

- 1.5 The lattice constant of GaAs is $a = 5.65 \text{ \AA}$. Calculate (a) the distance between the centers of the nearest Ga and As atoms, and (b) the distance between the centers of the nearest As atoms.

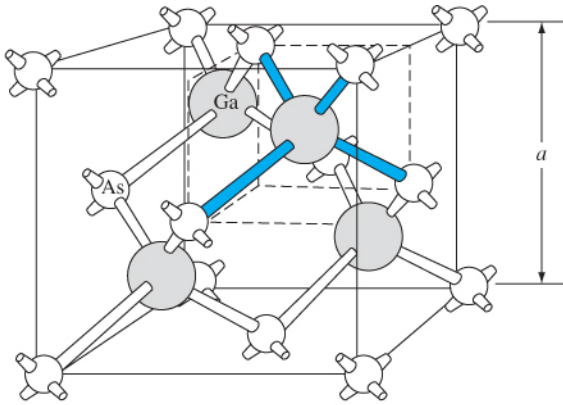


Figure 1.14 | The zincblende (sphalerite) lattice of GaAs.

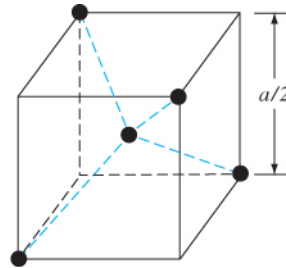


Figure 1.12 | The tetrahedral structure of closest neighbors in the diamond lattice.

- a) The distance from the Ga (center atom) to the closest As (corner atoms) is half the cubic diagonal of Fig. 1.12

$$d = \sqrt{\left(\frac{a}{2}\right)^2 + \left(\frac{a}{2}\right)^2 + \left(\frac{a}{2}\right)^2} = \frac{\sqrt{3}}{2} a$$

$$D_{\text{GaAs}} = \frac{d}{2} = \frac{\sqrt{3}}{4} a = \frac{\sqrt{3}}{4} (5.65 \text{ \AA}) = \underline{\underline{2.4465 \text{ \AA}}}$$

- b) The distance between closest As atoms is equal to the face diagonal of Fig 1.12

$$D_{\text{As-As}} = \sqrt{\left(\frac{a}{2}\right)^2 + \left(\frac{a}{2}\right)^2} = \frac{\sqrt{2}}{2} a = \frac{\sqrt{2}}{2} (5.65 \text{ \AA})$$

$$\underline{\underline{D_{\text{As-As}} = 3.995 \text{ \AA}}}$$