

Section 13.3

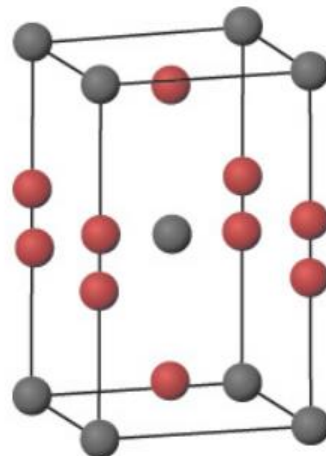
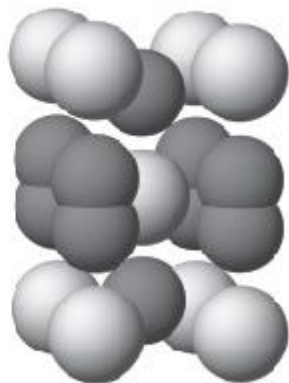
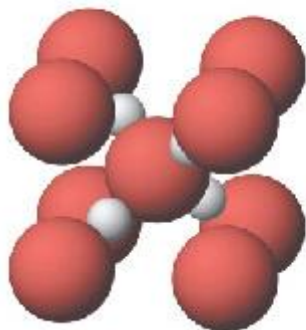
Ionic Solids

Types of Solids and Metallic Solids

In these sections...

- a. Ionic solid unit cells and formulas
- b. Holes in unit cells of anions
- c. Cesium chloride, sodium chloride and zinc blend
- d. What controls which shape a solid takes?
- e. Calculations related to unit cell dimensions

Ionic Solids and Formulas



cesium oxide (Cs on cornder, O on edges)

Ionic Compound Anion Unit Cells with Cations Occupying Holes

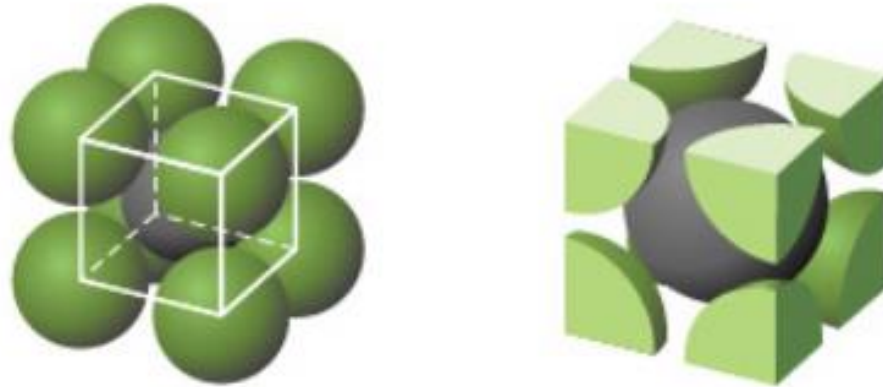
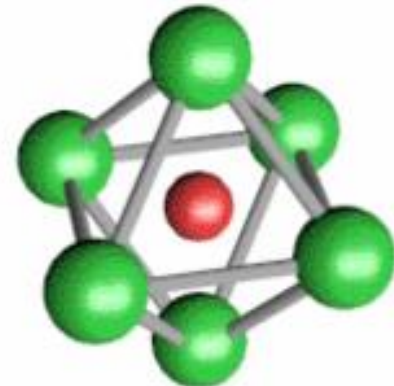
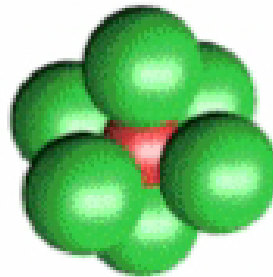


