

## Ionic Solids

1. The bonding in ionic solids will be primarily explained by the **closest packing** model.
2. What is typically larger, cation or anion? How does this affect the typical arrangement within a salt?

Anions are typically larger due to  $e^-/e^-$  repulsion. Because of the consequences of sizing, typically the larger anion will be packed and the smaller cations will be in the holes (or spaces between packed anions).

3. What two types of holes in a closest packed structure?
  - a. **Trigonal**
  - b. **Tetrahedral**
  - c. **Octahedral**
  - d. **Cubic**
4. Arrange these holes in order of increasing size.

**trigonal < tetrahedral < octahedral < cubic**

5. Guidelines for deciding which type of hole is used

$$\rho = R^+_{\text{cation}} / R^-_{\text{anion}}$$

**0.225 <  $\rho$  < 0.414**      use tetrahedral

**0.414 <  $\rho$  < 0.732**      use octahedral

**$\rho > 0.732$**       use cubic

Where:

“ $R^-$ ” refers to the radius of the anion

“ $R^+$ ” refers to the radius of the cation

6. Why are holes that are slightly smaller than the cation used?

Because when the cation is squeezed into the hold it pushes apart the anions a bit and that minimizes the anion/anion repulsion.

7. What is the ration of packed spheres to holes for

a. Tetrahedral

1 : 2 (there are twice as many holes as spheres).

b. Octahedral

1:1 (same number of spheres as holes)