RADIANT 2026

Chemistry

Chemical Changes and Reactions

Lecture - 01

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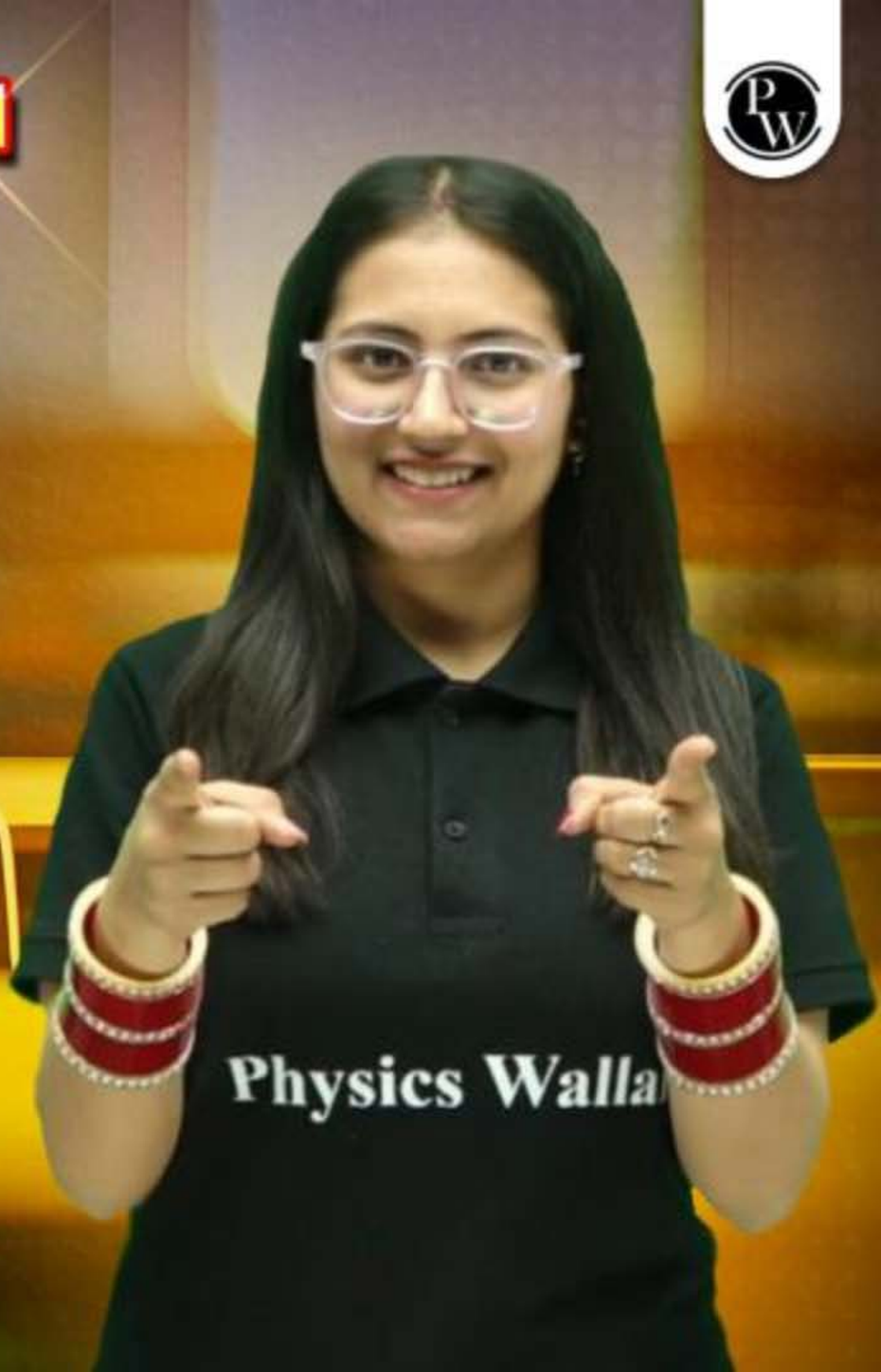


Topics *to be covered*

1. Introduction to Changes
2. Type of Changes
3. Physical and Chemical Changes — Imp
4. Type of Reactions — (Intro)
5) Characteristics of Chemical Reactions


Chinki tu bohot change ho gayli hai re

Chemical changes and reaction

Change is defined as the modification in either the physical or chemical feature of substance.

