12.10 (a) This portion of the problem asks that we specify which type of interstitial site the Be^{2+} ions will occupy in BeO if the ionic radius of Be^{2+} is 0.035 nm and the O^{2-} ions form an HCP arrangement. Since, from Table 12.3, $r_{O^{2-}} = 0.140$ nm, then

$$\frac{r_{Be^{2+}}}{r_{O^{2-}}} = \frac{0.035 \text{ nm}}{0.140 \text{ nm}} = 0.250$$

Inasmuch as r_C/r_A is between 0.225 and 0.414, the coordination number for Be^{2+} is 4 (Table 12.2); therefore, tetrahedral interstitial positions are occupied.

(b) We are now asked what fraction of these available interstitial sites are occupied by Be^{2+} ions. Since there are two tetrahedral sites per O^{2-} ion, and the ratio of Be^{2+} to O^{2-} is 1:1, one-half of these sites are occupied with Be^{2+} ions.