

SCH 3U

SYNTHESIS & DECOMPOSITION REACTIONS

Chemical reactions are classified according to a polychotomy – division or separation into many types or parts.

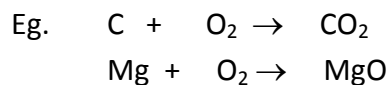
PART A: SYNTHESIS REACTIONS: aka. combination or formation reactions

- 2 or more elements or compounds combine to form a new substance.
- $A + B \rightarrow C$

TYPES of Synthesis Reactions:

1. element + element \rightarrow binary compound

- Metal or a non-metal reacting with oxygen produces an **oxide**...
...also known as **combustion**... see Part C on next page.



- Metal with a non-metal forms a binary compound of these elements.

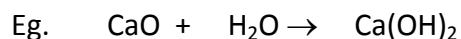


2. compound + compound \rightarrow polyatomic compound

- **Acidic oxide + water \rightarrow acid**
(non-metal oxide)



- **Basic oxide + water \rightarrow base**
(metal oxide)



- **Acidic oxide + basic oxide \rightarrow polysalt**

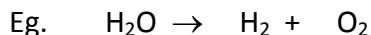


PART B: DECOMPOSITION REACTIONS: opposite of Synthesis reactions

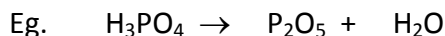
- A compound breaks down into elements or other compounds.
- $C \rightarrow A + B$

TYPES of Decomposition Reactions:

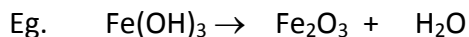
1. **binary compound \rightarrow element + element**



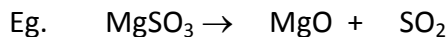
2. **acid \rightarrow acidic oxide + water**



3. **base \rightarrow basic oxide + water**



4. **polysalt \rightarrow acidic oxide + basic oxide**

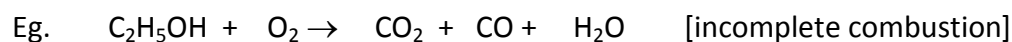


PART C: COMBUSTION REACTIONS: special synthesis reactions

- **Complete combustion reactions:** reactions of elements or compounds with O_2
- Common oxides of the elements/compounds are formed.
- Carbon-containing compounds, such as CH_4 and C_2H_5OH , combust to form CO_2 and H_2O .



- Sulfur-containing compounds combust to form sulfur oxides, such as SO_2 , which is a precursor to acid rain.
- **Incomplete combustion** is the result of a lack of O_2 , in which case other biproducts are formed. For instance, the incomplete combustion of a carbon-containing compound produces CO and water. CO is a deadly gas.



ADDENDUM:

ACIDS – A substance that begins with hydrogen tends to be acidic.

Eg. HF is an acid because it begins with H – known as hydrofluoric acid
H₂CO₃ is an acid – known as carbonic acid
H₂SO₄ is an acid – known as sulfuric acid

Exceptions: organic acids often end with H, such as CH₃COOH (acetic acid)

BASES – A substance that ends with the hydroxide (-OH) group. There are bases which do not have the hydroxide group; these bases are discussed in a later chapter.

Eg. NaOH – sodium hydroxide is a base.
Mg(OH)₂ – magnesium hydroxide is a base.