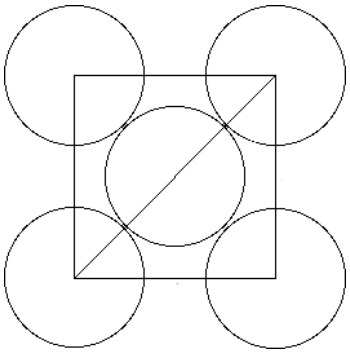
Answer on Question #61295-Physics-Solid State Physics

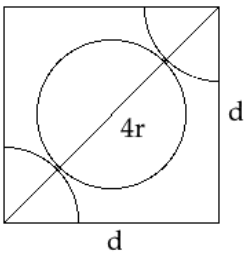
Silver has FCC structure and its atomic radius is 1.414 amstrong. Find the volume of the unit cell?

Solution

Remember that a face-centered unit cell has an atom in the middle of each face of the cube. The square represents one face of a face-centered cube:



Here is the same view, with 'd' representing the side of the cube and '4r' representing the 4 atomic radii across the face diagonal.



Using the Pythagorean Theorem, we find:

$$d^2 + d^2 = (4r)^2$$

$$r^2 = \frac{d^2}{8}$$

$$d = \frac{r}{2\sqrt{2}}$$

The volume of the unit cell is

$$d^3 = \left(\frac{r}{2\sqrt{2}}\right)^3 = \frac{(1.414 \cdot 10^{-10} m)^3}{16\sqrt{2}} = 1.25 \cdot 10^{-31} m^3$$