Type of changes

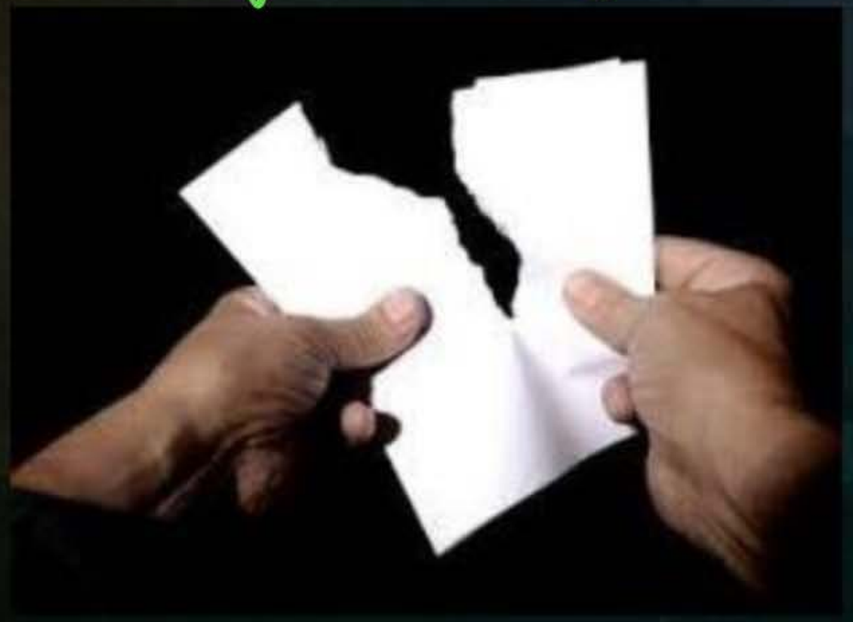
(a) slow and fast change

(b) Periodic and Non-periodic

(c) ✓ Physical and chemical changes

Type of changes

Physical change (A)



(A) No change in Chemical Composition

Chemical change (B)

Burning

(B) Change in chemical Composition of paper

Chemical changes and reaction

Imp

(New Sub./product)

	Physical changes	Chemical changes
1.	When a substance undergoes a physical change, its composition remains the same despite its molecules being rearranged.	When a substance undergoes a chemical change, its molecular composition is changed entirely. Thus, chemical changes involve the formation of new substances.
2	Physical change is a temporary change.	A chemical change is a permanent change.
3.	A Physical change affects only physical properties i.e. shape, size, etc.	Chemical change both physical and chemical properties of the substance including its composition

