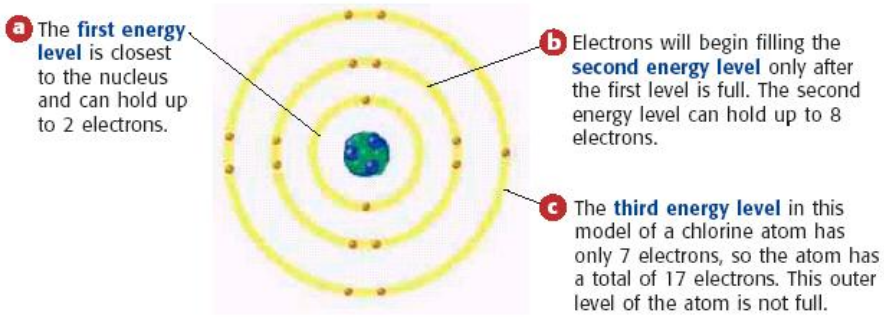
I ELECTRONS AND CHEMICAL BONDING:

A. Combining Atoms Through Chemical Bonding:

1. Chemical bonding is the _____ of _____ to form new substances.
2. The properties of the new substances are _____.
3. An interaction that _____ 2 atoms together is called a _____ _____.

B. Electron Number and Organization:

1. Remember,,,atoms have no charge, so the atomic _____ also is the number of _____.
2. Only electrons in the _____ energy level make chemical _____.
3. Electrons in the _____ energy level are called _____ electrons.



C. To Bond or Not to Bond:

1. The _____ of electrons in the outer level determine whether the atom _____.

2. Atoms that have ___ valence electrons do _____ bond!

3. Atoms bond by _____, _____, or _____ electrons to have a _____ outer energy level.

II IONIC BONDS:

A. Forming Ionic Bonds:

1. An ionic bond forms when electrons are _____ from one _____ to another.
2. During _____ bonding, _____ or _____ valence electrons are transferred.
3. When an atom gains or loses an _____ it is no longer _____, instead it is _____.
4. An atom that has a charge is called an _____.

B. Forming Positive Ions:

1. An atom that loses an electron becomes _____ because now it has fewer _____ than _____.
2. Metals have _____ valence electrons, so they _____ them easily.

B. Forming Negative Ions:

1. An atom that gains an electron becomes _____ because now it has more _____ than _____.
2. Nonmetals have an almost _____ outer energy level, so they tend to _____ electrons to get a full outer shell.

C. Gain or Lose?:

Element	Metal (M) Nonmetal (N)	Electrons in outer shell	Lose or Gain Electrons?
OXYGEN			
GOLD			
BROMINE			
IRON			
PHOSPHORUS			

D. Ionic Charge Practice:

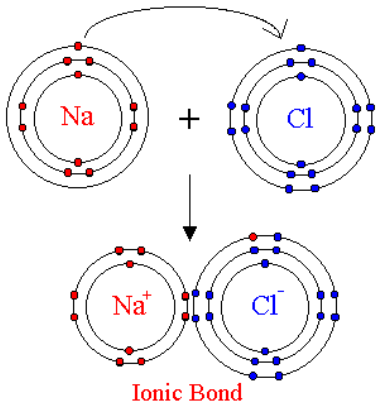
Element	Metal or Nonmetal	# of e's in last shell	Gain or Lose?	Ion Charge
Nickel				
Iodine				
Sulfur				
Cesium				

E. Ionic Compounds:

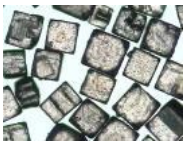
1. When ionic bonds form, the _____ of electrons lost by the _____ atoms equals the number _____by the nonmetal atoms.

2. The _____ is now _____ because the charges of the _____ cancel each other.

   a. The ions stay together because _____ attract !!

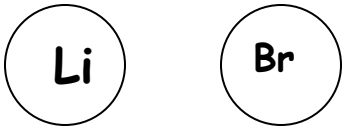


b. Ionic compounds form in a pattern called _____.