Figure 12.3.1: The cubic hole in a simple cubic lattice



Cubic Holes in Simple Cubic Unit Cells

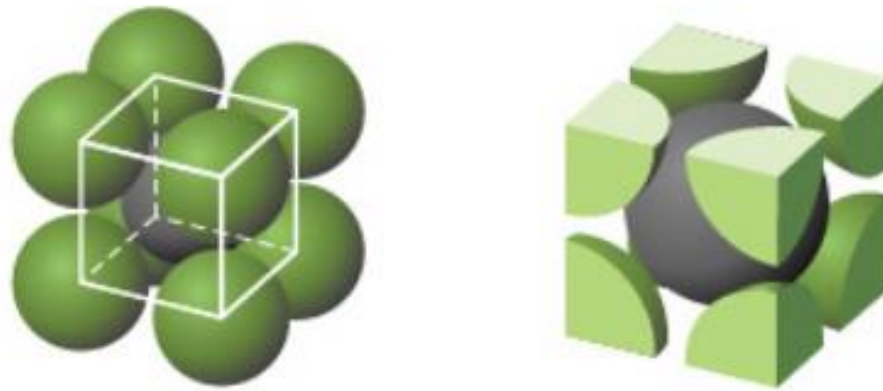
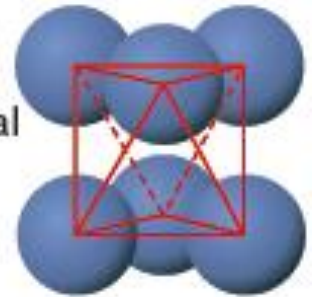
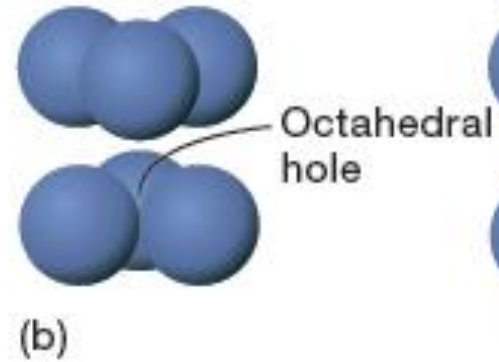
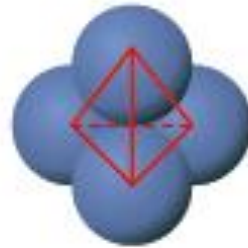
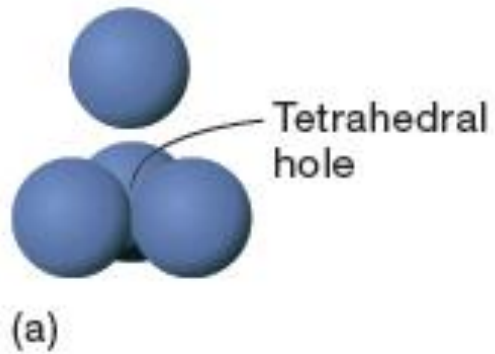
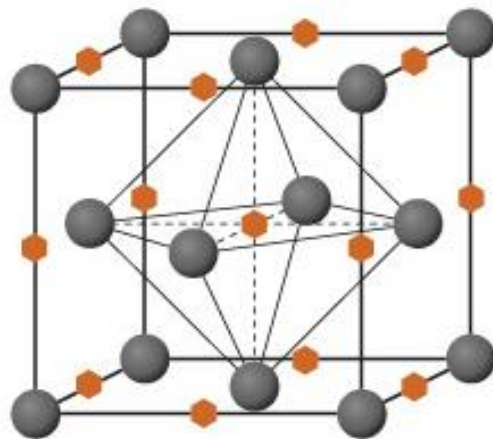
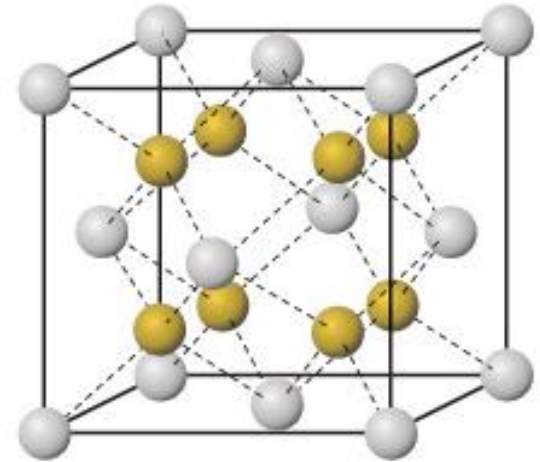
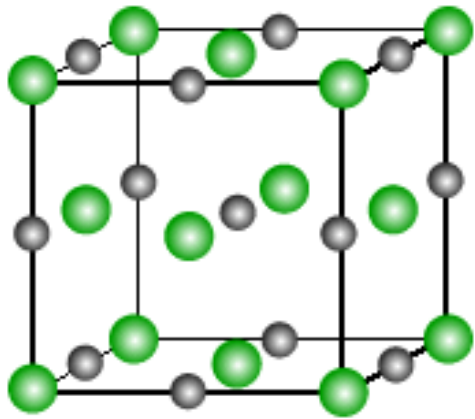


