

12.17 We are asked to determine the number of Si^{4+} and O^{2-} ions per unit cell for a crystalline form of silica (SiO_2). For this material, $a = 0.700 \text{ nm}$ and $\rho = 2.32 \text{ g/cm}^3$. Solving for n' from Equation 12.1, we get

$$n' = \frac{\rho V_C N_A}{A_{\text{Si}} + 2A_{\text{O}}} = \frac{\rho a^3 N_A}{A_{\text{Si}} + 2A_{\text{O}}}$$

$$= \frac{(2.32 \text{ g/cm}^3)(7.00 \times 10^{-8} \text{ cm})^3 (6.023 \times 10^{23} \text{ formula units/mol})}{(28.09 \text{ g/mol} + 2[16.00] \text{ g/mol})}$$

$$= 7.98 \text{ or almost } 8$$

Therefore, there are eight Si^{4+} and sixteen O^{2-} per unit cell.