NaCl crystals 

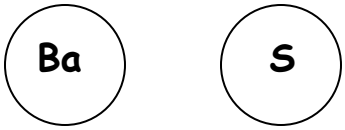
F. Ionic Bond Practice:

1. LiBr



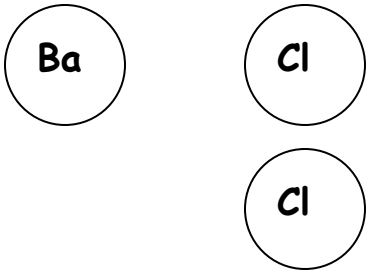
---

2. BaS



---

3. $BaCl_2$



---

4. MgO

---

5. CsO

---

6. CaI_2

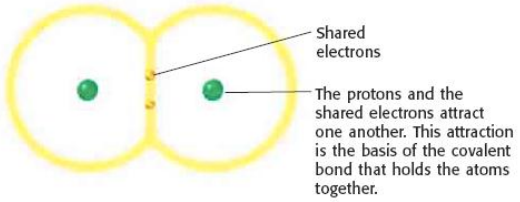
---

7. Rb_2S

III Covalent and Metallic Bonds:

A. Covalent Bonds:

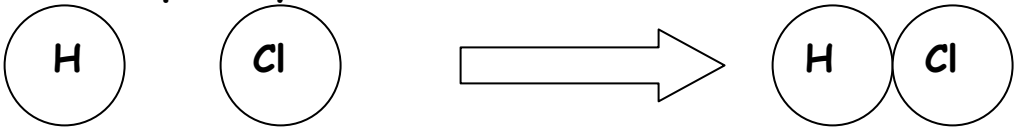
1. A covalent bond forms when atoms _____ one or more pairs of electrons.
2. This type of bond happens usually with _____.
3. Below is a picture of two hydrogen atoms in a covalent bond.



4. Each hydrogen _____ its one electron with the other.
5. Substances made with covalent bonds are made up of _____.
6. A molecule consists of _____ or more atoms joined in a definite _____.
7. The hydrogen molecule shown above is a very _____molecule.
8. Molecules made up of _____ atoms of the same element are called _____ molecules.
9. Elements found in nature as diatomic molecules are called _____ elements. Examples:

_____ _____ _____ _____ _____ _____ _____

10. A drawing of a _____ bond only shows the _____ shell.
11. Example: Hydrochloric acid HCl

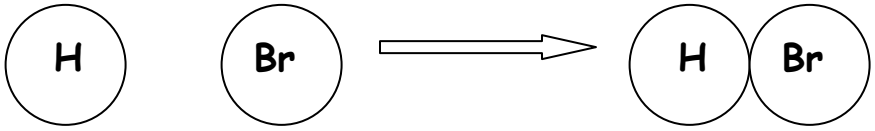


By sharing, H now has _____ electrons & Cl has ___electrons.

B. Practice Time:

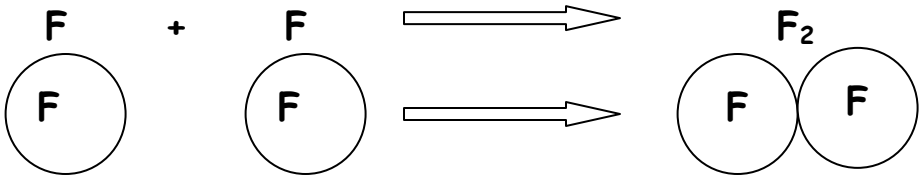
Use an X for the electrons of one element and a O for the electrons of a different element. That makes it less confusing !

1. H + Br → HBr



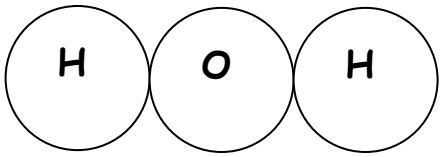
****

2. F + F → F_2



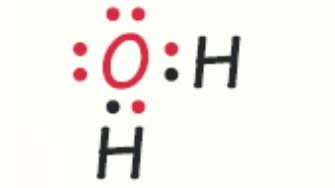
****

3. H_2O



****

4. You can also use an electron-dot diagram that shows the _____ electrons but not the _____. Instead of different colors, still show X's and O's



This electron-dot diagram for water shows only the outermost level of electrons for each atom. But you still see how the atoms share electrons.

5. Your turn !!!

a) PI_3

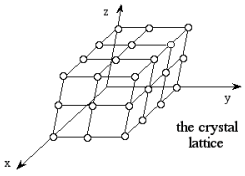
b) H_2Se

IV IONIC AND COVALENT COMPOUNDS:

A. Ionic Compounds and Their Properties:

1. Compounds made with _____ bonds are ionic _____.

2. ***Brittleness:***



a) Ionic compounds are made in a _____ lattice.

b) When hit, the pattern _____ which causes it to _____

3. ***High Melting Points:***

a) Ionic bonds are _____ so melting points are _____

b) Most ionic compounds are _____ are room temperature.

4. ***Solubility and Electrical Conductivity:***

a) They dissolve _____ in water.

b) The _____ that forms when an ionic compound dissolves in _____ can _____ electricity.