Figure 12.3.1: The cubic hole in a simple cubic lattice

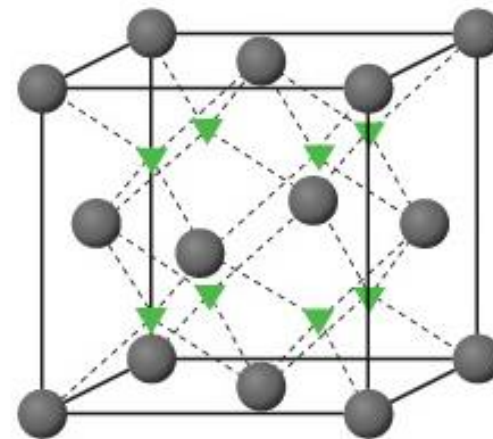
Octahedral and Tetrahedral Holes in FCC Unit Cells



Octahedral and Tetrahedral Holes in FCC Unit Cells

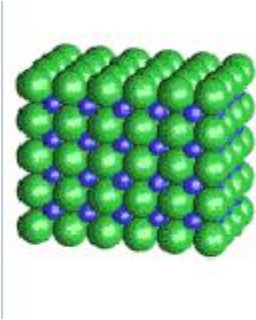


● Octahedral holes

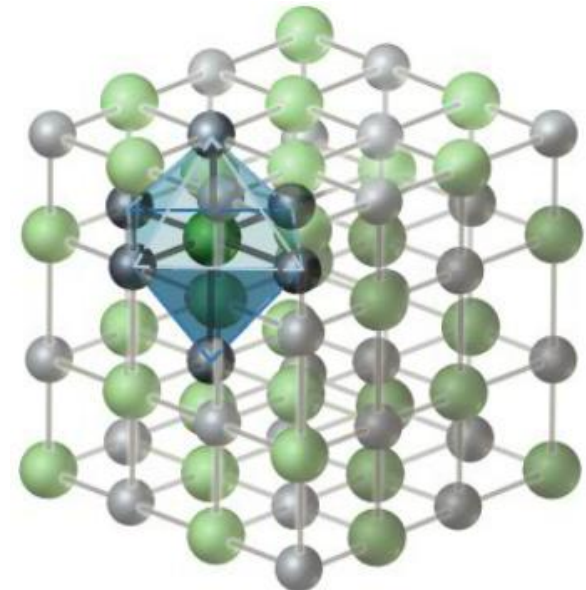
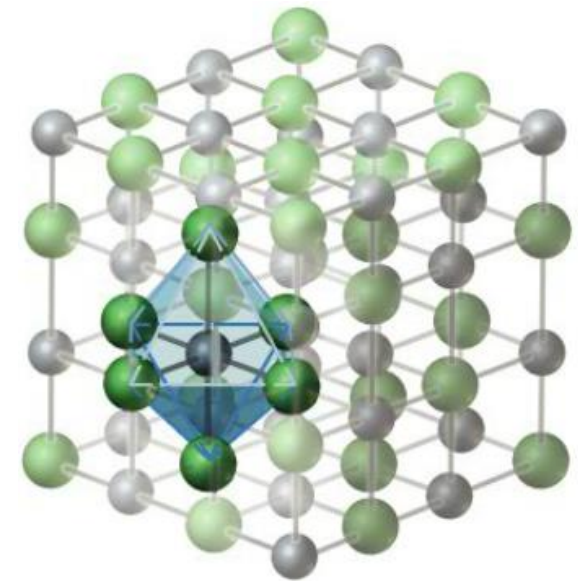
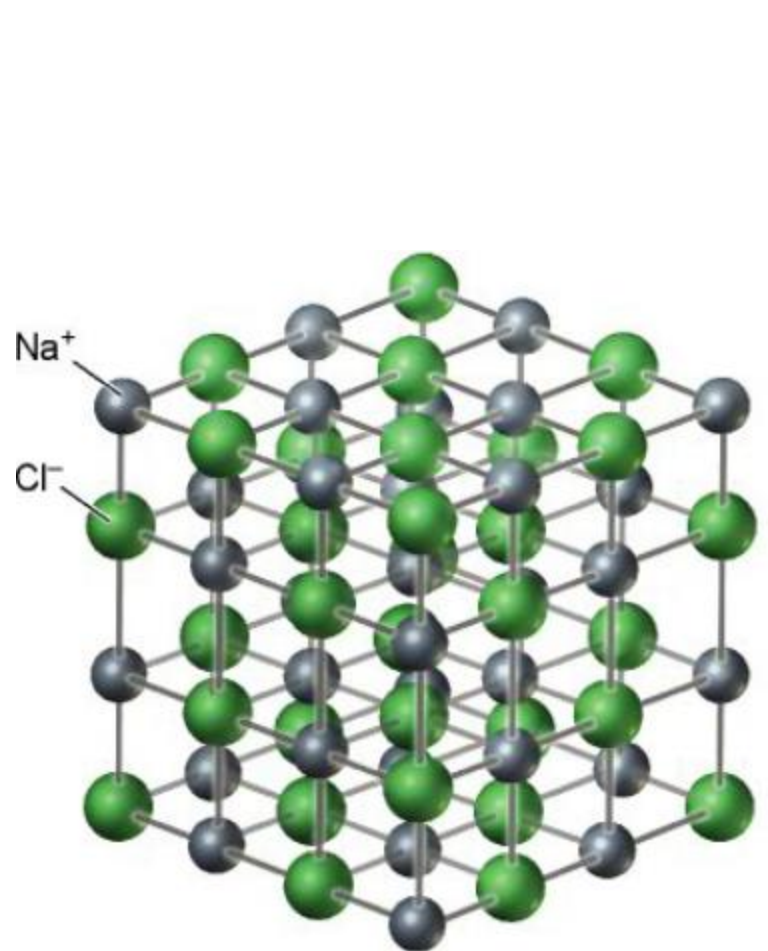


