

3.11 (a) The volume of the Ti unit cell may be computed using Equation 3.5 as

$$V_C = \frac{nA_{\text{Ti}}}{\rho N_A}$$

Now, for HCP,  $n = 6$  atoms/unit cell, and for Ti,  $A_{\text{Ti}} = 47.9$  g/mol. Thus,

$$\begin{aligned} V_C &= \frac{(6 \text{ atoms/unit cell})(47.9 \text{ g/mol})}{(4.51 \text{ g/cm}^3)(6.023 \times 10^{23} \text{ atoms/mol})} \\ &= 1.058 \times 10^{-22} \text{ cm}^3/\text{unit cell} = 1.058 \times 10^{-28} \text{ m}^3/\text{unit cell} \end{aligned}$$

(b) From part of the solution to Problem 3.6, for HCP

$$V_C = 6R^2c\sqrt{3}$$

But, since  $a = 2R$ , (i.e.,  $R = a/2$ ) then

$$V_C = 6\left(\frac{a}{2}\right)^2 c\sqrt{3} = \frac{3\sqrt{3}a^2c}{2}$$

but, since  $c = 1.58a$

$$V_C = \frac{3\sqrt{3}(1.58)a^3}{2} = 1.058 \times 10^{-22} \text{ cm}^3/\text{unit cell}$$

Now, solving for  $a$

$$\begin{aligned} a &= \left[ \frac{(2)(1.058 \times 10^{-22} \text{ cm}^3)}{(3)(\sqrt{3})(1.58)} \right]^{1/3} \\ &= 2.96 \times 10^{-8} \text{ cm} = 0.296 \text{ nm} \end{aligned}$$

And finally

$$c = 1.58a = (1.58)(0.296 \text{ nm}) = 0.468 \text{ nm}$$