B. Covalent Compounds and Their Properties:

1. Most _____ are covalent compounds.

2. Covalent bonds are _____ than ionic bonds.

3. Remember, covalent bonds form _____.

4. ***Low Solubility:***

a) Many covalent compounds do _____ dissolve well in water.

b) Examples: * Carbon dioxide in soda * Oil in vinegar

5. ***Low Melting Points***:

a) Since covalent bonds are _____ they melt _____.

6. ***Electrical Conductivity***:

a) Some _____ in water, but most don't.

b) If they do dissolve, the solution has _____ molecules, so they _____ conduct electricity.

C. Comparison Table:

IONIC BONDS	COVALENT BONDS

V FORMING NEW SUBSTANCES:

A. Chemical Reaction Signs:

1. _____ 2. _____

3. _____ 4. _____

5. Most important:_____

B. Bonds: Holding Molecules Together:

1. How do new substances form in a chemical reaction?

a) First:_____

b) Then:_____

c) Then :_____

VI CHEMICAL FORMULAS ….:

A. What is a chemical formula?

1. A _____ way to use chemical _____ and _____ to represent a _____.

B. Rules for writing formulas:

1. Write the _____ ion first.
2. Write the _____ ion second.
3. The negative ion ends in _____.
4. The sum of the ion charges must be _____.
5. Some elements (_____ metals) can have more than _____ ion charge.

C. Example:

1. Lithium is in Group _____ and will _____ its one electron.
2. If it loses its one electron, its charge will be _____.
3. It is written as follows:_____

D. Formula Example:

1. Lithium ion: _____ Chlorine ion: _____

Name of compound:_____

2. Potassium ion:_____ Oxygen ion:_____

Name of compound:_____

E. Formula Table:

Ions	Cl^{1-}	O^{2-}	S^{2-}	N^{3-}
Li^{1+}				
Cu^{1+}				
K^{1+}				
Ba^{2+}				
Zn^{2+}				

F. Polyatomic Ions:

1. A group of _____ that act as one _____.

2. When writing the formula, put a _____ around the polyatomic ion and then write the _____ outside of it.

3. Example: Ca^{2+} NO_3^{1-}

Compound Name*:_____ (endings don't change!)

G. Oxidation Table: The table below is used as a reference.
BUT !! You can still figure out ion charges with the periodic table!

H. More Practice !!!

1. Potassium and Iodine:

Formula?_____

Name?_____

2. Zinc and Bromine:

Formula?_____

Name?_____

3. Aluminum and Sulfate:

Formula?_____

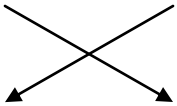
Name?_____

4. Magnesium and Phosphate:

Formula?_____

Name?_____

I The Easier Method: (Criss Cross)



1. Ba^{2+} Cl^{1-}

2. Na^{1+} O^{2-}

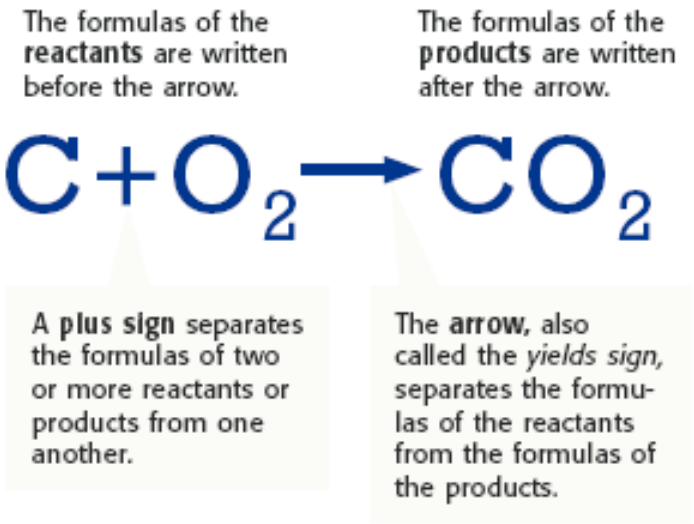
3. Ca^{2+} PO_4^{3-}

4. Al^{3+} S^{2-}

VII CHEMICAL EQUATIONS:

A. TERMS:

1. A CHEMICAL EQUATION: uses chemical _____ and _____ as a shortcut to describe a chemical _____.
2. REACTANTS: The _____ materials in a chemical _____. They are found on the _____.
3. PRODUCTS: The substances _____ from a reaction. They are found on the _____ of the arrow.



B. Equations Must be Balanced:

1. Atoms are in a reaction are NEVER _____ or _____.
2. Every atom in the _____ becomes part of the _____.
3. When writing a chemical equation, make sure….

