Key points of 02/14 lecture

- Grand canonical ensemble : system in contact with heat and particle reservoir

  Macrovariables: T, μ, V

  (μ: chemical potential)

  (alternatively, may choose $z = e^{\beta\mu}$; z: fugacity)

- Grand partition function $\mathcal{Q}$:

$$\mathcal{Q}(T,\mu,V) = \sum_{N=0}^{\infty} z^N Q_N(T,V) = \sum_{N=0}^{\infty} e^{\beta\mu N} Q_N(T,V)$$

- Ensemble average:

$$\langle f \rangle = \frac{\sum_{N=0}^{\infty} f\, z^N Q_N(T,V)}{\sum_{N=0}^{\infty} z^N Q_N(T,V)}$$

- Connection between grand canonical ensemble and thermodynamics:

$$P V = k T \log \mathcal{Q}$$

(P: pressure)