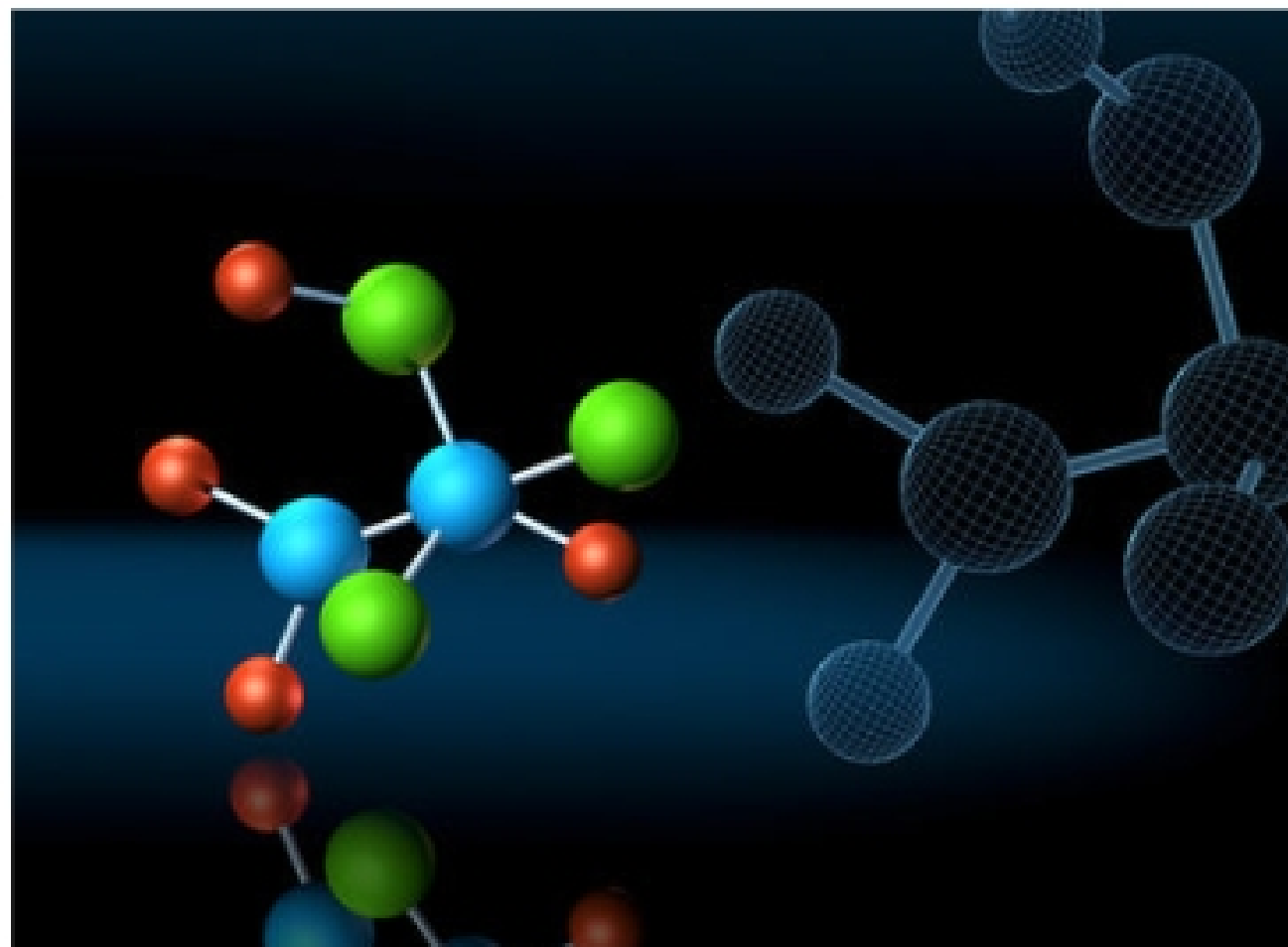


CHEM 101

# Basic Concepts of Chemical Bonding



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## Chapter 8

### Chemical Bonds

Three basic types of bonds:

Ionic: electrostatic attraction between ions

Covalent: sharing of electrons

Metallic: metal atoms bonded to several other atoms.

