UDAAN

2025

Bharat Mata ki Joi

CHEMICAL REACTIONS AND EQUATIONS

Decomposition Reactions and Its Types

Live Experiments + Recorded

CHEMISTRY | Lecture - 05

BY: SUNIL BHAIYA

Topics *to be covered*

1. Decomposition Reactions and Its Types


SUNIL BHAIYA
JOIN MY OFFICIAL TELEGRAM CHANNEL

④ Imp. Information

- Tuesday
- Saturday (Extra Class)

← Chemistry Classes

Knowledge Ride On

Decomposition Reactions and Its Types

Knowledge Ride On

Insaniyat Ka Gyaan

RIDDLE WALLAH

Can you decode the below element?

E UM = Germanium (Ge)

Germony

RIDDLE WALLAH

Can you decode the below element?

E UM = Ge

Pyaare Bacche Be Like

Decomposition Reactions and Its Types

'Compounds का breakup'

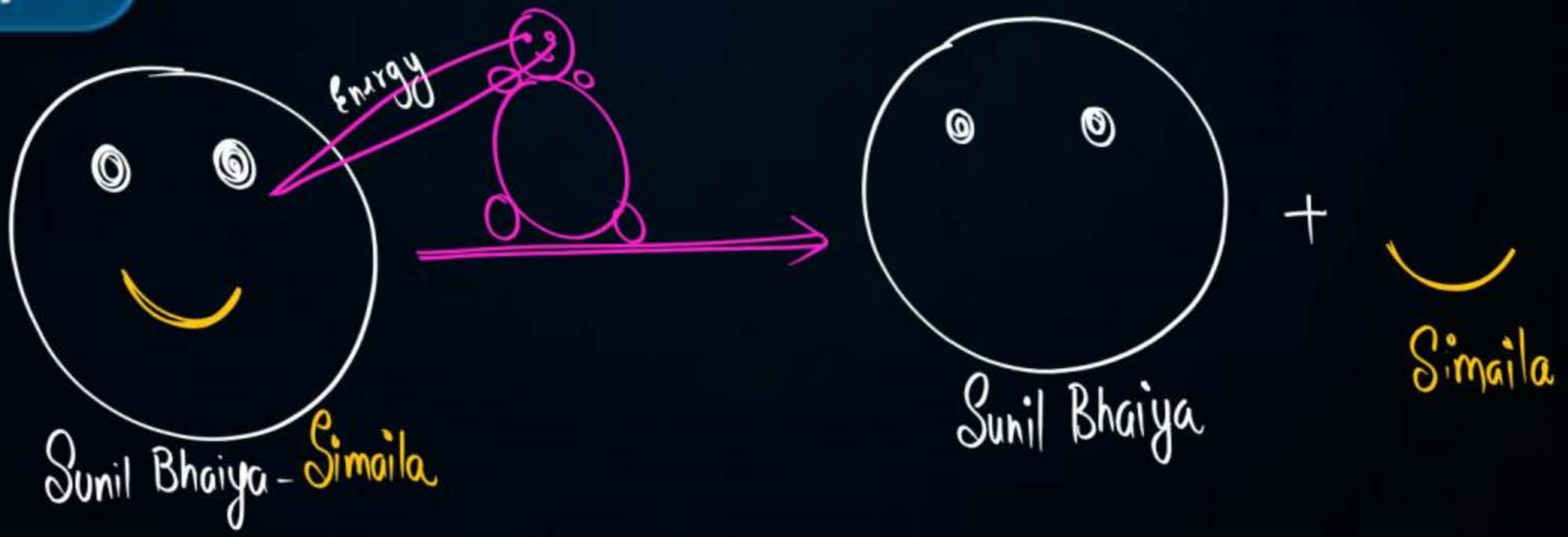
'With CBSE PYQs', NCERT Ex., CHIPPA HUA GYAAN'

A chemical reaction in which a single compound breaks down into two or more elements or compounds when the energy is supplied in the form of heat, electricity or sunlight. → Inverse of combination rxn

