

1 Quantum concentration

Consider one particle confined to a cube of side L ; the concentration in effect is $n = L^{-3}$. Find the kinetic energy of the particle when in the ground state. There will be a value of the concentration for which this zero-point quantum kinetic energy is equal to the temperature kT . (At this concentration the occupancy of the lowest orbital is of the order of unity; the lowest orbital always has a higher occupancy than any other orbital.) Show that the concentration n_0 thus defined is equal to the quantum concentration n_Q defined by (63):

$$n_Q \equiv \left(\frac{MkT}{2\pi\hbar^2} \right)^{\frac{3}{2}} \quad (1)$$

within a factor of the order of unity.