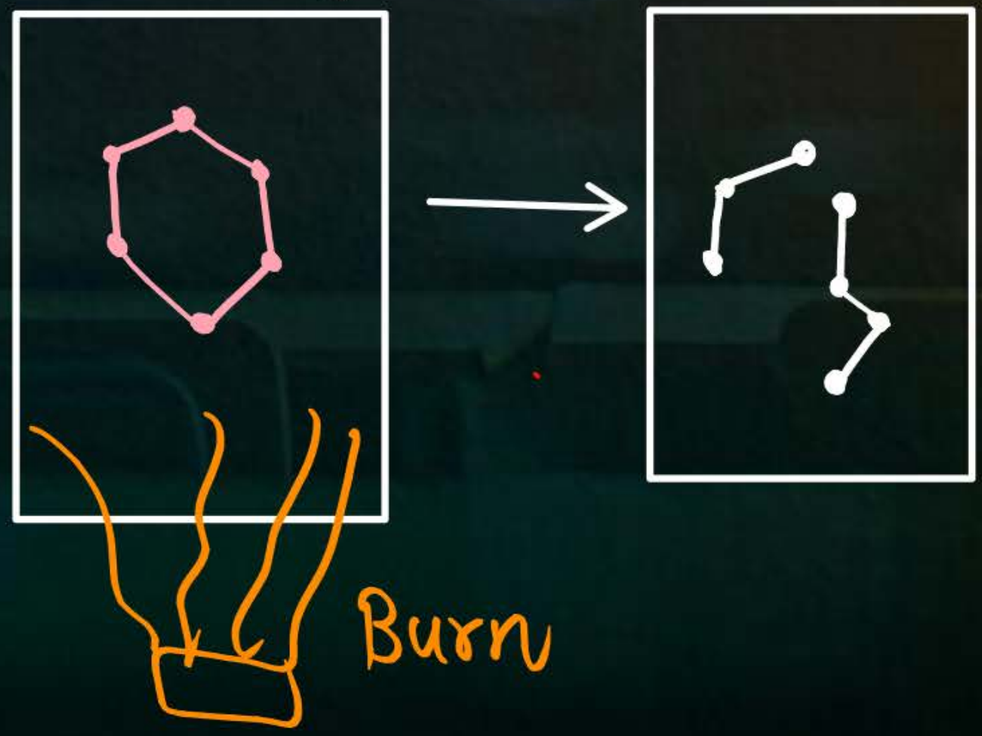
	Physical changes	Chemical changes
4.	A physical change involves very little to no absorption of energy.	During a chemical reaction, absorption and evolution of energy take place.
5.	Some examples of physical change are freezing of water, melting of wax, boiling of water, etc.	A few examples of chemical change are digestion of food, burning of coal, rusting, etc.
6.	Generally, physical changes do not involve the production of energy.	Chemical changes usually involve the production of energy (which can be in the form of heat, light, sound, etc.)
7.	In a physical change, no new substance is formed.	A chemical change is always accompanied by one or more new substance(s).
8.	Physical change is easily reversible i.e. original substance can be recovered.	Chemical changes are irreversible i.e. original substance cannot be recovered.

Chemical changes

The property that involve a change in the chemical composition of the substance.

Eg.: Burning, reaction with Acids etc.

Carbon + Oxygen ⟶ Carbondioxide + Heat (Change in composition)



Chemical changes

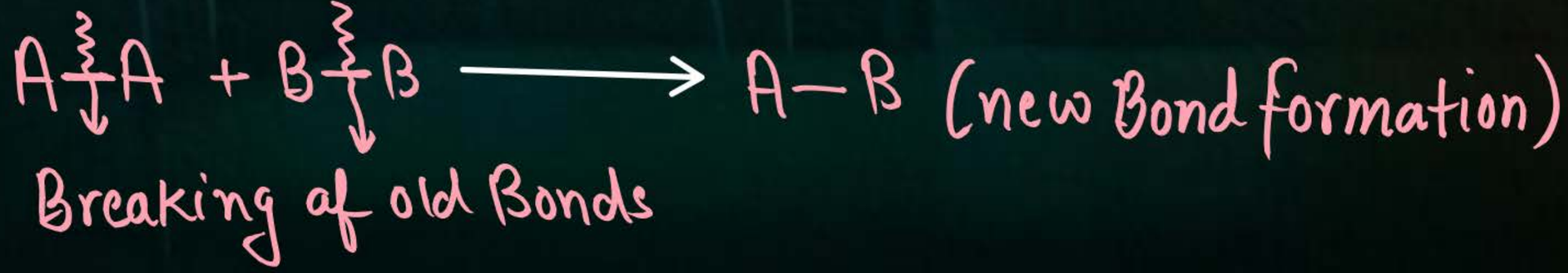
Note: Chemical Bond is force of Attraction b/w two ions / atoms

A chemical change involve a chemical reaction.

A chemical reaction is the process of breaking the chemical bonds of reaction substance and formation of new bonds in product.

