

12.5 This problem calls for us to predict crystal structures for several ceramic materials on the basis of ionic charge and ionic radii.

(a) For CaO, using data from Table 12.3

$$\frac{r_{\text{Ca}^{2+}}}{r_{\text{O}^{2-}}} = \frac{0.100 \text{ nm}}{0.140 \text{ nm}} = 0.714$$

Now, from Table 12.2, the coordination number for each cation (Ca^{2+}) is six, and, using Table 12.4, the predicted crystal structure is sodium chloride.

(b) For MnS, using data from Table 12.3

$$\frac{r_{\text{Mn}^{2+}}}{r_{\text{S}^{2-}}} = \frac{0.067 \text{ nm}}{0.184 \text{ nm}} = 0.364$$

The coordination number is four (Table 12.2), and the predicted crystal structure is zinc blende (Table 12.4).

(c) For KBr, using data from Table 12.3

$$\frac{r_{\text{K}^{+}}}{r_{\text{Br}^{-}}} = \frac{0.138 \text{ nm}}{0.196 \text{ nm}} = 0.704$$

The coordination number is six (Table 12.2), and the predicted crystal structure is sodium chloride (Table 12.4).

(d) For CsBr, using data from Table 12.3

$$\frac{r_{\text{Cs}^{+}}}{r_{\text{Br}^{-}}} = \frac{0.170 \text{ nm}}{0.196 \text{ nm}} = 0.867$$

The coordination number is eight (Table 12.2), and the predicted crystal structure is cesium chloride (Table 12.4).