### Lewis Symbols

G.N. Lewis developed a method to denote potential bonding e- by using one dot for every valence e- around the element symbol.

### Lewis Dot Symbols

Using noble gas configurations as shorthand for electron configurations.

-The e- after the noble gas shorthand is represented with a dot

- Li -  $1s^2 2s^2$  or [He]  $2s^1$
- Li has one valence e- :Li $\cdot$

-Single e- are available for binding. Therefore Li has one bonding e-

### Lewis Dot Structures

Lewis dot structures are not used for transition metals

Valence e- for the largest value of n for lewis dot symbols.

### Formation of Bonds

Octet Rule: When atoms form a compound, they will gain, lose or share e- to obtain a noble gas e- configuration.

### Exceptions to the Octet Rule

There are three types of ions or molecules that do not follow the octet rule:

- Ions or molecules with an odd number of e-
- Ions or molecules with less than an octet
- Ions or molecules with more than eight valence e- (an expanded octet)

## Ionic Formation

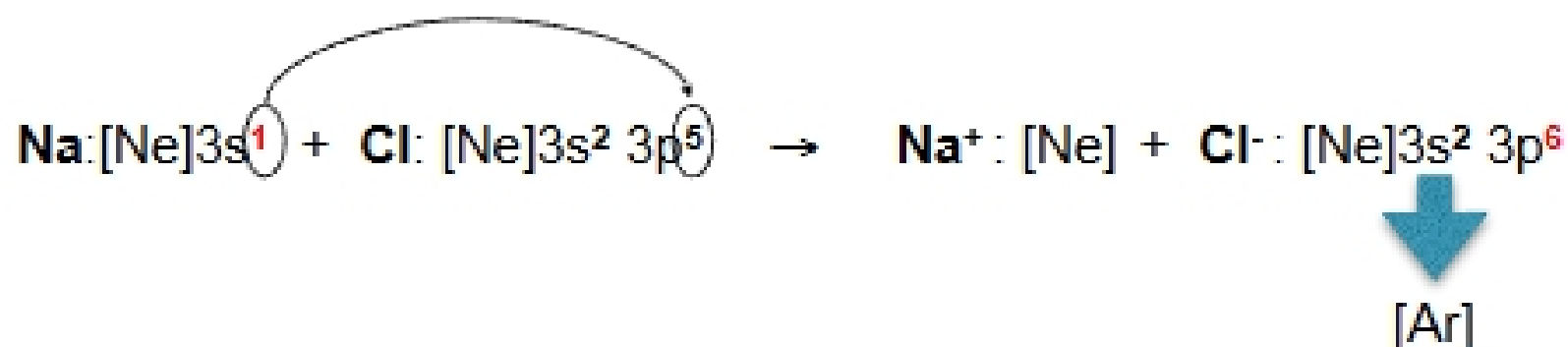
Metals lose e<sup>-</sup> (low IE) to form cations and obtain the e<sup>-</sup> configuration of the **previous** noble gas

-This is usually  $ns^2np^2 = \text{"octet"}$

Nonmetals gain e<sup>-</sup> (high EA) to form anions and obtain the e<sup>-</sup> configuration of the **next** noble gas.

-This is usually  $ns^2np^2 = \text{"octet"}$

Ex:



## Energetics of Ionic Bonding: Born-Haber Cycle

Many factors affect the energy of ionic bonding:

- 1) Start with the metal and nonmetal elements: Na(s) and Cl<sup>2</sup>(g)
- 2) Make gaseous atoms: Na(g) and Cl(g)
- 3) Make ions: Na<sup>+</sup>(g) and Cl<sup>-</sup>(g)
- 4) Combine atoms: NaCl(g)

It takes energy to convert element to atoms (endothermic)

It takes energy to create a cation

Energy is released by making the anion (exothermic)

The formation of the solid releases a huge amount of energy (exothermic)

-This makes the formations of salts from the elements exothermic