

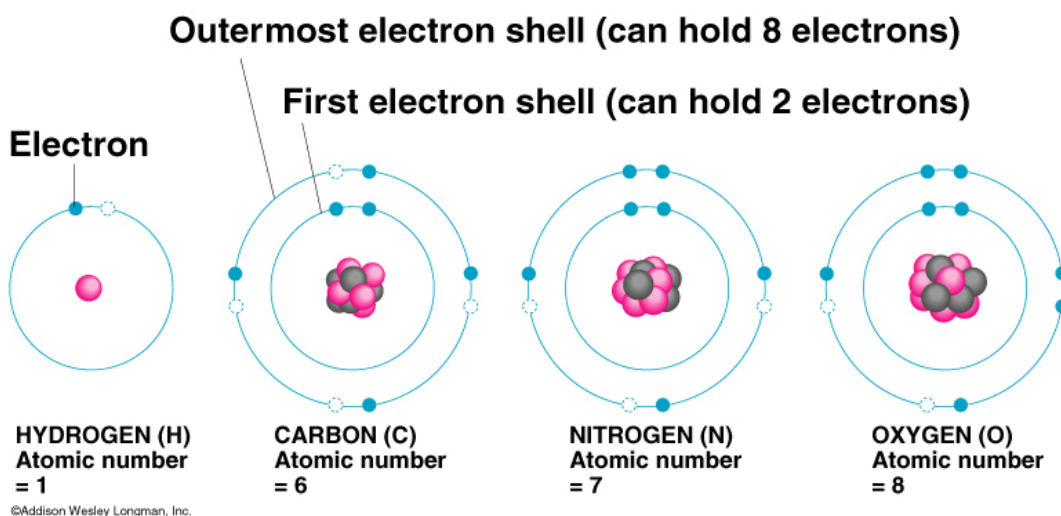
# Chemical Bonding

## Prerequisite Concepts

- Atomic # = # of protons
- Electron charge is (-)
- Proton charge is (+)
- In a neutral atom, # of protons = # of electrons
  - (the net charge is zero)
- Electrons are arranged in specific configurations
  - Energy level (e- shell) → sublevel → orbital
- Valence e- are the outermost shell e-
  - Lewis Diagrams represent the valence e- of an element
- Diagonal staircase separates
  - metals (to the left)
  - nonmetals (to the right)

## The Octet Rule

- Atoms tend to combine so that they each have full valence shells.
  - 8 e- for all atoms except period 1
  - H and He need 2 e-
    - H and He only have the 1st energy level
    - (which is full with 2 e-)
  - Elements all want to be like their closest noble gas neighbor (full valence shell)



- H would like to: gain 1 e-
- C would like to: gain 4 e-
- N would like to: gain 3 e-
- O would like to: gain 2 e-

# Types of Bonds

- Nonmetal + Metal → **Ionic Bond**
- Nonmetal + Nonmetal → **Covalent Bond**
- Metal + Metal → **Metallic Bond**

## Chem. Bonding Steps

1. Metal or Nonmetal?
  - Metal + Nonmetal: **IONIC**
  - Nonmetal + Nonmetal: **COVALENT**
2. Determine Valence e-
  - Draw Lewis Diagrams for each element
3. Rearrange e- to make stable atoms.
4. Rewrite molecule showing bonds.
5. Write Chemical Formula.

## Ionic Bond

- Formed by transferring e- between atoms
  - When an atom loses or gains e-, it has an unequal # of protons (+) and electrons (-)
    - This forms an ion: a charged atom
    - Losing e- → positive charged atom (cation)
    - Gaining e- → negative charged atom (anion)
  - Opposite charged ions **attract** forming an ionic bond.



Na: 11 protons (+)  
11 electrons (-)  
neutral charge

Na: 11 protons (+)  
10 electrons (-)  
1+ charge



Cl: 17 protons (+)  
17 electrons (-)  
neutral charge

Cl: 17 protons (+)  
18 electrons (-)  
1- charge

## Ionic Bond Practice

Sodium + Chlorine

Calcium + Chlorine

Potassium + Oxygen

Lithium + Nitrogen

Aluminum + Chlorine

Aluminum + Sulfur

## Covalent Bond

- Formed by sharing of electrons between atoms.
  - Nonmetal + Nonmetal

## Covalent Bond Practice

Fluorine + Fluorine

Hydrogen + Oxygen

Phosphorus + Chlorine

Hydrogen + Sulfur

Oxygen + Oxygen (double covalent bonding)

Carbon + Oxygen (double covalent bonding)

2 Carbon + 4 Hydrogen  
(mixed covalent bonding)

## **Metallic Bond**

- Formed between atoms of metallic elements
- Holds metal atoms together very strongly
- Electron cloud around atoms
- Good conductors at all states, lustrous, very high melting points
- Examples; Na, Fe, Al, Au, Co