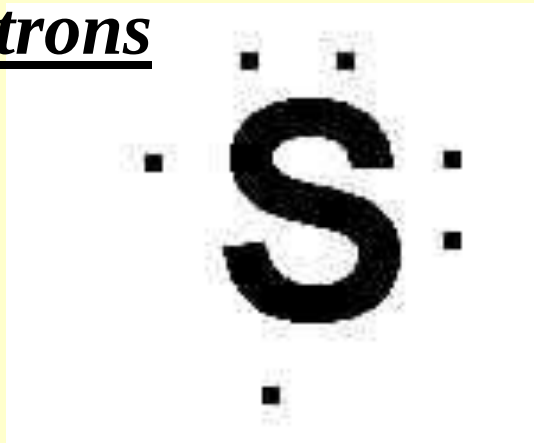
How Atoms Combine

Electrons and Compounds

- **Atoms combine in such a way so that there electrons resemble a noble gas***
- **The electrons involved in forming compounds are the outer electrons or *valence electrons****

Chemical bonds & Electron Dot Model

- **Atoms are held together by chemical bonds**
- **Electron dot model***
  - **A model that uses the Symbol as the nucleus and puts dots around it to represent the electrons.**
  - **An electron dot model only uses the outer energy electrons***
- **The outer electrons are *Valence electrons***

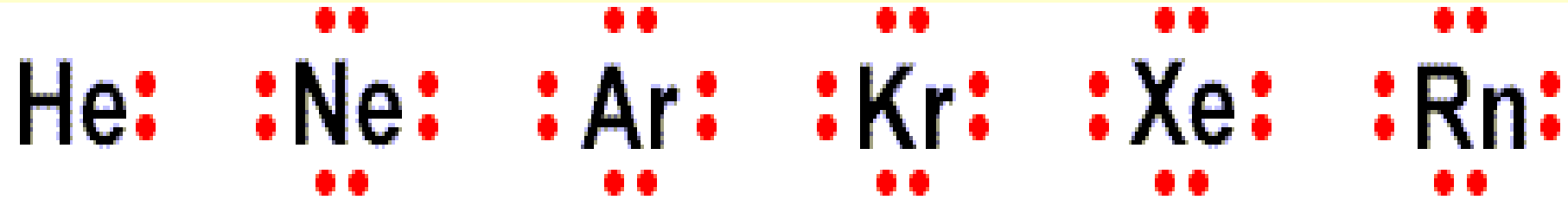


The Octet Rule

Atoms tend to gain, lose, or share electrons until they have eight valence electrons. *

Octet Rule

Noble Gas configuration

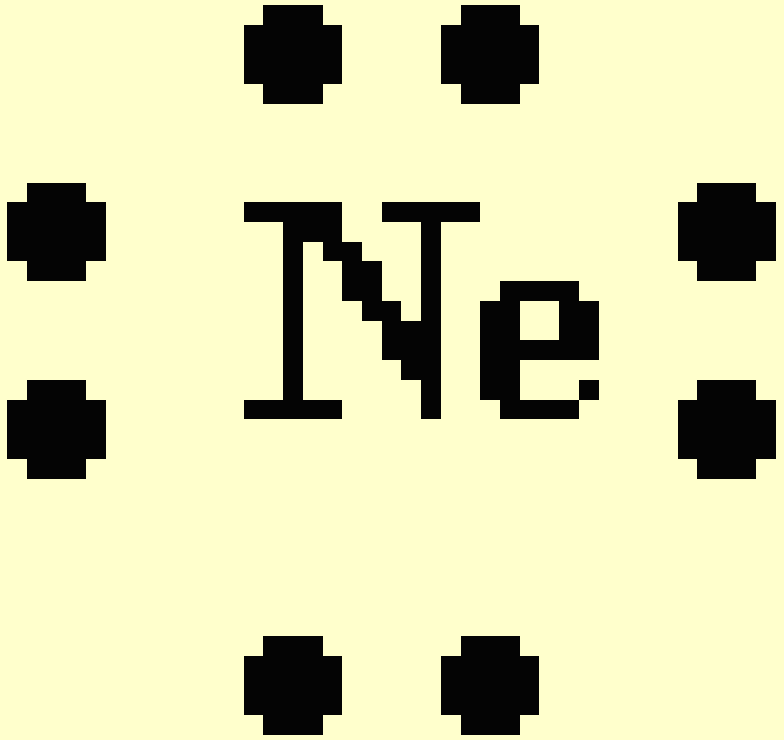


Duet Rule

- Hydrogen, Lithium, beryllium and Boron combine so that they have two valence electrons

