RECAP

- **FUNDAMENTAL POSTULATES OF STAT MECH**
  - GIVEN A SYSTEM IN A PARTICULAR MACROSTATE, LET $n = 1, 2, 3, \ldots$ LABEL THE ACCESSIBLE MICROSTATES (ENERGY E' STATES).
  - THE PROBABILITY DISTRIBUTION AT EQUILIBRIUM $\{ P_n^{(eq)} : n = 1, 2, 3, \ldots \}$ MAXIMISES THE GENERALISED ENTROPY

$$\boxed{\tilde{S}(\{P_n\}) = -k_B \sum_n P_n \ln P_n}$$

AND

$$\boxed{S(E, V, \vec{N}) = \tilde{S}(\{P_n^{(eq)}\})}$$

THERMODYNAMIC ENTROPY

- USING THE METHOD OF LAGRANGE MULTIPLIERS

WE FOUND:

- $\rho_n^{(eq)}$ FOR ISOLATED SYSTEMS

$$\boxed{\rho_n^{(eq)} = \frac{1}{\Omega(E, N, \vec{V})}}$$

MICROCANONICAL DISTRIBUTION FUNCTION

$\Omega(E, N, \vec{V})$ — No. OF ACCESSIBLE STATES

ALL STATES ARE EQUALLY LIKELY.

+ $$\boxed{S(E, V, \vec{N}) = k_B \ln \Omega(E, V, \vec{N})}$$

- **$\rho_n^{(eq)}$ FOR A SYSTEM WITH A FIXED No° OF PARTICLES IN CONTACT WITH A HEAT RESERVOIR AT TEMP T**

$$\boxed{\rho_n^{(eq)} = \frac{e^{-E_n/k_B T}}{Z}}$$

$$\boxed{Z = \sum_n e^{-E_n/k_B T}}$$

CANONICAL PARTITION FUNCTION

WHERE n LABELS THE ACCESSIBLE ENERGY E'STATES & E_n IS THE ENERGY OF THE n^{th} E'STATE.

ASIDE: WE CANNOT LABEL IDENTICAL INDISTINGUISHABLE PARTICLES IN QUANTUM MECHANICS. EXACTLY WHICH PARTICLE IS IN WHICH STATE CANNOT BE KNOWN.

ROUGHLY: THE UNCERTAINTY PRINCIPLE TELLS US THAT WE CANNOT KEEP TRACK OF EACH PARTICLE.

EXAMPLE: CONSIDER A TWO-PARTICLE SYSTEM WITH EACH HAVING TWO ENERGY LEVELS $n=1$ & $n=2$ AVAILABLE TO IT.

FOR DISTINGUISHABLE PARTICLES WE CAN LABEL THEM A & B

ALL POSSIBLE STATES OF SYSTEM

	$n=1$	$n=2$
STATE 1	A	B
STATE 2	B	A
STATE 3	AB	–
STATE 4	–	AB

FOR IDENTICAL INDISTINGUISHABLE PARTICLES

$A = B$

	$n=1$	$n=2$
STATE 1	A	A
STATE 2	AA	–
STATE 3	–	AA

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