▼ Tetrahedral holes

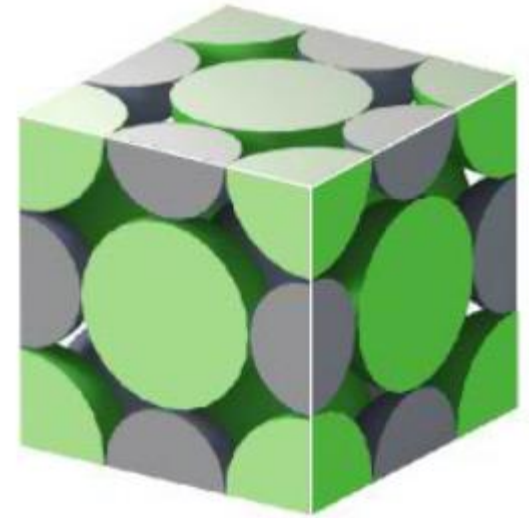
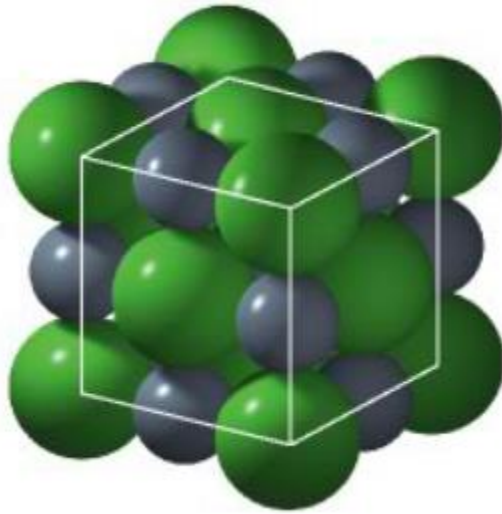
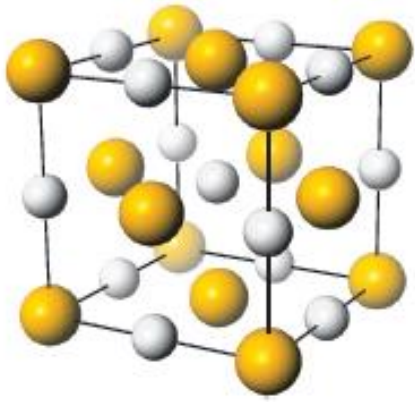
Three Important Ionic Unit Cells: cesium chloride



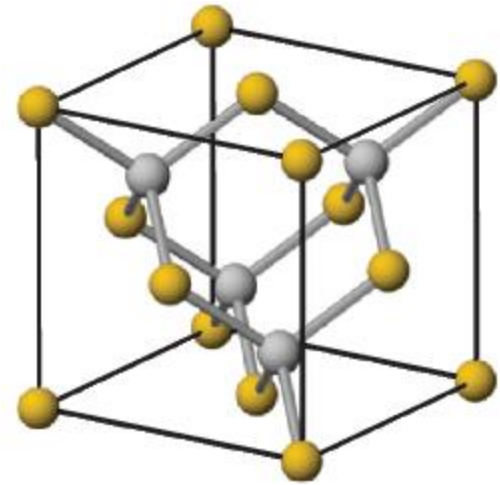
Three Important Ionic Unit Cells: sodium chloride



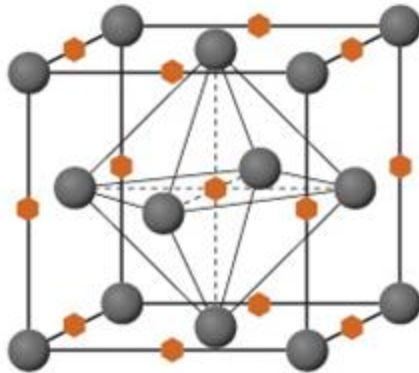
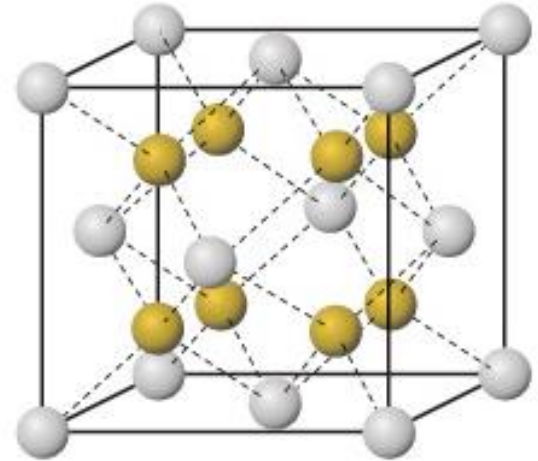
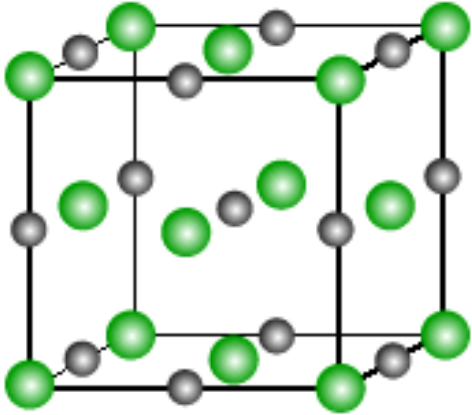
Three Important Ionic Unit Cells: sodium chloride