In a chemical Reaction:

Old Bond Break and new Bonds form:

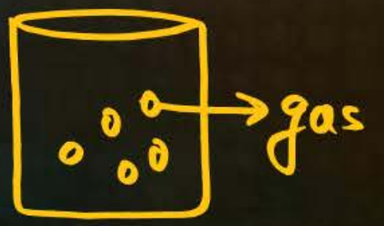


Characteristics of chemical reaction

1. **Evolution of gas:** In many chemical reactions, one of the products is a gas.

$$\underset{\text{[zinc]}}{Zn} + \underset{\text{[dil. sulphuric cid]}}{H_2SO_4} \longrightarrow \underset{\text{[Zinc sulphate]}}{ZnSO_4} + \underset{\text{[Hydrogen]}}{H_2}\uparrow$$

(Metal) + Acid ⟶ Metal Salt + Gas (H_2)↑



Characteristics of chemical reaction

2. **Change in color:** Certain chemical reactions are characterized by a change in the colour of the reactants.

$$\underset{\text{[iron]}}{Fe} + \underset{\text{[blue solution]}}{CuSO_4} \longrightarrow \underset{\text{[Green solution]}}{FeSO_4} + \underset{\text{[Copper red deposite]}}{Cu}$$

Metal + Salt soln

Blue ⟶ Green

Characteristics of chemical reaction

(Insoluble mass)

3. **Formation of precipitate:** Certain chemical reactions are characterized by the formation of insoluble solid substances called precipitates.

(a) $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(aq)\downarrow + NaNO_3(aq)$

[Silver nitrate solution] [Sodium chloride solution] [Silver chloride] (White ppt) [Sodium nitrate Solution]

(b) $FeSO_4(aq) + 2NaOH(aq) \rightarrow Fe(OH)_2\downarrow + Na_2SO_4(aq)$

[Ferrous sulphate] [Sodium hydroxide] [Ferrous hydroxide] (dirty green ppt) [Sodium sulphate]

Characteristics of chemical reaction

4. **Change in State:** In many chemical reactions, a change of state is observed. The reaction might start with gaseous or liquid reactants and end up with solid products, and vice versa.

$NH_3(g) + HCl(g) \rightleftharpoons NH_4Cl(s)$

↓ Phy. state

↳ Solid

NH_3 (gas) HCl (gas)

Gas } Reactant ⟶ Solid } Product

(5) Change in temp :- Exothermic Rxn

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

Type of Chemical Reaction

1.) Combination Reaction $A + B \longrightarrow AB$

2.) Decomposition Reaction (Break down) $AB \longrightarrow A + B$

3.) Displacement Reaction

4.) Double displacement Reaction

5.) Neutralisation Rx^n

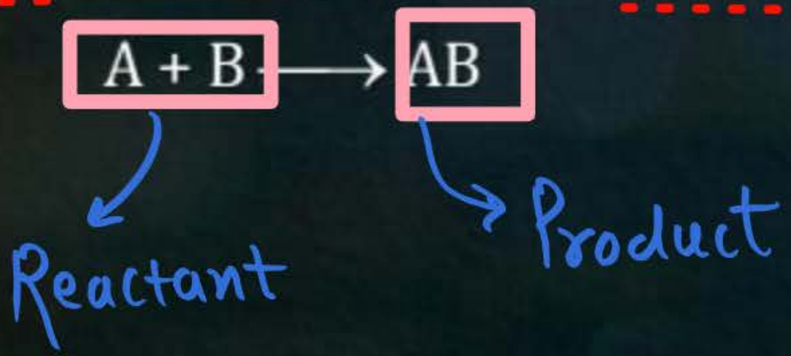
6.) Precipitation Rx^n

7.) Oxid^n Rx^n (8) Red^n Rx^n 9) Redox

10.) Exo and Endothermic Rx^n

Direct combination or synthesis

A reaction in which two or more substances combine together to form a single substance is called a combination reaction or synthesis.



Direct combination or synthesis

(i) Two elements combine to form a compound.

$$\underset{\text{[Carbon]}}{C(s)} + \underset{\text{[Oxygen]}}{O_2(g)} \xrightarrow{\text{Heat}} \underset{\text{[Carbon dioxide]}}{CO_2(g)} + \text{Heat}$$

$$Fe(s) + S(s) \xrightarrow{\text{Heat}} Fe(s)$$ FeS $\rightarrow$ Fe^{+2} (Ferrous)

$$2Fe(s) + 3Cl_2(g) \longrightarrow 2FeCl_3(s)$$ $\rightarrow$ Fe^{+3} (Ferric)

Direct combination or synthesis

Imp.

