\[ E = c l \rho \]

\[ Z = \frac{Z}{e} e^{-\beta E} = \frac{Z}{e} e^{-\beta c l \rho} \quad \text{from (6.35)} \]

Convert the sum to an integral by multiplying and dividing by \( \Delta q \) and taking \( \Delta q \to 0 \):

\[ Z = \frac{1}{\Delta q} \frac{Z}{e} e^{-\beta c l \rho} \Delta q \]

\[ Z = \frac{1}{\Delta q} \int_{-\infty}^{\infty} e^{-\beta c l \rho} dq \]

To treat absolute value, need to break integral into two pieces:

\[ Z = \frac{1}{\Delta q} \int_{-\infty}^{0} e^{\beta c q} dq + \frac{1}{\Delta q} \int_{0}^{\infty} e^{-\beta c q} dq \]

By the symmetry of the integrand around \( q = 0 \),

\[ Z = \frac{2}{\Delta q} \int_{0}^{\infty} e^{-\beta c q} dq \]

Let \( u = \beta c q \Rightarrow du = \beta c dq \Rightarrow dq = \frac{du}{\beta c} \)
\[ Z = \frac{2}{\Delta q \beta c} \int_0^\mu e^{-u} du \]

\[ Z = \frac{2}{\Delta q c} \beta^{-1} = C \beta^{-1} \]

\[ \bar{E} = -\frac{1}{2} \frac{\partial^2}{\partial \beta^2} \text{ from eq. 6.25} \]

\[ \frac{\partial \bar{Z}}{\partial \beta} = -C \beta^{-2} \Rightarrow \bar{E} = \mp (\alpha^2 \beta) (-\Delta \beta^2) \]

\[ \bar{E} = \beta^{-1} = kT \quad \text{which was to be shown.} \]