## **Types of Reactions**

- synthesis (combination) reactions
- decomposition reactions
- single displacement reactions
- double displacement reactions

(note: sometimes displacement is called replacement)

#### **General Reaction Patterns:**

Combination or synthesis

$$A + B \rightarrow AB$$

Decomposition

$$AB \rightarrow A + B$$

Single Displacement

$$A + BC \rightarrow B + AC$$

Double Displacement

## Combination / Synthesis Reactions

- Two or more (relatively simple) reactants unite to form a single (relatively complex) product.
- S + O<sub>2</sub> → SO<sub>2</sub> sulfur dioxide
- 2 S + 3 O<sub>2</sub> → 2 SO<sub>3</sub> sulfur trioxide
- 2 Fe + O<sub>2</sub>  $\rightarrow$  2 FeO iron (II) oxide

# **Decomposition Reactions**

- A single (relatively complex) reactant is decomposed or broken down into two or more (relatively simple) products
- CaCO<sub>3</sub> 

  calcium carbonate 

  calcium oxide 

  carbon 

  dioxide
- 2 H<sub>2</sub>O → 2 H<sub>2</sub> + O<sub>2</sub>

  water hydrogen oxygen
- $2 \text{ KCIO}_3 \rightarrow 2 \text{ KCI} + 3 \text{ O}_2$

potassium chlorate potassium chloride oxygen

## Single Displacement Reactions

- A single free element replaces or is substituted for a similar element in a compound.
- Zn + 2 HCl → H<sub>2</sub> + ZnCl<sub>2</sub>

  zinc hydrochloric acid hydrogen zinc chloride
- Cu + 2 AgNO<sub>3</sub> → 2Ag + Cu(NO<sub>3</sub>)<sub>2</sub>
  copper silver nitrate silver copper (II) nitrate
- 2 Na + 2 H<sub>2</sub>O → 2 NaOH + H<sub>2</sub> sodium water sodium hydroxide hydrogen

## **Double Displacement Reactions**

- You can think of it like the positive ions in two reactant compounds are trading partners
- For ionic compounds, the positive ion in the first compound combines with the negative ion in the second compound, and the positive ion in the second compound combines with the negative ion in the first compound.
- · HCl + NaOH → NaCl + H<sub>2</sub>O

  hydrochloric sodium sodium water
  acid hydroxide
  - BaCl<sub>2</sub> + 2 AgNO<sub>3</sub> → 2 AgCl + Ba(NO<sub>3</sub>)<sub>2</sub>
    barium chloride silver chloride barium nitrate
- CaCO<sub>3</sub> + 2 HCl → CaCl<sub>2</sub> + H<sub>2</sub>CO<sub>3</sub>

  calcium hydrochloric carbonic chloride acid calcium carbonic chloride

# Types of Reactions Practice

Identify the following unbalanced reactions as synthesis, decomposition, single displacement, or double displacement. **EXPLAIN YOUR CHOICE.** 

1. 
$$KOH + HBr \rightarrow KBr + H_2O$$

2. 
$$Mg + CO_2 \rightarrow MgO + C$$

3. 
$$PCl_3 + Cl_2 \rightarrow PCl_5$$

# **Combustion Reaction**

In a **combustion reaction** (burning), a carbon compound combines with oxygen and releases a large amount of energy in the form of light and heat.

Carbon compound  $+ O_2 \rightarrow CO_2 + H_2O$ 

The products of a combustion reaction are ALWAYS CO<sub>2</sub> + H<sub>2</sub>O

Type of Reaction	Identifying the type	General Equation
Synthesis	two or more reactants combine to produce ONE compound	$A + B \rightarrow AB$ $+ \bigcirc \rightarrow \bigcirc$
Decomposition	ONE compound is broken down to produce two or more compounds	$AB \rightarrow A + B$ $\longrightarrow \longrightarrow +$
Single Displacement	element + compound produces element + compound	$A + BX \rightarrow AX + B$ $+ \bigcirc \longrightarrow \bigcirc + \bigcirc$
Double Displacement	two compounds produce two compounds	$AB + CD \rightarrow AD + BC$ $+ \longrightarrow + \longrightarrow +$
Com <mark>bustion</mark>	burning - carbon compound combines with oxygen to release heat/energy	Carbon compound + O <sub>2</sub> → CO <sub>2</sub> + H <sub>2</sub> O  ALWAYS THE PRODUCTS!

