

Ionic Bonding:

Illustrate the bonding bet. sodium and chlorine.

a. orbital notation

b. Lewis structures

Remember:

**Cations—positive ions—form when electrons are lost
Small than the parent atom**

**Anions—negative ions—form when electrons are gained
Larger than the parent atom**

Isoelectronic ions—ions with the same number of valence electrons

The size decreases as the number of protons increases because there is more attraction bet. the protons and electrons.

Arrange the following ions in order of decreasing size:
 Se^{2-} , Br^- , Rb^+ , and Sr^{2+}

Choose the largest ion:

Li^+ , Na^+ , K^+ , Rb^+ , Cs^+

Ba^{2+} , Cs^+ , I^- , Te^{2-}

isoelectronic
same
 $s^2 p^6$
use # p^+



isoelectronic ions

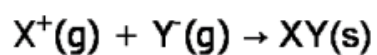
more p^+ the smaller ion

Ionic Compounds and energy:

Lattice energy—change in energy that takes place when separated gaseous ions are packed together to form an ionic solid

also defined as the energy released when an ionic solid forms from its ions

has a negative value since the system is losing energy



Remember the rxn occurs in a series of steps. The sum of the energy changes for each step gives the energy change for the overall rxn. (Just like Hess's Law)

Reaction Mechanism for the formation of an ionic solid

1. sublimation of solid metal
2. ionization of the gaseous metal
3. dissociation of the nonmetal molecules
4. formation of nonmetal ion from atoms in gaseous phase
5. formation of ionic solid from the gaseous ions

Ex. formation of LiF	ΔE (kJ)
$\text{Li(s)} \rightarrow \text{Li(g)}$	161
$\text{Li(g)} \rightarrow \text{Li}^+(\text{g}) + 1\text{e}^-$	520
$\frac{1}{2} \text{F}_2(\text{g}) \rightarrow \text{F(g)}$	77
$\text{F(g)} + 1\text{e}^- \rightarrow \text{F}^-(\text{g})$	-328
$\text{Li}^+(\text{g}) + \text{F}^-(\text{g}) \rightarrow \text{LiF(s)}$	-1047

Overall eq:



The magnitude of the lattice energy depends on the charges of the ions, their sizes, and their arrangement in the solid.

Lattice energy increases as the charges on the ions increase and as their radii decrease.

Lattice energy depends primarily on the ionic charges because the ionic radii don't vary significantly.

Arrange the following ionic compounds in order of increasing lattice energy:

1. NaF, CsI, CaO
2. AgCl, CuO, or CrN

Lattice energy is proportional to product of ion charges

$(+1)(-1)$
-1

$(+1)(-1)$
-1

$(+2)(-2)$
-4

$CsI < NaF < CaO$

$(+1)(-1) = -1$
 $(+2)(-2) = -4$
 $(+3)(-3) = -9$

$AgCl < CuO < CrN$

$BaCl_2$ BaO
 $(+2)(-1)$ $(+2)(-2)$
-2 -4