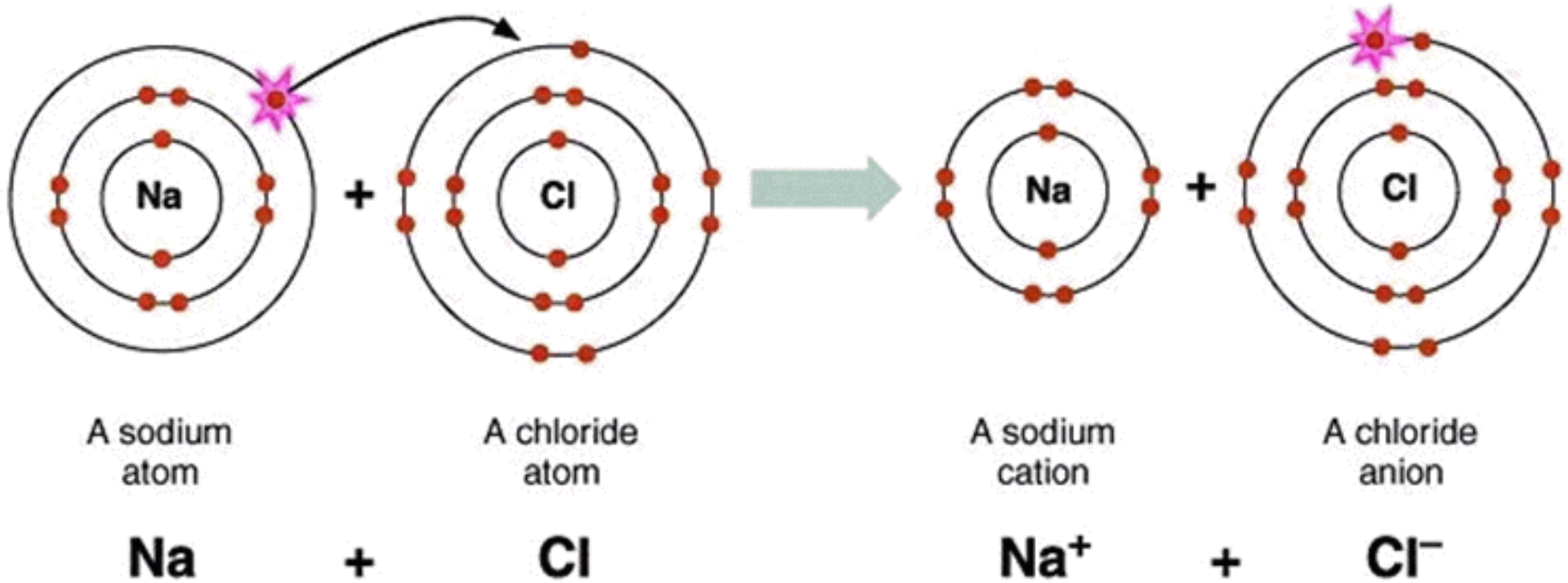


# Ionic Bonding



# CA Standards

□ *Students know atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging electrons to form ionic bonds.*

□ *Students know salt crystals, such as NaCl, are repeating patterns of positive and negative ions held together by electrostatic attraction.*

# Bonds

□ Forces that hold groups of atoms together and make them function as a unit.

❖ Ionic bonds - transfer of electrons

❖ Covalent bonds - sharing of electrons

# The Octet Rule - Ionic Compounds

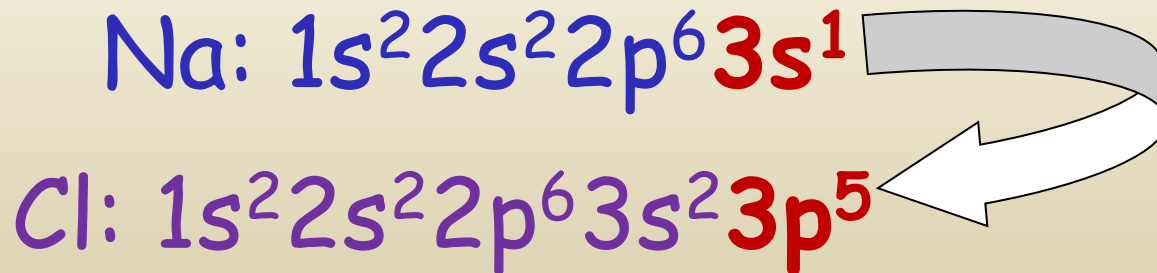
Ionic compounds form so that each atom, by gaining or losing electrons, has an octet of electrons in its highest occupied energy level.

