

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:**

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

- **grand canonical ensembles**

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

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