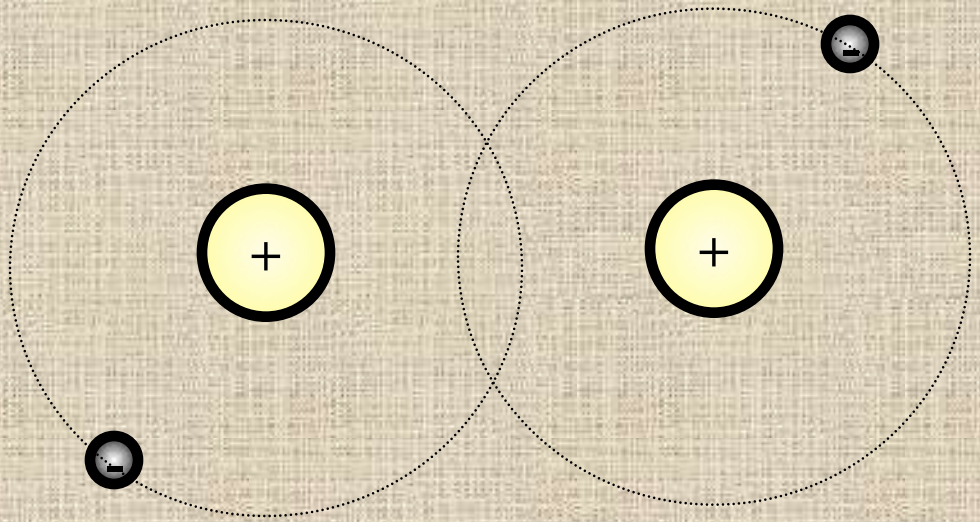
Writing Chemical Reactions



An introduction to chemical reactions

Warm-Up: Review from Bonding

Directions:

ANSWER REVIEW QUESTIONS # 1-6 on the top of your notes. We will go over them after 5 minutes.

Warm-Up: Review from Bonding

1. A(n) ionic compound is characterized by a transfer of electrons.

2. A(n) covalent compound is characterized by a sharing of electrons.

Warm-Up: Review from Bonding

3. Name the following compounds and state if they are Ionic (I) or Covalent (C).

a. $AlCl_3$ Aluminum chloride (I)

b. LiOH Lithium hydroxide (I)

c. NaCN Sodium cyanide (I)

d. NO_3 Nitrogen trioxide (C)

e. Na_2SO_4 Sodium sulfate (I)

f. $Sr(CH_3COO)_2$ Strontium acetate (I)

Warm-Up: Review from Bonding

4. (T/F) Metallic bonds are explained by the electron sea model.

5. (T/F) Ionic bonds typically form between two nonmetals.

6. (T/F) Carbon tetrafluoride is an example of a covalent compound.

Chemical Reaction

- The process by which a chemical change occurs
- Atoms are rearranged, and chemical bonds are broken and reformed
- One or more substances change to produce one or more different substances
- Different Types of Reactions
  - Synthesis (creating)
  - Decomposition (separating)
  - Combustion (burning)
  - Single Displacement/Replacement (switching)
  - Double Displacement/Replacement

Physical Change

- a change in shape, size, color, or state
- a change without a change in chemical composition
- a change that is generally reversible

Examples

tearing paper

cutting your hair

change in state/phase

Physical changes are not indicative of a chemical reaction

Chemical Change

- a change in which a substance becomes another substance having **different properties**
- a change that is **not reversible** using ordinary **physical means**
- a change that requires an indicator of a chemical reaction

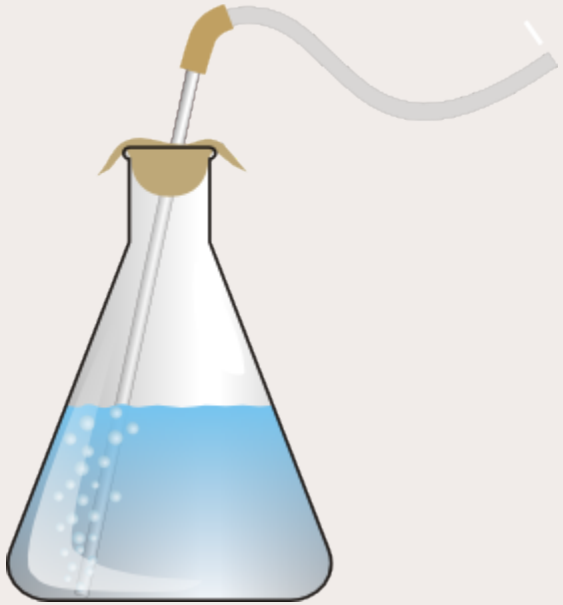
Examples

mixing vinegar & baking soda
burning a piece of wood
soured milk

A chemical analysis is the only 100% way to know a chemical change has occurred.

