

M98T.2—Helium Atoms in a Box

Problem

A cube of volume $V = L^3$ contains 10^{22} freely moving ${}^4\text{He}$ atoms. What fraction of particles is in the first excited level at temperature $T = 10^{-3}$ K, when $L = 1$ cm? The mass of each atom is 6.6×10^{-24} g, $h = 6.6 \times 10^{-27}$ erg s, and $k_B = 1.38 \times 10^{-16}$ erg/K.