Metals lose electrons to form positively-charged cations

Nonmetals gains electrons to form negatively-charged anions

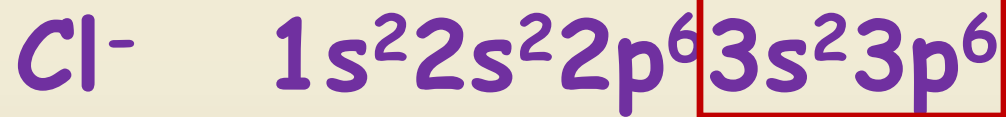
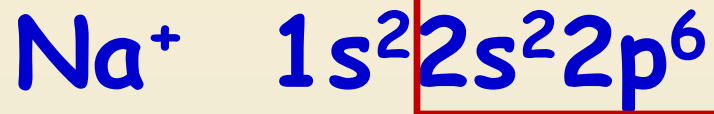
# Ionic Bonding: The Formation of Sodium Chloride

- ❑ Sodium has 1 valence electron
- ❑ Chlorine has 7 valence electrons
- ❑ An electron transferred gives each an octet



# Ionic Bonding: The Formation of Sodium Chloride

This transfer forms ions, each with an octet:



# Ionic Bonding:

## The Formation of Sodium Chloride

The resulting ions come together due to electrostatic attraction (opposites attract):



The net charge on the compound must equal zero

# Examples of Ionic compounds

$Mg^{2+}Cl^{-}_2$  **Magnesium chloride:** Magnesium loses two electrons and each chlorine gains one electron

$Na^{+}_2O^{2-}$  **Sodium oxide:** Each sodium loses one electron and the oxygen gains two electrons

$Al^{3+}_2S^{2-}_3$  **Aluminum sulfide:** Each aluminum loses three electrons (six total) and each sulfur gains two electrons (six total)



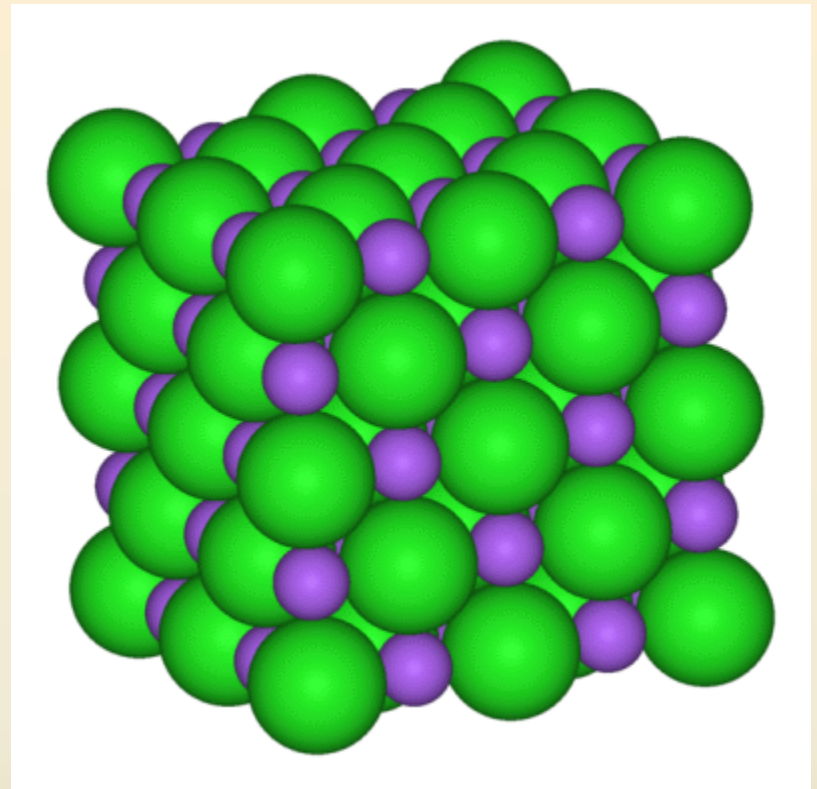
<b>Metal</b>	<b>Monatomic Cations</b>	<b>Ion name</b>
Lithium	$\text{Li}^+$	Lithium
Sodium	$\text{Na}^+$	Sodium
Potassium	$\text{K}^+$	Potassium
Magnesium	$\text{Mg}^{2+}$	Magnesium
Calcium	$\text{Ca}^{2+}$	Calcium
Barium	$\text{Ba}^{2+}$	Barium
Aluminum	$\text{Al}^{3+}$	Aluminum

Nonmetal	Monatomic Anions	Ion Name
Fluorine	F <sup>-</sup>	Fluoride
Chlorine	Cl <sup>-</sup>	Chloride
Bromine	Br <sup>-</sup>	Bromide
Iodine	I <sup>-</sup>	Iodide
Oxygen	O <sup>2-</sup>	Oxide
Sulfur	S <sup>2-</sup>	Sulfide
Nitrogen	N <sup>3-</sup>	Nitride
Phosphorus	P <sup>3-</sup>	Phosphide

# Sodium Chloride Crystal Lattice

Ionic compounds form solid *crystals* at ordinary temperatures.

Ionic compounds organize in a characteristic crystal lattice of alternating positive and negative ions.



All salts are ionic compounds and form crystals.

# Properties of Ionic Compounds

<b><i>Structure:</i></b>	Crystalline solids
<b><i>Melting point:</i></b>	Generally high
<b><i>Boiling Point:</i></b>	Generally high
<b><i>Electrical Conductivity:</i></b>	Excellent conductors, molten and aqueous
<b><i>Solubility in water:</i></b>	Generally soluble