SAI International School
Lesson Notes
Subject_Chemistry
Ch-Chemical Reactions and Equations
Topic-Types of Chemical Reactions
(Combination, Decomposition Reactions)

Module -2 **Dt_20/3/2020**

Suggested Video_ https://www.youtube.com/watch?v=GjWFJOsOu7g
https://www.youtube.com/watch?v=ND6jB2CNh3c
https://www.youtube.com/watch?v=DVGaNxEM7M8&pbjreload=10
https://www.youtube.com/watch?v=SNGtEG-kI-I

To be done in CW Copy

A **combination reaction** is a **chemical reaction** in two or more substances combine together to produce a new compound.

$H_2 + Cl_2 \rightarrow 2HCl$

element + element → compound

$2CO + O_2 \rightarrow 2CO_2$

compound + element → compound

$NH_3 + HCl \rightarrow NH_4Cl$

compound + compound → compound

A single substance as a product is the key characteristic of the combination reaction.

For ex- $2\ H_2(g) + O_2(g) \rightarrow 2\ H_2O(\ell)$

Most **combination reactions** are **exothermic** in nature. ... **Combination reactions** involve the formation of new bonds and this process releases a large amount of energy in the form of heat.

Ex-i)Burnig of Magnesium ribbon

$2Mg+O_2 \rightarrow 2MgO+Heat$

ii)Formation of slaked lime

$CaO + H_2O \rightarrow Ca(OH)_2 + Heat$

respiration considered an exothermic reaction:

- During respiration, glucose combines with oxygen in the cells of our body to form carbon dioxide and water along with the production of energy.

Glucose + oxygen → carbon dioxide + water + energy

It is an exothermic reaction, because energy is produced during this process

Decomposition reaction

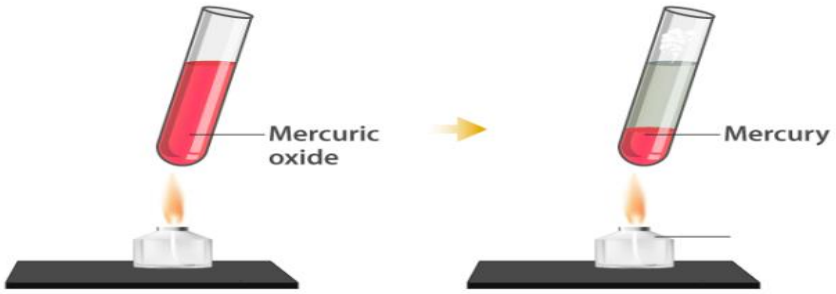
A single reactant decomposes on the application of heat or light or electricity to give two or more products.

Decomposition reactions can be classified into three types:

- Thermal **decomposition reaction**.
- Electrolytic **decomposition reaction**.
- Photo **decomposition reaction**.

Thermal decomposition reaction A thermal decomposition reaction can be defined as a decomposition reaction which is activated by thermal energy. The reaction is generally endothermic as energy is required to break chemical bond in order to separate the constituent elements.

a. Decomposition reactions which require heat – thermolytic decomposition or thermolysis.



Thermal decomposition of HgO

When heated Calcium Carbonate, decomposes into Calcium Oxide and Carbon Dioxide. This process is employed in the manufacturing of quick lime which is an important component in industries.

- $CaCO_3 \rightarrow CaO + CO_2$

Heating of ferrous sulphate crystals

(a) A single compound breaks down into simpler compounds, so it is a decomposition reaction.

(b) $FeSO_4.7H_2O \xrightarrow{\Delta} FeSO_4 + 7H_2O$

Ferrous sulphate → Anhydrous ferrous sulphate

$2FeSO_4(s) \xrightarrow{\Delta} Fe_2O_3(s) + SO_2(g) + SO_3(g)$

Anhydrous ferrous sulphate → Ferric Oxide, Sulphur dioxide, Sulphur trioxide

On heating, **ferrous sulphate crystals** lose water and anhydrous **ferrous sulphate** (FeSO4) is formed. So their colour changes from light green to white. On further heating, anhydrous **ferrous sulphate** decomposes to form **ferric** oxide (Fe2O3), sulphur dioxide (SO2) and sulphur trioxide (SO3).

When lead nitrate is heated, it decomposes into lead oxide, nitrogen dioxide and oxygen.

