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for each particle. $\langle \varepsilon \rangle = -\left(\frac{\partial \ln q}{\partial \beta}\right)_{N,V}$

q: partition fn. for each particle.

ensembles: (collection of particles) → (?) → systems ?

① canonical ensemble ⇒ N. T. V. constant.

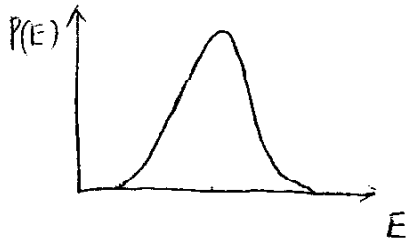
② Isobaric - isothermal ensemble ⇒ N. T. P constant.

③ Grand - canonical ensemble ⇒ T. V. μ constant

④ MicroCanonical ensemble ⇒ N. U. V
↓ no energy fluctuation allowed. (∵ isolated system)

ch. 12.

C_v — energy fluctuation



$\mu = \langle E \rangle$

$\sigma_E^2 = kT^2 C_v$

from experimental measurement C_v. U. can construct the left graph roughly

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ch 13. chemical equilibrium

$A \underset{}{\overset{K_{AB}}{\rightleftharpoons}} B \qquad K_{AB} = \frac{N_B}{N_A}$

at constant T. P. ☆:

$$dG = -SdT + Vdp + \mu_A dN_A + \mu_B dN_B = 0$$

$$\mu_A dN_A + \mu_B dN_B = 0$$

$N = N_A + N_B \Rightarrow dN_A = -dN_B$ $\Rightarrow (\mu_A - \mu_B) dN_A = 0$

$\Rightarrow \mu_A = \mu_B$