Phy 410
Quiz #8, March 26, 2010

Write down the expression for quantum concentration n_Q associated with particles of mass M at temperature τ.

$$n_Q = \left(\frac{M\tau}{2\pi\hbar^2} \right)^{3/2}$$

If for electrons at room temperature T=300K, $n_Q = 1.27x10^{25} \frac{1}{m^3}$ then what is n_Q at T=3K and at T=30,000K.

$$T = 3K;\ n_Q = 1.27x10^{25} \frac{1}{m^3} \left(\frac{3}{300} \right)^{3/2} = 1.27x10^{22} \frac{1}{m^3}$$

$$T = 30{,}000K;\ n_Q = 1.27x10^{25} \frac{1}{m^3} \left(\frac{30000}{300} \right)^{3/2} = 1.27x10^{28} \frac{1}{m^3}$$

Is n_Q larger or smaller for ^{3}He atoms (which are fermions) than that for electrons at the same temperature?

Larger because $n_Q \propto M^{3/2}; M_{He3} = 3x1837xm_{electron}$