   ** the _____ of atoms of each element in the _____ equals the number of _____ of those elements in the _____.

4. Lavoisier (in the 1700's) work led to the ……

_____ of _____ of _____

5. It states that _____ is neither _____

or _____.

C. How to Balance an Equation:

1. To balance an equation, you must use _____

2. Coefficients are used in _____ of symbols & formulas.

3. A coefficient tells the….

* number of _____ * number of _____

$4\ H_2O$

_____ water _____

_____ hydrogen _____

_____ oxygen _____

4. When balancing an equation:

* ONLY CHANGE THE _____

* NEVER CHANGE THE _____

5. EXAMPLES:

a) Sodium plus chlorine yields sodium chloride

_____ Na + _____ Cl_2 ⟶ _____ NaCl

b) Potassium plus Bromine yields potassium bromide

_____K + _____ Br_2 ⟶ _____KBr

c) Carbon plus chlorine yields carbon tetrachloride.

_____ C + _____Cl_2 ⟶ _____CCl_4

6. Using R P charts:

a). ___C + ___Cl_2 ⟶ ___CCl_4

R	P

b) ___ CaO + _____ SO_2 ⟶ ____O_2 + ___ $CaSO_4$

c) ____Al + _____ Cl_2 ⟶ ____$AlCl_3$

d) _____HCl + _____ Zn ⟶ ___ $ZnCl_2$ + ___ H_2

e) ____N_2 + _____ H_2 ⟶ ____NH_3

f) ____SO_2 + _____O_2 ⟶ ____SO_3

g) ___H_2S + ____ O_2 ⟶ _____H_2O + _____S

h) ____H_2S + ____ SO_3 ⟶ _____H_2O + _____ S

7. More Practice!!!

a) _____CaO + _____SO_2 + _____ O_2 ⟶ _____$CaSO_4$

b) _____$C_6H_{12}O_6$ ⟶ _____C + _____ H_2O

c) _____Cr + _____O_2 ⟶ _____ Cr_2O_3

d) _____CH_4 + _____ O_2 ⟶ _____CO_2 + _____ H_2O

e) _____H_2 + _____O_2 ⟶ _____ H_2O

f) _____Fe + _____ O_2 ⟶ _____Fe_2O_3

g) _____$KClO_3$ ⟶ _____ KCl + _____ O_2

h) _____$AgNO_3$ + _____H_2SO_4 ⟶ _____Ag_2SO_4 + _____HNO_3

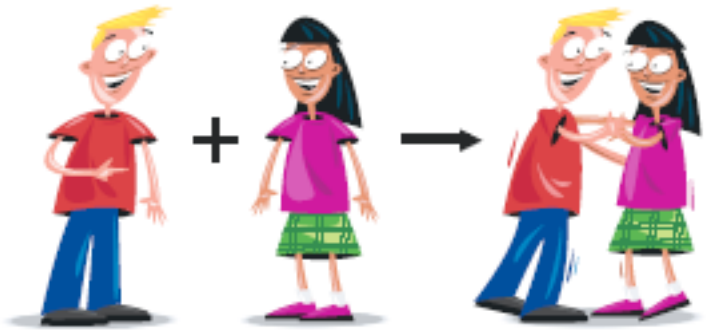
VIII TYPES OF CHEMICAL REACTIONS:

