10.5.3: Isothermal-isobaric and grand canonical ensembles

Also useful are the isothermal-isobaric and grand canonical ensembles, which are defined just as they are for the classical cases:

- **isothermal-isobaric:**

$$\Delta(N,P,T)=\int_0^\infty dVe^{-\beta PV}Q(N,V,T)=\int_0^\infty dV\mathrm{Tr}(e^{-\beta(H+PV)})$$

- **grand canonical ensembles**

$$\mathcal{Z}(\mu,V,T)=\sum_{N=0}^{\infty}e^{\beta\mu N}Q(N,V,T)=\sum_{N=0}^{\infty}\mathrm{Tr}(e^{-\beta(H-\mu N)})$$