$$= 5.72 \text{ x } 10^{22} \text{ atoms/cm}^3$$

Now, from Equation 4.1, the total number of vacancies, N_{v} , is computed as

$$N_{\nu} = N_{\rm Au} \, \exp\left(-\frac{Q_{\nu}}{kT}\right)$$
$$= (5.72 \times 10^{22} \, \text{atoms/cm}^3) \exp\left[-\frac{0.98 \, \text{eV/atom}}{(8.62 \times 10^{-5} \, \text{eV/K})(800 + 273 \, \text{K})}\right]$$

=
$$1.432 \times 10^{18}$$
 vacancies/cm³

We now want to determine the number of vacancies per unit cell, which is possible if the unit cell volume is multiplied by N_v . The unit cell volume (V_C) may be calculated using Equation 3.5 taking n = 4 inasmuch as Au has the FCC crystal structure. Thus, from a rearranged form of Equation 3.5

$$V_C = \frac{nA_{\rm Au}}{\rho_{\rm Au}N_{\rm A}}$$

.

$$= \frac{(4 \text{ atoms/unit cell})(196.97 \text{ g/mol})}{(18.699 \text{ g/cm}^3)(6.023 \times 10^{23} \text{ atoms/mol})}$$

=
$$6.996 \times 10^{-23} \text{ cm}^3/\text{unit cell}$$

Now, the number of vacancies per unit cell, n_v , is just

$$n_v = N_v V_C$$

=
$$(1.432 \times 10^{18} \text{ vacancies/cm}^3)(6.996 \times 10^{-23} \text{ cm}^3/\text{unit cell})$$

What this means is that instead of there being 4.0000 atoms per unit cell, there are only 4.0000 - 0.0001002 = 3.9998998 atoms per unit cell. And, finally, the density may be computed using Equation 3.5 taking *n* = 3.9998998; thus

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