3.26 (*a*) Determine the total number (#/cm³) of energy states in silicon between E_c and $E_c + 2kT$ at (*i*) $T = 300$ K and (*ii*) $T = 400$ K.

a) Per (3.72), $g_c(E) = \frac{4\pi(2m_n^*)^{3/2}}{h^3}\sqrt{E-E_c}$

Per Example 3.4,

$$N_c = \int_{E_c}^{E_c+2k_BT} g_c(E)\,dE = \frac{4\pi(2m_n^*)^{3/2}}{h^3}(2/3)(E-E_c)^{3/2}\Big|_{E_c}^{E_c+2k_BT}$$

From Table 4.1, $m_n^* = 1.08\,m_0$

$$N_c = \frac{4\pi\left[2(1.08)9.1093837\times10^{-31}\right]^{3/2}}{(6.62607015\times10^{-34})^3}(2/3)\left[2k_BT-0\right]^{3/2}$$

(k_B: 1.380649×10^{-23})

$$= 1.15328\times10^{22}\,T^{3/2}$$

(i) $T = 300$ K

$$N_c = 1.15328\times10^{22}(300)^{3/2}$$

$$N_c = 5.9926\times10^{25}\ \#/m^3 = 5.9926\times10^{19}\ \#/cm^3$$

(ii) $T = 400$ K

$$N_c = 1.15328\times10^{22}(400)^{3/2}$$

$$N_c = 9.2262\times10^{25}\ \#/m^3 = 9.2262\times10^{19}\ \#/cm^3$$