(ii) When calcium oxide (quick lime) combines with water, a vigorous reaction takes place with the liberation of a large amount of heat.

$$\underset{\text{(Quick Lime)}}{CaO} + H_2O \longrightarrow \underset{\text{(Slaked Lime)}}{Ca(OH)_2} + \text{Heat}$$

Combination and Exothermic reaction

↓

(used as white wash)

Direct combination or synthesis

Slaked lime is used for white washing. When a solution of slaked lime is applied to the walls, calcium hydroxide reacts slowly with carbon dioxide present in the atmosphere to form a thin layer of calcium carbonate on the walls of the building.

$$Ca(OH)_2(aq) + CO_2(g) \longrightarrow CaCO_3(s) + H_2O(l)$$

The layer of calcium carbonate formed gives a shiny finish. Imp

Que Which sub. is used for white washing?

(A) $CaCO_3$

(B) $Ca(OH)_2$ (Slaked Lime)

(C) CaO

(d) $CaCO_3 + H_2O$

Decomposition

'Break down'

The chemical reaction in which a compound splits into two or more simpler substance (elements or compounds) is called decomposition reaction.

$AB \longrightarrow A + B$

Only one Reactant

two product

Decomposition

lysis: tutna

Decomposition may occur in the presence of heat or light, or by the passage of an electric current.

Thermo: Heat

lysis: Breakdown

Thermal Decomposition
OR
Thermolysis

Electrolytic decomposition
OR
Electrolysis

Photolytic decomposition
OR
Photolysis

In a decomposition reaction

(i) A compound breaks up into two or more elements.

$$\underset{\text{[Mercuric oxide]}}{2HgO(s)} \xrightarrow[\text{Heat}]{\Delta} \underset{\text{[Mercury]}}{2Hg(l)} + \underset{\text{[Oxygen]}}{O_2(g)}$$ } (thermolysis / Thermal decomposition)

$$2H_2O(l) \xrightarrow[\text{Current}]{\text{Electric}} 2H_2(g) + O_2(g)$$ (Electrolysis)

In a decomposition reaction

(ii) $\underset{\text{[Calcium carbonate]}}{CaCO_3(s)} \xrightarrow[1000°C]{\text{Heat}} \underset{\text{[Calcium oxide]}}{CaO(s)} + \underset{\text{[Carbon dioxide]}}{CO_2(g)}$ (Thermal decomposition)

(Carbonate) ($CO_2\uparrow$) Rule:

Chemical Name

1. Cuprous chloride
   ↳ less
   Cu^{+1} Cl^{-1} → $CuCl$
2. Cupric chloride
   ↳ Adhik
   Cu^{+2} Cl^{-1} → $CuCl_2$
3. Stannous chloride
   Sn^{+2} Cl^{-1} → $SnCl_2$
4. Stannic chloride
   Sn^{+4} Cl^{-1} → $SnCl_4$

Cu → Cu^{+1} (less), Cu^{+2}

Sn (tin) → Sn^{+2} (less) ous, Sn^{+4} (more) ic

Chemical Name

Naming Salts: Following terminologies are often used.

Sodium nitrate : Na^{+1} NO_3^{-1} → $NaNO_3$

Sodium nitrite : Na^{+1} NO_2^{-1} → $NaNO_2$

Sodium dihydrogen phosphate → NaH_2PO_4

Sodium hydrogen phosphate → Na_2HPO_4

Phosphate = PO_4^{3-}

Hydrogen Phosphate = HPO_4^{2-}

Dihydrogen Phosphate = $H_2PO_4^{-1}$

Chemical Name

Hypo : no. of oxy atom

one atom : Hypo

two oxy atom : ite

3 oxy atom : ate

More (3) OR 4 oxy : (per)

Sodium hypochlorite $NaClO$

Sodium chlorite $NaClO_2$

Sodium chlorate $NaClO_3$

Sodium perchlorate $NaClO_4$

Homework

Notes ✓

Revision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Thank You