SECTION 6.1
TYPES OF CHEMICAL REACTIONS
SYNTHESIS (COMBINATION) REACTION

Reaction between two or more reactants (A and B) to produce a single product (AB)

- element + element → compound

- A + B → AB
  - (The letters A and B represent elements.)

- Example
  - hydrogen + oxygen → water
DECOMPOSITION REACTION

- Reaction where a compound is **broken** down into smaller compounds or separate elements.

- Is the **reverse** of a **synthesis** reaction.

- **compound** → **element** + **element**

- **AB** → **A + B**

- **Example**
  - calcium chlorate → calcium chloride + oxygen
SINGLE REPLACEMENT REACTION

- Reaction between a **reactive** element and a **compound** to produce another element and another compound.

- The **element** that is replaced could be a **metal** or a **non-metal**.

- **element** + **compound** → **element** + **compound**

- A + BC → B + AC where A is a **metal**
  OR
- A + BC → C + BA where A is a **non-metal**

- Example
  - aluminum + lead(II) nitrate → aluminum nitrate + lead
A reaction that involves two ionic solutions that react to produce two other ionic compounds.

One of the compounds forms a precipitate, which is an insoluble solid that forms from a solution.

\[
\text{ionic solution} + \text{ionic solution} \rightarrow \text{ionic solution} + \text{ionic solid}
\]

\[
\text{AB(aq)} + \text{CD(aq)} \rightarrow \text{AD(aq)} + \text{CB(s)}
\]

Example

iron(II) chloride + lithium phosphate $\rightarrow$ iron(II) phosphate + lithium chloride
5  NEUTRALIZATION (ACID-BASE) REACTION

- A reaction where an acid and a base react to form a salt and water.

- acid + base $\rightarrow$ salt + water

- HX + MOH $\rightarrow$ MX + H$_2$O

- (X represents a negative ion. M represents a positive ion.)

- Example:
  - sulphuric acid + sodium hydroxide $\rightarrow$ sodium sulphate + water
COMBUSTION REACTION

- Rapid reaction of a compound or element with oxygen to form an oxide and produce heat.

hydrocarbon + oxygen $\rightarrow$ carbon dioxide + water

- \[ C_xH_y + O_2 \rightarrow CO_2 + H_2O \]
  - (The subscripts \(X\) and \(Y\) represent integers.)

- Example:
  - \[ C_2H_6O_3 + O_2 \rightarrow CO_2 + H_2O \]
# THE SIX TYPES OF CHEMICAL REACTIONS

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