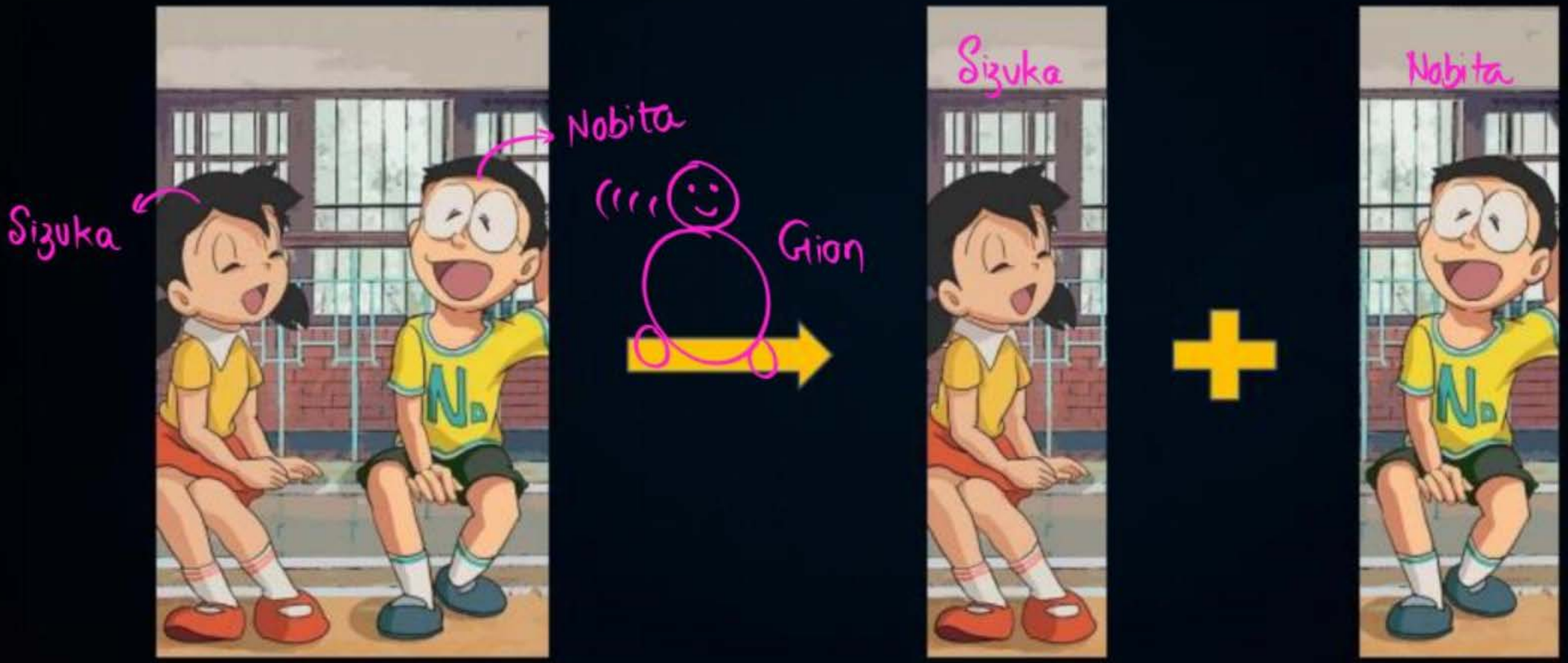
Representation →

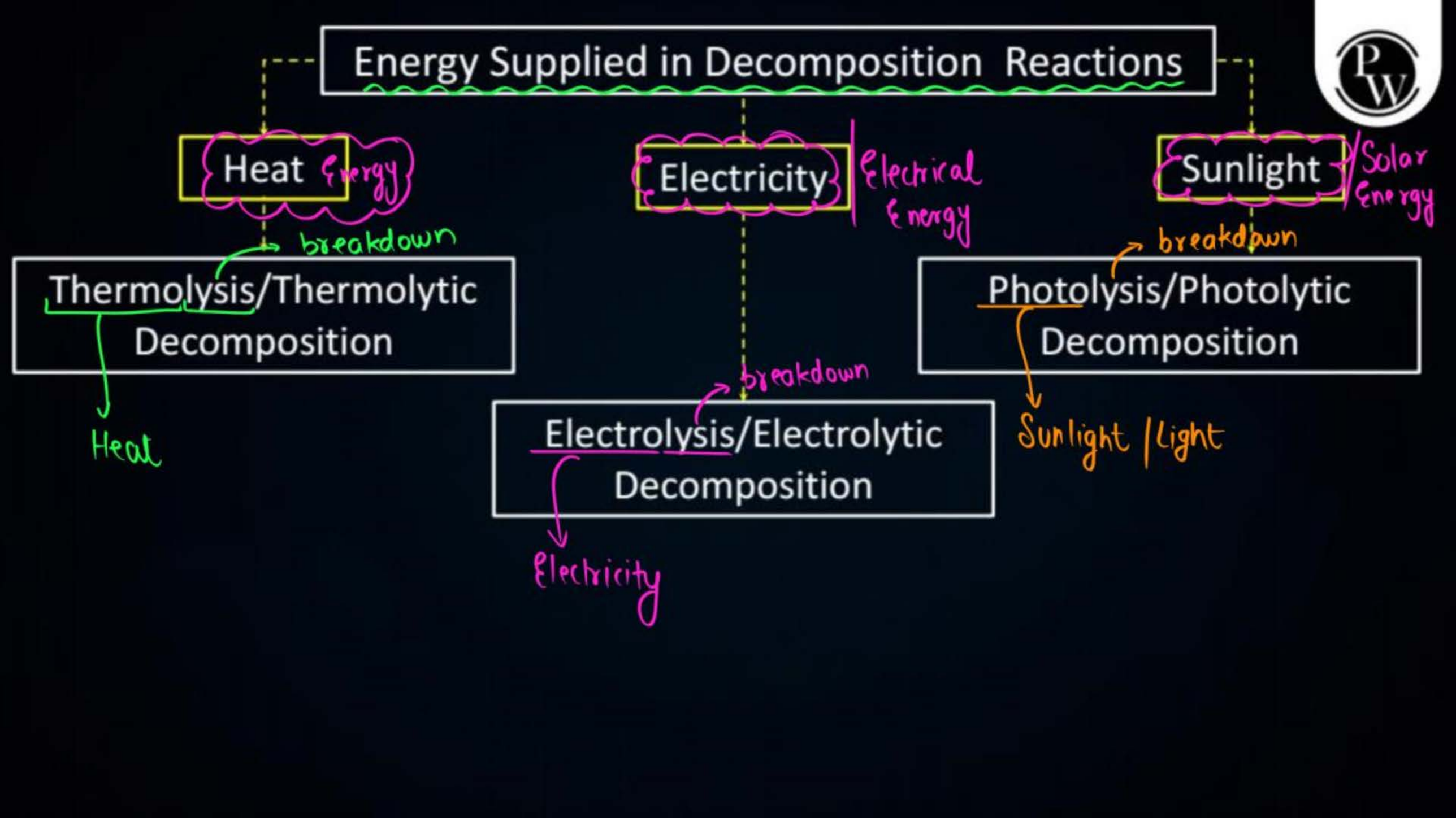
$$AB \xrightarrow{\text{heat / electricity / sunlight}} A + B$$

Analogy - I



Analogy - II




Energy Supplied in Decomposition Reactions
Heat Energy
Electricity
Electrical Energy
Sunlight
Solar Energy
breakdown
Thermolysis/Thermolytic Decomposition
Heat
breakdown
Electrolysis/Electrolytic Decomposition
Electricity
breakdown
Photolysis/Photolytic Decomposition
Sunlight / Light