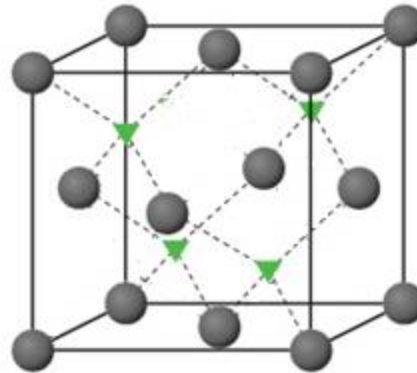
Three Important Ionic Unit Cells: zinc blend



Review of Anion Lattices and Holes in NaCl and zinc blend Unit Cells

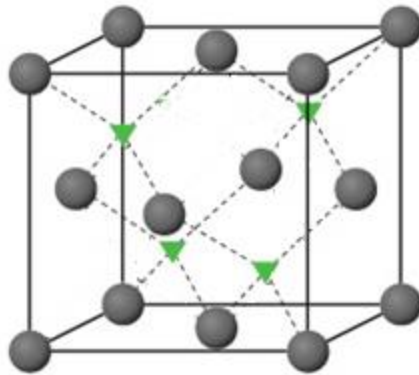
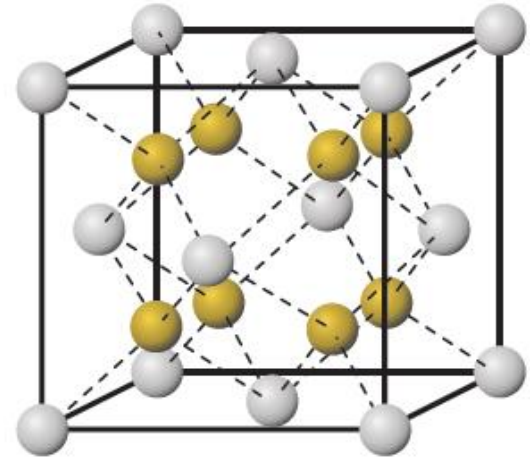
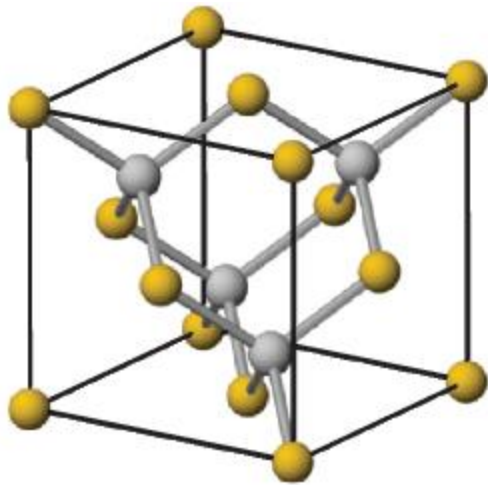