Periodic Chart & Chemical Stability

- **Elements form compounds (chemical bounds) for chemical stability***

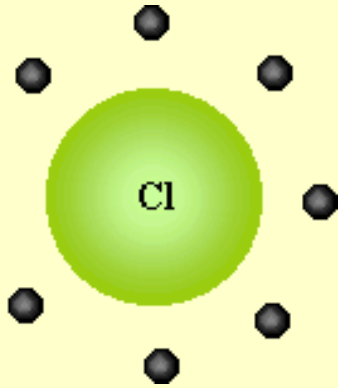


Chemical Formulas

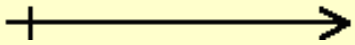
- **Chemical formulas tell the elements present, and the ratios of the elements ***
- **A formula is represented by a symbol and the number of atoms present**
  - **Water H_2O, has two hydrogen to every one oxygen**
  - **Sodium chloride NaCl, 1:1**
  - **Iron III oxide Fe_2O_3, two iron to three oxygen**
- **Lewis Dot formulas for compounds**

There are Two Kinds of chemical bonds

- Ionic *
  - Transfer of electrons



- Covalent *
  - Sharing of electrons

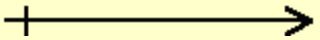


Ionic compounds

- **An ion is an atom with a charge***
  - **the charge is the result of electrons being lost or gained by an atom***
- **The result of ions with opposite charges are held together**
- **In an ionic bond electrons are gained or lost***
  - **An example of an ionic compound would be NaCl**
  - **Ionic bonds are generally the result of a metal combining with a nonmetal**
- **Ions are responsible for many things we observed and are involved in**
  - **Example would be nerve impulses**

Molecules and Covalent bond

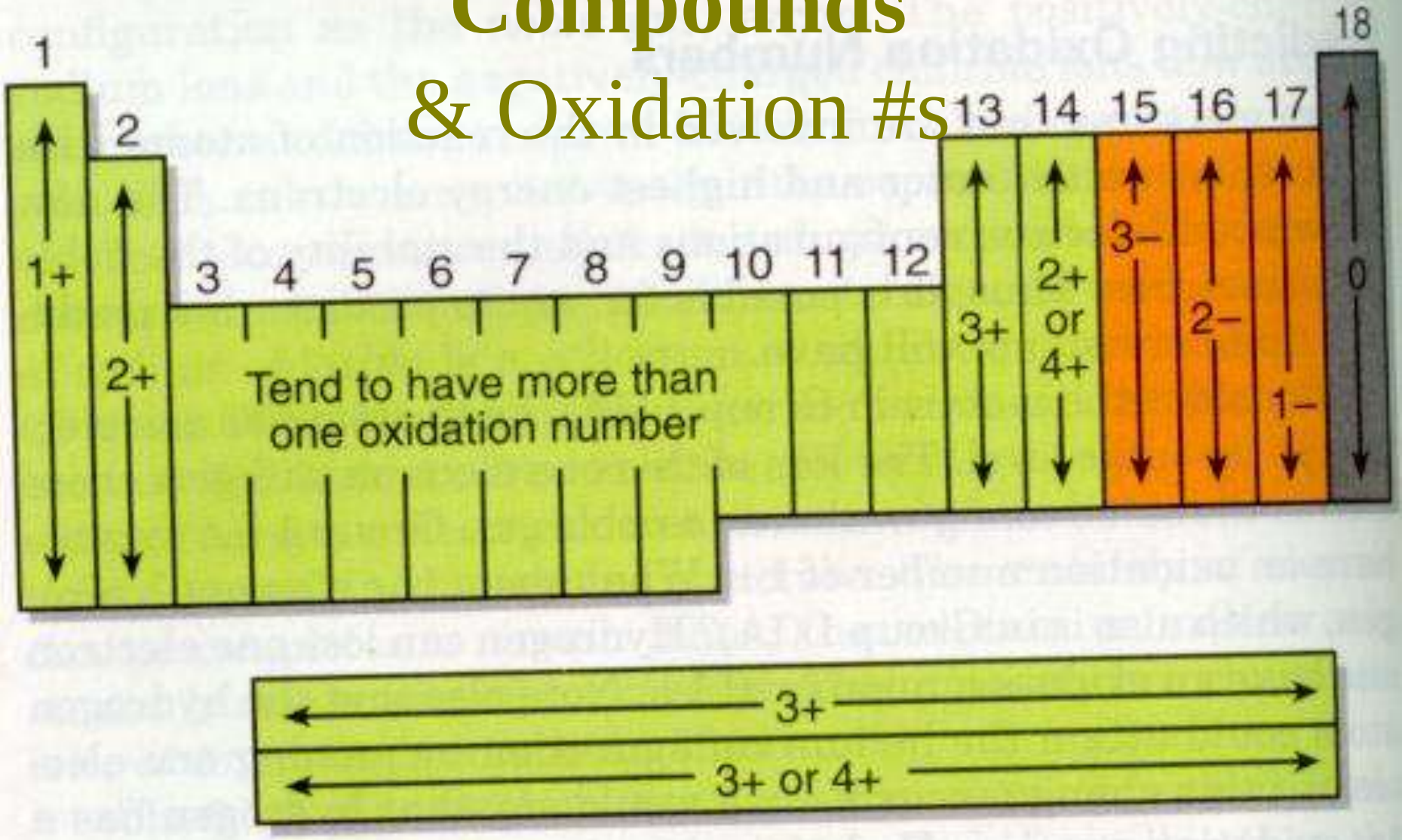
- **a bond formed by sharing of electrons* Example – H_2O**
- **Covalent bonds are generally the result of two nonmetals combining**



