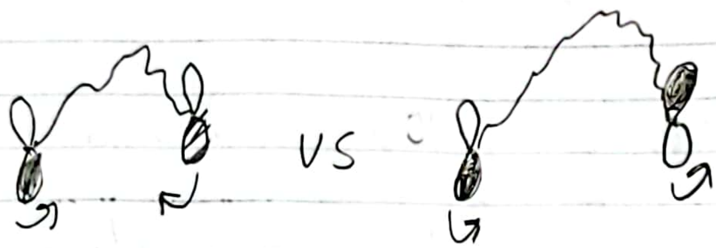
Lecture 17

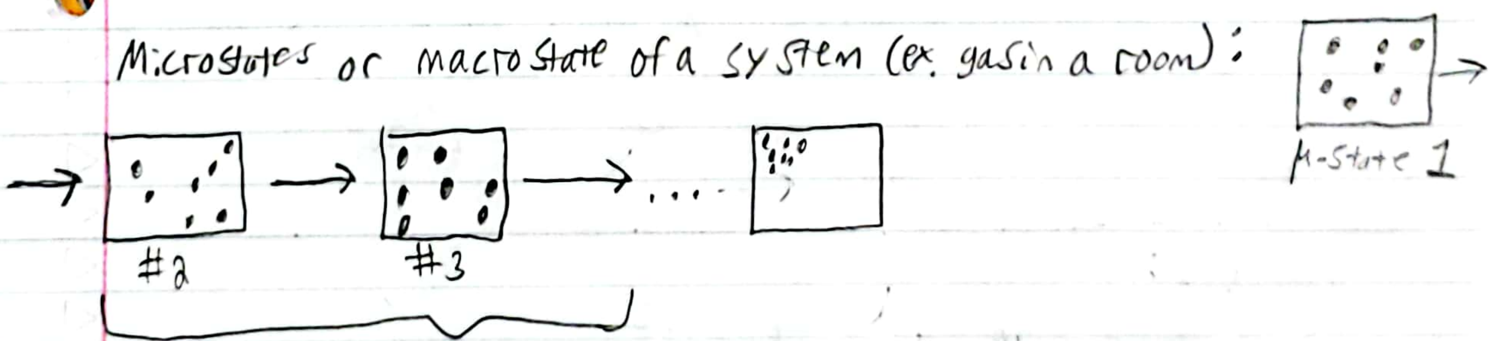
Last time:
Woodwart Hoffman



rotation needed to make bond

Today: Statistical Mechanics
Goal:
(1) Calculate how a large # of particles behaves on average
(2) How one particle behaves in an environment of many particles
<u>Important definitions:</u>
Isolated systems: system where no mass, energy, volume, etc. is exchanged

Microstates or macro state of a system (ex. gas in a room):



all μ-States that have the same E, V... = Macro State

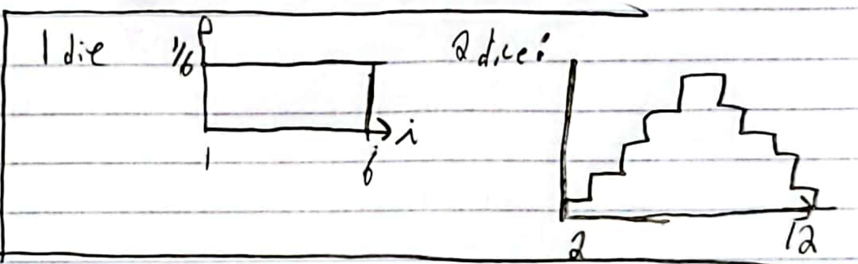
- State functions: the variables needed to specify a macrostate
  ex: color of gas, E, V, ...
- Reversible Process: Process that connects two macro states that differ infinitesimally in a state function, ex: dV
- Probability density "ρ": "Probability per some thing"
  ex: Probability of a value per throw of a die: $\rho_i = 1/6$ (6 ways)
  ways to throw die: $W = 6$ $P_i = \frac{1}{W} = \frac{1}{6}$

ex. Probability per unit distance of finding an e^- is equal to $P(x) = \rho(x) = |\psi(x)|^2 \rightarrow \psi$ has units of $m^{-1/2}$

ex: rolling 2 dice:

$P_{10} = ? \left\{ \begin{matrix} 6+4 \\ 5+5 \\ 4+6 \end{matrix} \right\}$ 3 ways of getting 10; $W = 36$ ways total

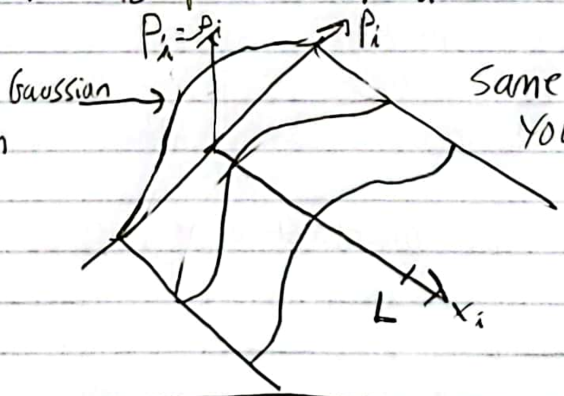
$\therefore P_{10} = \rho_{10} = \frac{3}{W} = \frac{3}{36} = \frac{1}{12}$



ex in classical mechanics; X and P are independent variables

$\rho = \rho(x_i; p_i)$

e.g. gas particles in a room



Same gaussian as you go across the room

Averages:

$A = \sum P_i A_i$ or $A = \int dx\, |\psi(x)|^2 A(x)$

$$\boxed{A = \int dx\, \psi^*(x) A(x) \psi(x)}$$: quantum mechanics