These notes are posted on my site for the following reasons:

- for students to copy in their own hand-writing
  - in order to complete their class notes
  - if student did not have enough time in class
  - if student was away and missed this section
- for assistants and tutors to follow progress of the concepts taught

Photocopied/printed notes can not be used during the Unit Notebook Check in class.

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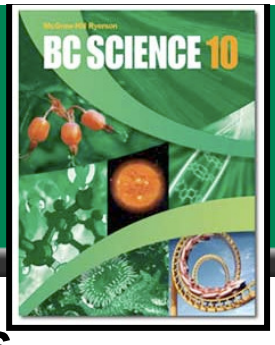
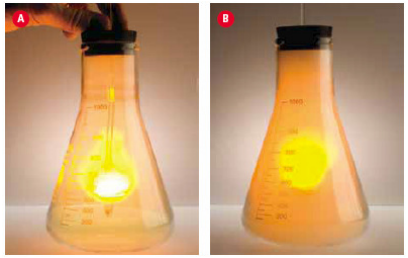
6.1 Types of Chemical Reactions: Synthesis



- **Synthesis reactions are also known as formation reactions.**
  - **Two or more reactants (usually elements) join to form a compound.**
  - **A + B → AB where A and B represent elements**

  - **The elements may form ionic compounds, like these:**
  - **Sodium metal and chlorine gas combine to form sodium chloride.**
  - $2Na + Cl_2 \rightarrow 2NaCl$



  - **Magnesium metal reacts with oxygen gas to form magnesium oxide.**
  - $2Mg + O_2 \rightarrow 2MgO$

  - **Or the elements may form covalent compounds, like this:**
  - **Nitrogen gas and oxygen gas join to form dinitrogen monoxide.**
  - $2N_2 + O_2 \rightarrow 2N_2O$

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6.1 Types of Chemical Reactions: Decomposition

- **Decomposition reactions are the opposite of synthesis reactions.**
  - **A compounds breaks down into two or more products (often elements).**
  - **AB $\rightarrow$ A + B where A and B represent elements**

  - **Ionic compounds may decompose to produce elements, like this:**
  - **Table salt, sodium chloride, can be broken down into sodium metal and chlorine gas by melting salt at 800ºC and running electricity through it.**
  - $2NaCl \rightarrow 2Na + Cl_2$

  - **Or covalent compounds may decompose into elements, like this:**
  - **By running electricity through water, the water molecules decompose into hydrogen and oxygen gases.**
  - $2H_2O \rightarrow 2H_2 + O_2$

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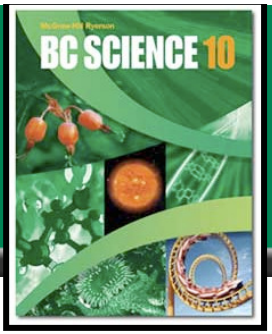
6.1 Types of Chemical Reactions: Single Replacement



- **Single replacement reactions replace one element from a compound with a separate element added as a reactant.**
  - **A compound and an element reactant, and the element switches places with part of the original compound.**
    - **A + BC $\rightarrow$ B + AC where A is a metal, or**
    - **A + BC $\rightarrow$ C + BA where A is a non-metal**

  - **When A is a metal:**
  - **Aluminum foil in a solution of copper II chloride produces solid copper and aluminum chloride.**
  - $Al + CuCl_2 \rightarrow Cu + AlCl_3$

  - **When A is a non-metal:**
  - **When fluorine is bubbled through a sodium iodide solution, iodine and sodium fluoride are produced.**
  - $Fl_2 + NaI \rightarrow I_2 + NaF$

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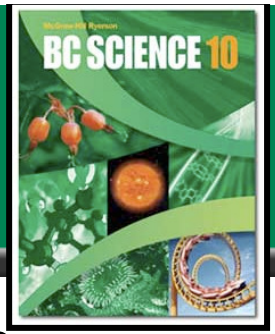
6.1 Types of Chemical Reactions: Double Replacement



