Chapter 7: Chemical Reaction Guided Notes

I. Chemical Changes in Matter
   A. Chemical Reaction
      1. A change in which one or more substances are converted to _______________ substances.

         \[ \text{A + B} \rightarrow \text{C + D} \]

   B. Law of Conservation of Matter
      1. In a chemical reaction, matter is not _______________ or _______________.
      2. Atoms can only be _______________.
      3. Discovered by Lavoisier.

   C. Chemical Equations
      1. __________________ - # of units of each substance.
      2. Individual atom = \textit{atom}
         \[ 2\text{Mg} \rightarrow 2 \text{________} \text{of magnesium} \]
      3. Covalent substance = \textit{molecule}
         \[ 3\text{CO}_2 \rightarrow 3 \text{________} \text{of carbon dioxide} \]
      4. Ionic substance = \textit{unit}
         \[ 4\text{MgO} \rightarrow 4 \text{________} \text{of magnesium oxide} \]

II. Balancing Equations
   A. Steps for Balancing Equations
      1. Write the __________________equation.
      2. __________________atoms on each side.
      3. Add __________________to make numbers (#) ____________.

         \[ \text{Coefficient} \times \text{Subscript} = \# \text{ of Atoms} \]

      4. __________________coefficients to lowest possible ratio, if necessary.

   \[ \text{Pb(NO}_3\text{)}_2(aq) + 2\text{KI(aq)} \rightarrow \text{PbI}_2(s) + 2\text{KNO}_3(aq) \]
5. Double check atom _____________________ !!!

B. Balancing Example:

Aluminum and copper (II) chloride form copper and aluminum chloride.

\[ \text{____Al} + \text{____CuCl}_2 \rightarrow \text{____Cu} + \text{____AlCl}_3 \]

\[
\begin{align*}
\text{Al} - 1 & \quad \text{Al} - 1 \\
\text{Cu} - 1 & \quad \text{Cu} - 1 \\
\text{Cl} - 2 & \quad \text{Cl} - 3
\end{align*}
\]

Balancing Equations Practice Problems

1) \( \text{HgO} \rightarrow \text{Hg} + \text{O}_2 \) 
2) \( \text{N}_2 + \text{H}_2 \rightarrow \text{NH}_3 \)
3) \( \text{KClO}_3 \rightarrow \text{KCl} + \text{O}_2 \) 
4) \( \text{KBr} + \text{Cl}_2 \rightarrow \text{KCl} + \text{Br}_2 \)
5) \( \text{CO} + \text{O}_2 \rightarrow \text{CO}_2 \)

C. Rates of Change

1. To increase the rate(speed) of a reaction (in most cases):
   - Increase ____________________
   - Increase ____________________ area
   - ____________________ solutions
   - ____________________ pressure
   - Massive, bulky molecules react slower.

D. Catalysts

1. A catalyst is a substance that ____________________ up a chemical reaction without being permanently changed itself.
2. They are ____________________ reactants or products.
3. ____________________ are proteins that are catalysts for chemical reactions in _________________ things.

E. Inhibitors

1. Substances that are used to ____________________ with one of the reactants to prevent certain reactions from occurring.
2. Examples are: ____________________ ____________________ & lemon juice on cut fruit to keep it from turning brown.

F. Equilibrium Systems
1. Some reactions are ____________________.
2. ____________________ results when rates balance.
   ***When the reaction moving →, equals the reaction moving ←***

III. Types of Reactions
There are five (5) main types of Chemical Reactions. These are __________________, __________________, _____________, __________________, and ____________________.

A. Synthesis
1. The ____________________ of two (2) or more substances to form a compound.
2. Only one (1) ____________________ forms.

   \[A + B \rightarrow AB\]  
   *example: \(2P + 3\text{Br}_2 \rightarrow 2\text{PBr}_3\)

B. Decomposition
1. A compound ____________________ into two (2) or more simpler substances.
2. Only one (1) ____________________.

   \[\text{AB} \rightarrow \text{A} + \text{B}\]  
   *example \(2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2\)

C. Single Replacement
1. One element ____________________ another in a compound.
   - Metal replaces metal (+)
   - Nonmetal replaces nonmetal (-)

   \[A + \text{BC} \rightarrow \text{AC} + \text{B}\]  
   *Example: \(\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2\)

D. Double Replacement
1. Ions in two compounds “____________________” partners.
2. ____________________ (+) of one compound combines with ____________________ (-) of the other.

   \[\text{AB} + \text{CD} \rightarrow \text{AD} + \text{CB}\]  
   *Example: \(2\text{KOH} + \text{CuSO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{Cu(OH)}_2\)

E. Combustion
1. Uses ____________________ (O\(_2\)) as a reactant.
2. Produces ____________________.
3. The products usually include ____________________ (H\(_2\) O) and ____________________ (CO\(_2\)).

   \[\text{AB} + \text{O}_2 \rightarrow \text{A} + \text{BO}_2\]  
   *Example: \(\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}\)

IV. Energy & Chemical Reactions
- Signs of chemical changes
  - Production of a ____________________
  - Production of a ____________________
  - Change in ____________________
  - Change in ____________________
  - Production of ____________________ or ____________________
A. Energy Changes
1. During a chemical reaction...
   • energy is used to __________________ bonds.
   • energy is __________________ when new bonds are formed.

![Diagram of bond breaking and making]

B. Endothermic Reaction
1. Reaction that __________________ energy.
2. Energy required to __________________ old bonds outweighs energy released by making new bonds.
   \[2\text{Al}_2\text{O}_3 + \text{energy} \rightarrow 4\text{Al} + 3\text{O}_2\]
3. Process used to obtain aluminum from aluminum ore.

C. Exothermic Reaction
1. Reaction that __________________ energy.
2. Energy __________________ by making new bounds outweighs energy required to break old bonds.
   \[\text{H}_2(l) + \text{O}_2(l) \rightarrow \text{H}_2\text{O}(g) + \text{energy}\]
3. Reaction that powers the space shuttle lift-off.

V. Law of Conservation of Mass
A. Explanation
   • In all chemical reactions __________________ is __________________
   • The mass of __________________ MUST __________ the mass of __________________
   • This fact can be used to determine the amount of a missing reactant or product.

B. Application
   • Mass of reactants = mass of products
   • 14 g Al and 23 g O produces _______ grams of Aluminum oxide.
   • 25 g water breaks down into 19 grams of oxygen and _______ g Hydrogen
   • _________ g water break down into 82 g oxygen and 21 g hydrogen.