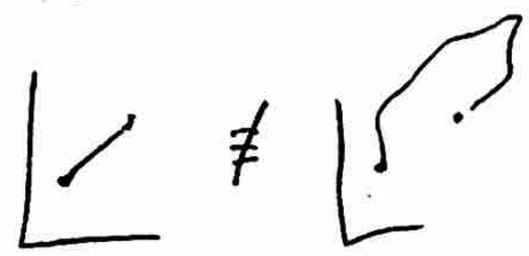
$Q = mc\Delta T$, m C_{vap}, C_{fus}, etc.

state functions:

enthalpy H
internal energy U
Gibbs free energy G
entropy S
P, T, V, n

path functions:

heat
work



Laws of Thermodynamics:

0th Law If $T_1 = T_2$ and $T_2 = T_3$, then $T_1 = T_3$.

$U + nRT$

1st Law $H(S,p) = U + pV$

$H \simeq U$ nRT for ideal gases

2nd Law "no process is possible in which the sole result is absorption of heat from a reservoir and its complete conversion into work"

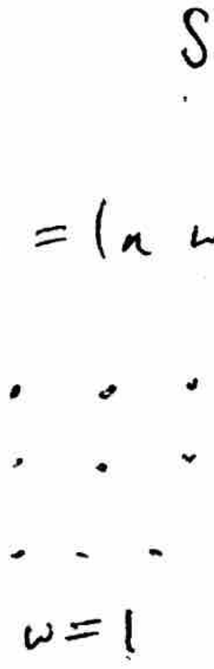
↳ heat loss is inevitable

3rd Law $\Delta S_{univ} > 0$ ∀ spontaneous change

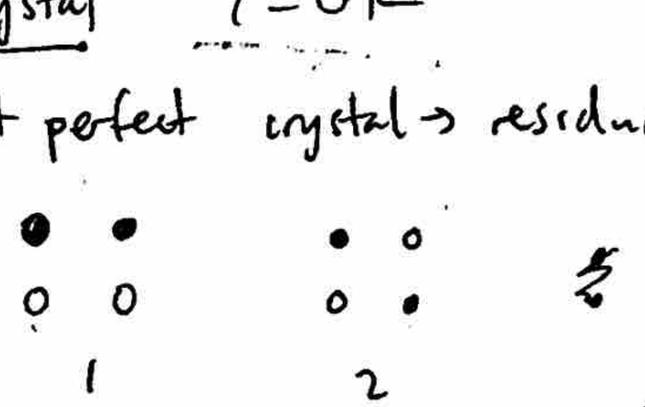
$S = 0$ for <u>perfect crystal</u> $T = 0\,K$

↳ not perfect crystal → residual entropy

$S = \ln w$



$w = 1$



$w = 2$ 0.693

multiple microstates $S = \ln 2 > 0$

may occur for non perfectly crystalline substances

Enthalpy Change:

Heat of Rxn:

Heat of Combustion, Formation, Solvation, Vaporization, Fusion, etc.

$\Delta H = X$ $2A + B \rightarrow C$

$\Delta H = Y$ $3A \rightarrow B + D$

$5A \rightarrow C + D$ $\Delta H = X + Y$

~~$\Delta H(H^+_{aq}) = 0$~~

$\Delta H = \sum n\Delta H_{products} - \sum n\Delta H_{reactants} = \sum$ bond energy reactants $- \sum$ bond energy products