● Octahedral holes

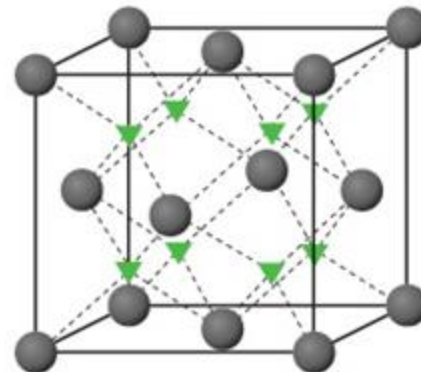


▼ Tetrahedral holes

Comparison of ZnS and SrCl₂ Unit Cells

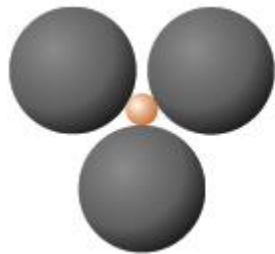
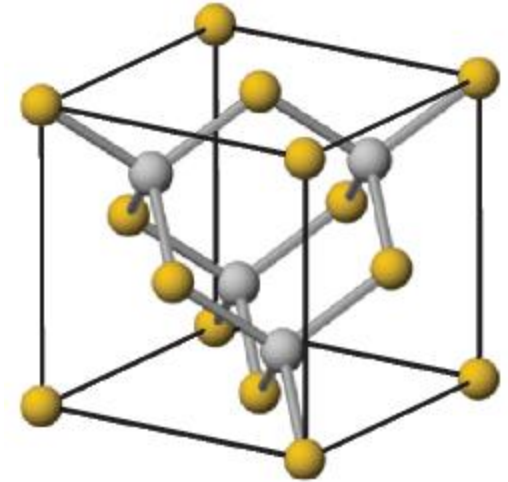
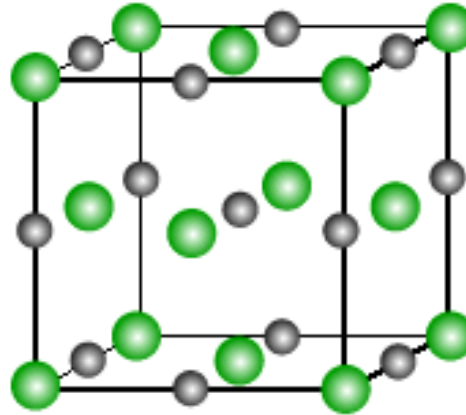
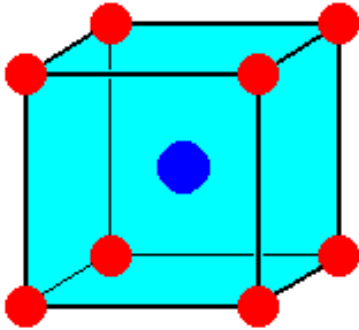


▼ Tetrahedral holes

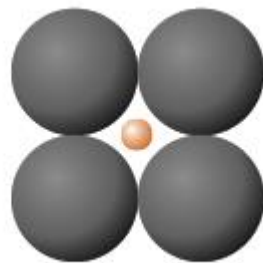


▼ Tetrahedral holes

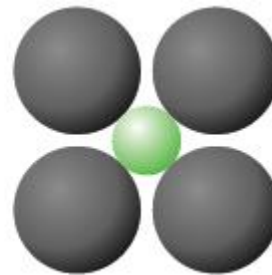
Why do different solids of the same formula type adopt different unit cell structures?



Stable



Unstable



Stable

Stable arrangement has the greatest coordination number without leaving gaps between the cation and the surrounding ions

As r_-/r_+ increases, coordination # decreases

Determine an ionic radius from unit cell dimensions

Magnesium oxide crystallizes with the sodium chloride structure. If the edge length of the unit cell is determined to be 420 pm and the O^{2-} ion is assigned a radius of 126 pm, what is the radius of the Mg^{2+} ion?



CdF₂ crystallizes with the **CaF₂** structure which is represented in the following model, with the anions in green.

If the edge length of the unit cell is **540 pm**, what is the density of crystalline

CdF₂ in g/cm³?

