$\rho(p,q)$ dist. f'n

variable $f(p,q)$

$\bar{f} = \int \rho(p,q) f(p,q)\, dp\, dq$

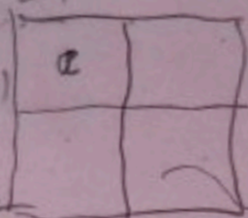
$p = p_1 \cdots p_s$

$q = q_1 \cdots q_s$

$dp = dp_1 \cdots dp_s$

Need $\rho(p,q)$

$\rho^{total} = \rho^{(1)} \rho^{(2)} \rho^{(3)} \cdots \rho^{(6)}$



ρ^{total}

$\rho^{(a)}$

prob. is multiplitive

Additive const. of motion

$E^{total} = E^{(1)} + E^{(2)} \cdots$

$\ln \rho^{total} = \ln \rho^{(1)} + \ln \rho^{(2)} \cdots$

$\ln \rho^{(a)} = -\alpha^{(a)} - \underbrace{\beta}_{1/k_B T} E^{(a)}$

$N^{(a)}, N^{(a)}$

$\rho^{(a)} = e^{-\alpha^{(a)} - \beta E^{(a)}}$ Gibbs Dist.

$E^{(a)} = H^{(a)}(p,q)$ $\quad dp\,dq \to \frac{dp\,dq}{(2\pi\hbar)^s}$

$\rho^{(a)} = \frac{1}{(2\pi\hbar)^s} e^{-\alpha^{(a)} - \beta H^{(a)}(p,q)}$

Partition f'n

$\bar{f} = \int \frac{dp\,dq}{(2\pi\hbar)^s} f(p,q)\, e^{-\overset{\text{norm}}{\alpha} - \beta H(p,q)}$

$\int \frac{dp\,dq}{(2\pi\hbar)^s} e^{-\alpha - \beta H(q,q)} = 1$

$\frac{1}{(2\pi\hbar)^s} e^{-\alpha} = \frac{1}{\int dp\,dq\, e^{-\beta H}}$

$\bar{f} = \frac{\int dp\,dq\, f(p,q)\, e^{-\beta H(p,q)}}{\int dp\,dq\, e^{-\beta H}}$

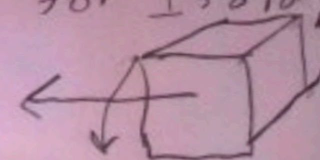
Z = partition f'n $= \int dp\,dq\, e^{-\beta H}$

$-\frac{\partial \ln Z}{\partial \beta} = \frac{\int dp\,dq\, H(p,q)\, e^{-\beta H}}{\int dp\,dq\, e^{-\beta H}} \equiv \bar{E}$

$-\frac{\partial}{\partial \beta} \ln Z = \bar{E}$

Micro canonical ensemble

for Isolated system



isolated E_0

simplify

$P = 0$

$M = 0$

$dw \propto \delta(E - E^{(0)})$

later discuss in q.m. context