A. Synthesis Reactions:

1. A reaction in which _____ or more substances _____ to form one _____ compound.
2. A + B ⟹ AB
3. Examples:

a)_____

b)_____

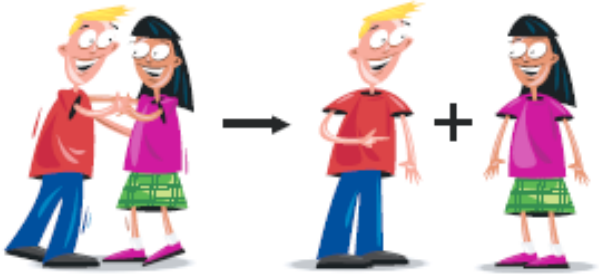


B. Decomposition Reactions:

1. A reaction in which a _____ compound _____ down to form 2 or more _____ substances.
2. AB ⟹ A + B
3. Examples:

a)_____

b)_____

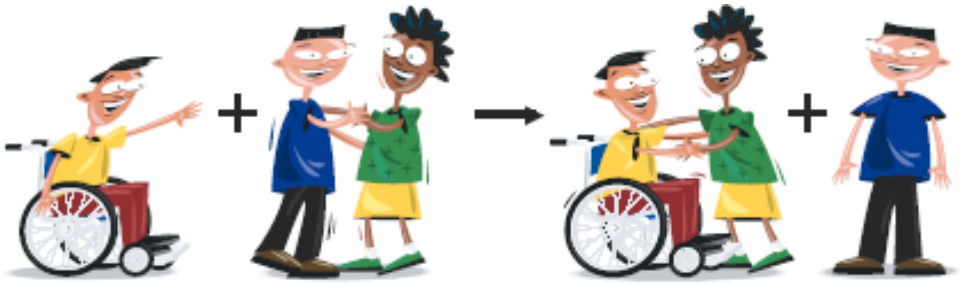


C. Single-Displacement Reactions:

1. An element _____ another element that is part of a _____.
2. A + BC ⟹ AC + B
3. Examples:

a)_____

b)_____

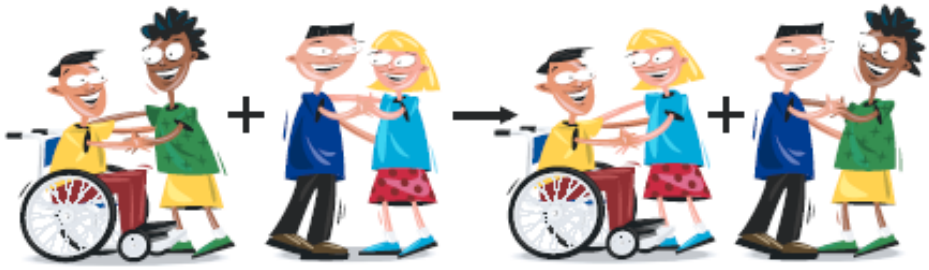


D. Double-Displacement Reactions:

1. A reaction in which _____ from _____ compounds _____ places.
2. AB + CD ⟹ AD + CB
3. Examples:

a)_____

b)_____



IX ENERGY AND RATES OF CHEMICAL REACTIONS:

A. Reactions and Energy:

1. Chemical _____ is part of _____ chemical reactions.
2. Energy is needed to _____ bonds in the reactants.
3. As new bonds form in the products, energy is _____.
4. By _____ both above, you can decide if energy is _____ or _____ in the overall reaction.

B. Exothermic Reaction:

1. A chemical reaction in which energy is _____.
2. The energy released is often written as a _____.

$$2\ Na + Cl_2 \Longrightarrow 2\ NaCl + \text{energy}$$

3. The temperature goes _____.

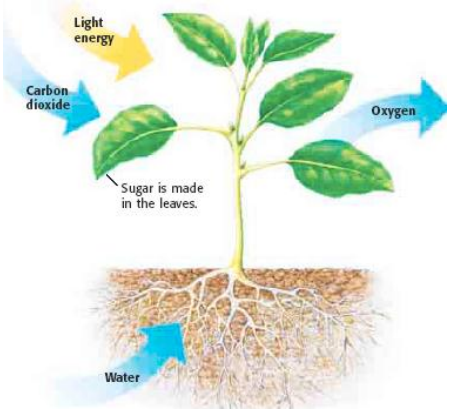
C. Endothermic Reaction:

1. A chemical reaction in which energy is _____.
2. The energy that is taken in is often written as a _____.

$$2\ H_2O + \text{energy} \Longrightarrow 2H_2 + O_2$$

3. The temperature goes _____.
4. Photosynthesis is an endothermic reaction.

$$6\ CO_2 + 6\ H_2O + \text{energy} \Longrightarrow C_6H_{12}O_6 + 6\ O_2$$



D. Rate of Reaction.

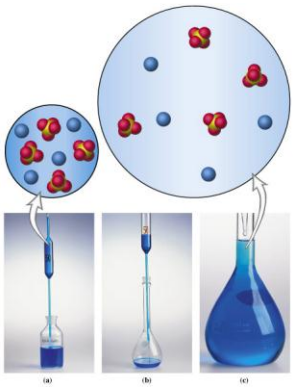
1. The _____ at which new particles form is called the _____ of _____.

E. Factors That Increase the Rate of Reaction:

1. High Temperature

a) At high temperatures, particles of reactants move _____ and _____ often.

2. High Concentration



a) When there is a high concentration, there is a _____distance between reactant particles, and they _____ into each other _____.

3. More Surface Area

a) Greater surface area exposes _____ reactant particles to other _____ particles.

4. Catalyst

a) A substance that _____ a reaction without being permanently _____.

b) An inhibiter is the opposite. It _____ or _____ a chemical reaction.

* An example:_____