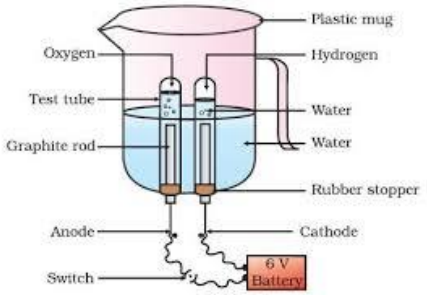
$$\underset{\text{Lead Nitrate}}{2Pb(NO_3)_2(s)} \xrightarrow{\text{Heat}} \underset{\text{Lead Oxide}}{2PbO(s)} + \underset{\text{Nitrogen dioxide}}{4NO_2(g)} + \underset{\text{Oxygen}}{O_2}$$

Lead nitrate crystals on strong heating **decompose** to form **lead** monoxide, nitrogen dioxide gas and oxygen gas. ... The heating of **lead nitrate** does produce toxic fumes of **lead** and nitrogen dioxide.

Electrolytic decomposition reaction

- An electrolytic decomposition reaction is a type of decomposition reaction in which the activation energy for decomposition.

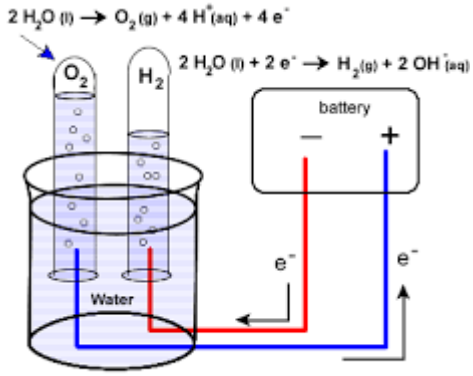
Example of electrolytic



decomposition reaction

$$2\ H_2O(l) \rightarrow 2\ H_2(g) + O_2(g)$$

The number of hydrogen molecules produced is thus twice the number of oxygen molecules.



photolysis or Photo Decomposition:

Reactions in which a compound decomposes because of sunlight are known as **photolysis** or **photo decomposition**.

Example:

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When silver chloride is put in sunlight, it decomposes into silver metal and chlorine gas.

$$\underset{\text{Silver chloride}}{2AgCl(l)} \xrightarrow{\text{Sunlight}} \underset{\text{Silver}}{2Ag(s)} + \underset{\text{Chlorine}}{Cl_2(g)}$$

Similarly, when silver bromide is put under sunlight, it decomposes into silver metal and bromine gas.

$$\underset{\text{Silver bromide}}{2AgBr(l)} \xrightarrow{\text{Sunlight}} \underset{\text{Silver}}{2Ag(s)} + \underset{\text{Bromide}}{Br_2(g)}$$

Photographic paper has coat of silver chloride, which turns into grey when exposed to sunlight. It happens because silver chloride is colourless while silver is a grey metal.

Assessment

MCQs

- ***For Assertion& Reason question follow the following directions.***

DIRECTION:*Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.*

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If Assertion is incorrect but Reason is correct.
(e) If Assertion & Reason both are incorrect.

Q1. Assertion:Combustion reactions are also called exothermic oxidation reactions
Reason:In these reactions, oxygen is removed and heat is released.

Q2. Assertion -Colour of Iron sulphate changes when it is heated.
Reason: Water evaporates during the heating of Iron sulphate & change the colour .

Q3. . Assertion :White silver chloride turns grey in the presence of sunlight.
Reason:Silver chloride undergoes displacement reaction.

Q4. Assertion:Most combination reactions are exothermic
Reason:In exothermic reactions, heat is absorbed

Q5. . Assertion:During electrolysis of water one of the test tube shows twice the empty spaces as compared to the other.

Reason: Water molecules breaks in to two component.i.e H_2 & O_2 but the volume of H_2 evolved is double then the volume of O_2.

Home assignment

Q1. Photographic fixer is a mixer of chemicals used in the final step in the photographic processing of film or paper. The fixer stabilises the image, removing the unexposed **silver halide** remaining on the photographic film or photographic paper, leaving behind the reduced metallic silver that forms the image.

i) Name the Silver halide & write its formula.
ii) Is there a chemical reaction undergone? If yes, then write its type.
iii) How will you confirm that a chemical change has taken place.

Pen down the chemical equation associated with the change.

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Q2. 2 g of ferrous sulphate crystals were heated in a hard glass test tube and observations recorded.

a. What type of odour is observed on heating ferrous sulphate crystals?

b. Name the products obtained on heating ferrous sulphate crystals.

c. What type of reaction is taking place.

Q.3 A substance X, which is an oxide of a group 2 element, is used intensively in the cement industry. This element is present in bones also. On treatment with water it forms a solution which turns red litmus blue. Identify X and also write the chemical reactions involved.

Q.4 Why do we store silver chloride in dark coloured bottles?

Q.5 On heating blue coloured powder of copper (II) nitrate in a boiling tube, copper oxide (black), oxygen gas and a brown gas *X* is formed.
(a) Write a balanced chemical equation of the reaction.
(b) Identify the brown gas *X* evolved.
(c) Identify the type of reaction.
(d) What could be the pH range of aqueous solution of the gas X?