- **Double replacement reactions swap elements between two compounds reacting together to form two new compounds.**
  - **Two compounds reactant, with elements switching places between the original compounds.**
  - **Two solutions react to form a precipitate (ppt, solid) and another solution**
    - **Ionic soln + ionic soln → ionic soln + ionic soln/ppt**
    - **AB + CD → AD + BC**

- **When potassium chromate and silver nitrate react, they form a red precipitate, silver chromate, in a solution of potassium nitrate.**
- $K_2CrO_4 + AgNO_3 \rightarrow Ag_2CrO_4 + KNO_3$

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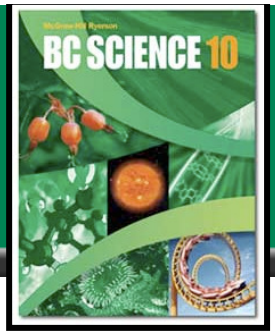
6.1 Types of Chemical Reactions: Neutralization (aka Acid-Base reactions)



- **Neutralization reactions occur when an acid and a base react to form a salt and water.**
  - **An acid (most compounds starting with H) and a base (most compounds ending in OH, or beginning with NH_4) react.**
    - **Acid + base $\rightarrow$ salt + water**
    - **HX + MOH $\rightarrow$ MX + H_2O where X and M are elements**

- **Sulphuric acid is used to neutralize calcium hydroxide:**
- $H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 + 2H_2O$

- **Phosphoric acid helps to neutralize the compounds that cause rust, such as iron (II) hydroxide.**
- $H_3PO_4 + 3Fe(OH)_2 \rightarrow Fe_3(PO_4)_2 + 6H_2O$

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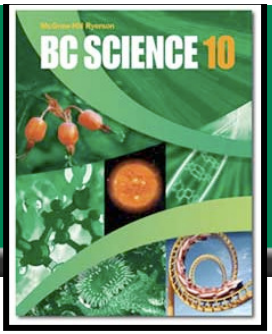
6.1 Types of Chemical Reactions: Combustion



- **Combustion reactions occur when a compound or element react with oxygen to release energy and produce an oxide.**
  - **Also sometimes referred to as hydrocarbon combustion**
  - **$C_XH_Y + O_2 \rightarrow CO_2 + H_2O$ where X and Y represent integers**

  - **Natural gas (methane) is burned in furnaces to heat homes.**
  - $CH_4 + O_2 \rightarrow CO_2 + 2H_2O$

  - **An acetylene torch is used to weld metals together**
  - $2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$

  - **Carbohydrates like glucose combine with oxygen in our body to release energy.**
  - $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

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6.1 Types of Chemical Reactions: Summary of Types

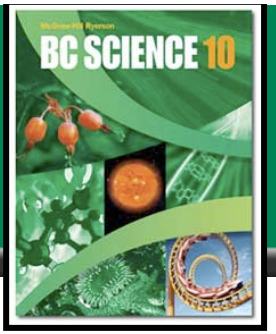

Table 6.1 Summary of Chemical Reactions

Reaction Type	Reactants and Products	Notes on the Reactants
Synthesis (combination)	$A + B \rightarrow AB$	• Two elements combine (Figure 6.9).
Decomposition	$AB \rightarrow A + B$	• One reactant only (Figure 6.9)
Single replacement If A is a metal If A is a non-metal	 $A + BC \rightarrow B + AC$ $A + BC \rightarrow C + BA$	• One element and one compound
Double replacement	$AB + CD \rightarrow AD + CB$	• Two compounds react.
Neutralization (acid-base)	$HX + MOH \rightarrow MX + H_2O$	• Acid plus base
Combustion	$C_xH_y + O_2 \rightarrow CO_2 + H_2O$	• Organic compound with oxygen

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Take the Section 6.1 Quiz