Polar and Non-polar Molecules

- **Polar molecules are the result of uneven attractions of the electrons in a covalent bond.***
- **If one atom pulls harder on the electron than another atom, there is a charge on each end of the molecule**
  - **An example of a polar molecule is water (p. 308)***
- **Non-polar molecules have an equal attraction for the electrons**
  - **An example would be O_2**

Formulas and Names of Compounds & Oxidation #s



Oxidation Numbers

- **Oxidation #s are the number of electrons gained lost or shared by an atom when it forms a chemical compound.***
- **Assigning oxidation #s**
  - **Positive oxidation #s***
    - **The # of electrons the element loses or shares to form a compound**
  - **Negative oxidation #s ***
    - **The number of electron gained or shared to form a compound**

Oxidation # *

- **Groups and their oxidation #s**
  - **Elements in group 1 have +1 oxidation #**
  - **Group 2 +2**
  - **Group 13 +3**
  - **Group 17 – 1**
  - **Group 16 – 2**
  - **Group 15 – 3**
- **Atoms combine in such a way that the sum of their oxidation #s = 0*****

Balancing Formulas & Using Subscripts

- **Subscripts used to balance the chemical combinations called *formulas**
- **Hydrogen has a +1 oxidation # Oxygen has a - 2 oxidation #.**
  - **To balance the formula, there must be 2 hydrogen to 1 oxygen**
  - **Example: H^{+1} and O^{-2} so it has to be written H_2O to balance the oxidation #s**

More Balancing Formulas

- **Iron III has a +3 oxidation # oxygen has an oxidation # of – 2**
  - **The formula is Fe_2O_3**
  - **This gives you 2 +3 iron atoms to 3 - 2 oxygen atoms**
  - **When you multiply the subscript times the oxidation number together you get a +6 & - 6 which when added equal 0**
  - **Formulas are the symbols and the ***subscripts**** **together to show the ratio of the atoms that are combined**
    - **(subscripts show the ratios that the elements combine)**

Naming Binary Chemical Compounds

- **Name the positive oxidation element first***
- **The name of the negative oxidation is second and the suffix ide is added***
  - **Example: NaCl Sodium Chloride**
  - Binary compounds end in ide
- **When two elements that are nonmetal combine prefixes are many times used to tell you the # of atoms***
  - **Example: CO_2 - Carbon dioxide, CO Carbon monoxide**

Polyatomic ions

- **are a group of atoms acting together as on ion.***
  - **Example CO_3^{-2} carbonate, PO_4^{-3} Phosphate, NO_3^{-1} Nitrate, OH^- Hydrate**
  - **Most compounds with negative polyatomic ions in them end in ate**

Chart of Polyatomic ions

+1	-1	-2	-3
Ammonium, NH_4^{+1}	Acetate, $C_2H_3O_2^{-1}$	Carbonate, CO_3^{-2}	Phosphate, PO_4^{-3}
	Chlorate, ClO_3^{-1}	Sulfate, SO_4^{-2}	
	Hydroxide, OH^{-1}		
	Nitrate, NO_3^{-1}		

Formulas with Polyatomic Ions

- **Polyatomic formulas are written and balanced just like binary compounds***
- **Example: aluminum sulfate $Al_2(SO_4)_3$**
- **Parentheses are used around the polyatomic ions when there is more than one ions needed to balance the equation***

Hydrated crystals

- **are a compounds that have water molecules in them***
  - **$CuSO_4 \cdot 5H_2O$**