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

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

Per Example 3.4,

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

From Table 4.1, $m_n^* = 0.067\,m_0$

$$N_c = \frac{4\pi\left[2(0.067)9.1093837\times10^{-31}\right]^{3/2}}{(6.62607015\times10^{-34})^3}\left(\tfrac{2}{3}\right)\left[2k_BT-0\right]^{3/2}$$

($k_B = 1.380649\times10^{-23}$)

$= 1.78201\times10^{20}\,T^{3/2}$

(i) $T = 300$ K

$N_c = 1.78201\times10^{20}(300)^{3/2}$

$N_c = 9.2596\times10^{23}\ \#/m^3 = 9.2596\times10^{17}\ \#/cm^3$

(ii) $T = 400$ K

$N_c = 1.78201\times10^{20}(400)^{3/2}$

$N_c = 1.42561\times10^{24}\ \#/m^3 = 1.42561\times10^{18}\ \#/cm^3$