

Problem E17:

In this problem we will determine the energy distribution of some particles in a one-dimensional harmonic oscillator well. The allowed energies for individual particles are $E_n = (n + \frac{1}{2})\hbar\omega$ where n is any non-negative integer. Assume that we put 10 identical particles into the well, and that there are two degenerate states at each energy level ($g_i = 2$).

- (a) Make a plot of the energy distribution of the particles (n_i vs i) at temperature $T = 0$ assuming the particles are (i) bosons; (ii) fermions.
- (b) Make the corresponding graphs (once again for both bosons and fermions) for a finite temperature T where $kT = \frac{3}{2}\hbar\omega$. Use the following helpful information: the constant e^α has the value 0.90445 for bosons and 0.03697 for fermions. Verify that these values are correct by showing that they give $\sum n_i = 10$, and then make the plots.