

Lecture 17

Friday, September 29, 2023 9:54 AM

Statistical Mechanics

Preview of Postulates =

- 1) Mechanics works for many particles
- 2) Two macrostates of equal energy have equal probability



"laws" of thermodynamics
 mass action "law"
 ideal gas "law"
 Nernst equation
 Protein Unfolding Curve

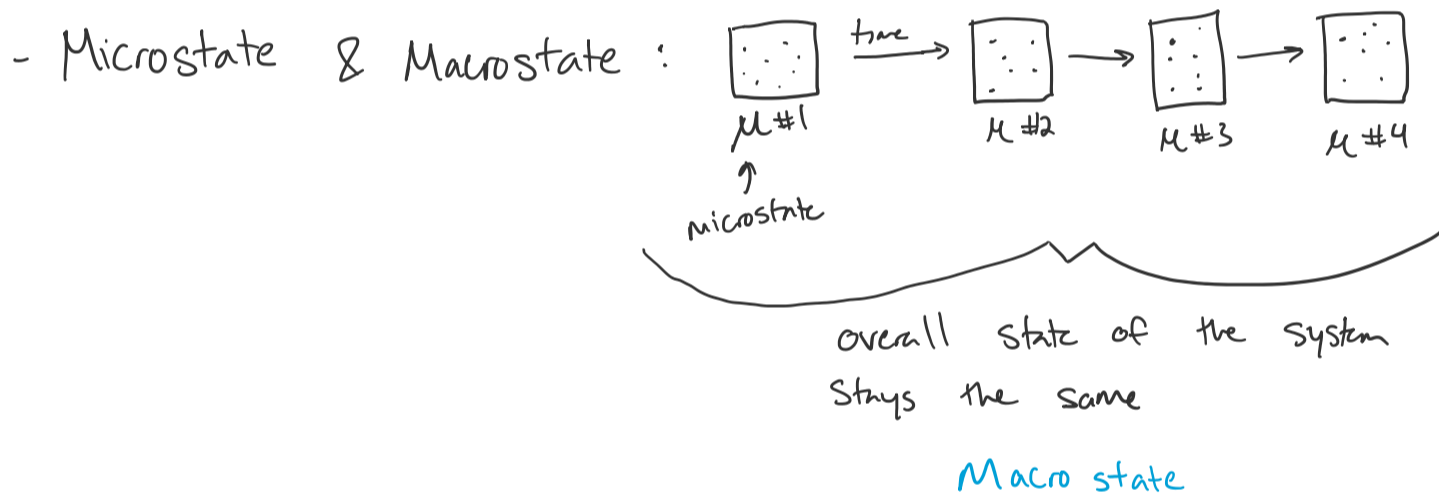
Goal of Stat Mech:

Calculate

- 1) "How a large number of particles behave on average"
- 2) "How one particle behaves in an environment made of many particles"

Important Definitions:

- Isolated system = system that exchanges no E, m, \dots w/ its environment (idealized)



- State Function: the variables needed to specify the microstate of a system
 e.g. E (energy), N (num. particles), V (Volume), etc.

- Reversible Processes = Processes that connect macrostates w/ nearly identical state functions

"Probability" & "Probability Density"

ρ is a probability per unit "something"

ex. probability per throw of getting a certain value is $P_i = \frac{1}{6}$ for $i=1,2,3,4,5,6$

prob. per unit distance of finding an e^- at x , $P(x) = |\Psi(x)|^2 = \rho(x)$
 $\frac{1}{m}$ is the units

$$P(e^- \text{ is b/w } 0 \text{ \& } \infty) \Rightarrow \int_0^\infty dx \rho(x) = P$$

\downarrow \downarrow
 m $\frac{1}{m}$

ex. In classical mechanics, x & p are independent variables,
 so the probability of a particle having position x & momentum p per unit distance & per unit momentum