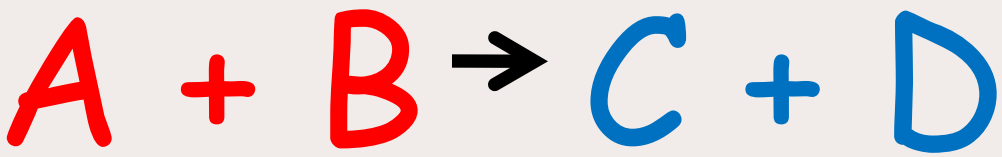
Indicators of a Chemical Reaction

- The following are signs that a chemical reaction has occurred:
  - Heat is produced
  - Light is produced
  - Explosion occurred
  - Precipitate formed
  - Color changed
  - New Odor formed
  - Gas formed



Chemical Equations

- Shorthand form for writing what reactants are used and what products are formed in a chemical reaction

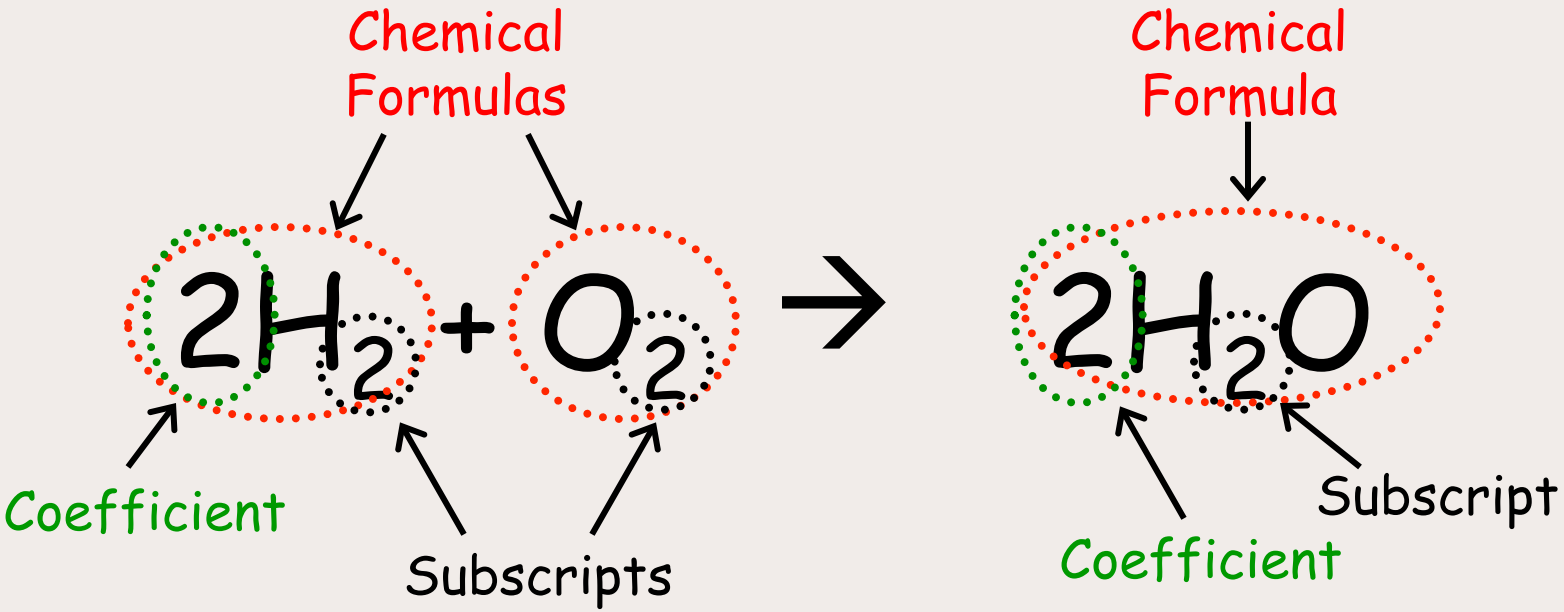


Reactants **Products**

Chemical Equations

SYMBOL	MEANING
$\longrightarrow$	produces, forms
+	plus, and
(s)	solid
(l)	liquid
(g)	gas
(aq)	aqueous (solid dissolved in water)
$\xrightarrow{\Delta}$	the reactants are heated

Components of a Chemical Equation



(Reactants) $\xrightarrow{\text{(Yield)}}$ ***(Products)***

Sometimes you will see a "yields" sign that looks like this. What do you think it means? $\rightleftharpoons$

Energy and Chemical Reactions

Exothermic Reaction

- A chemical reaction in which **energy is released**.
- The products have greater bond energy than the reactants

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ **+ energy**
(respiration)

Endothermic Reaction

- A chemical reaction in which **energy is absorbed**.
- The products have **lower bond energies** than the reactants

$CO_2 + H_2O$ **+ energy** $\rightarrow C_6H_{12}O_6 + O_2$
(photosynthesis)

Balancing Equations

Same numbers of each type of atom on each side of the equation

$Al + S \rightarrow Al_2S_3$ *Not Balanced*

$2Al + 3S \rightarrow Al_2S_3$ *Balanced*

Steps For Balancing Equations

1. Write the unbalanced equation
2. Count atoms on each side
3. Add coefficients to make numbers equal
   - Subscript × coefficient = number of atoms
4. Reduce coefficients to lowest possible ratio, if possible
5. Double check atom count to ensure it's balanced!!

Hints For Balancing Equations

- Balance one element at a time
- Update ALL atom counts after adding a coefficient
- If an element appears more than **ONCE** on a **SINGLE** side, balance it **LAST**
- Balance polyatomic ions as a single unit
  - "1 SO_4" instead of "1 S" and "4 O"
- Balance in the following order
  - **Polyatomic ions**
  - **Metals**
  - **Nonmetals**
  - **Hydrogen**
  - **Oxygen**

Balancing Equation- Example

- Aluminum and copper (II) chloride react to form copper and aluminum chloride

$Al\,(s) + CuCl_2\,(aq) \rightarrow Cu\,(s) + AlCl_3\,(aq)$

	Al	
	Cu	
	Cl	

Balancing Equation- Example

- EXAMPLE 2: THIS IS A LITTLE HARDER

	C	
	H	
	O	

Balancing Equation- Example

- EXAMPLE 3: POLYATOMICS!
- ____Mg + ___ $AgNO_3$ → ___ $Mg(NO_3)_2$ + __ Ag

	Mg	
	Ag	
	NO_3	