Important to Understand

Concept I

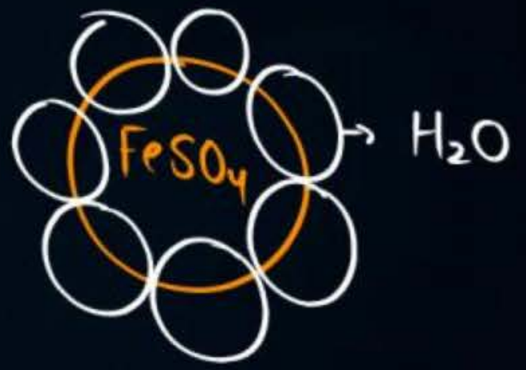
Valency

Fe → Fe^{2+} (2), Fe^{3+} (3)

- Chemical Symbol → Fe, SO_4
- Valency → 2, 2
- Formula → $FeSO_4$
- Common Name → Ferrous sulphate
- IUPAC Name → Iron(II) Sulphate

Concept III

What is the meaning of $FeSO_4.7H_2O$?



IUPAC name → Iron(II) Sulphate heptohydrate

Common name → Hydrated ferrous sulphate

Concept II

What will be the formula of Iron(III) sulphate?

Chemical symbol	Fe	SO_4
Valency	3	2

$Fe_2(SO_4)_3$

IUPAC name

Common name → Ferric sulphate

Thermolysis or Thermolytic Decomposition

(i) Thermolysis of hydrated ferrous sulphate ($FeSO_4.7H_2O$)

Pale Green (C)

$$FeSO_4.7H_2O(s) \xrightarrow[\Delta]{\text{heat or}} \underset{\text{WHITE (C)}}{FeSO_4(s)} + \underset{(C)}{7H_2O(g)}$$

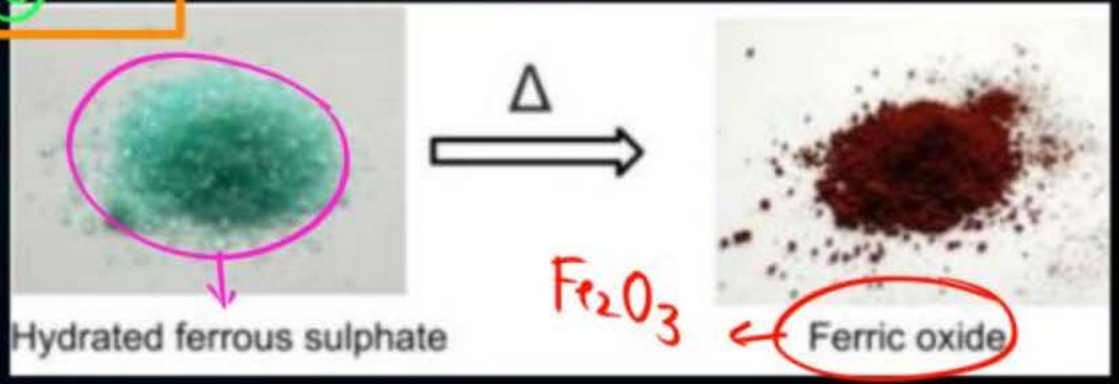
(GREEN VITRIOL)

anhydrous ferrous sulphate or anhydrous Iron(II) sulphate

$$\underset{(C)}{2FeSO_4(s)} \xrightarrow[\Delta]{\text{heat or}} \underset{(C)}{Fe_2O_3(s)} + \underset{(C)}{SO_2(g)} + \underset{(C)}{SO_3(g)}$$

(smell of burnt matchstick)

Reddish-brown colour



$FeSO_4.7H_2O$ → Pale green crystals

↓

water of crystallisation

↓

Water that provides

crystal structure

↓

fixed geometrical shape

PYQ's Wallah

PW Ka ChemStar!

CBSE 2019

A student wants to study a decomposition reaction by taking ferrous sulphate crystals. Write two precautions he must observe while performing the experiment.

CBSE 2019

A student wants to study a decomposition reaction by taking ferrous sulphate crystals. Write two precautions he must observe while performing the experiment.

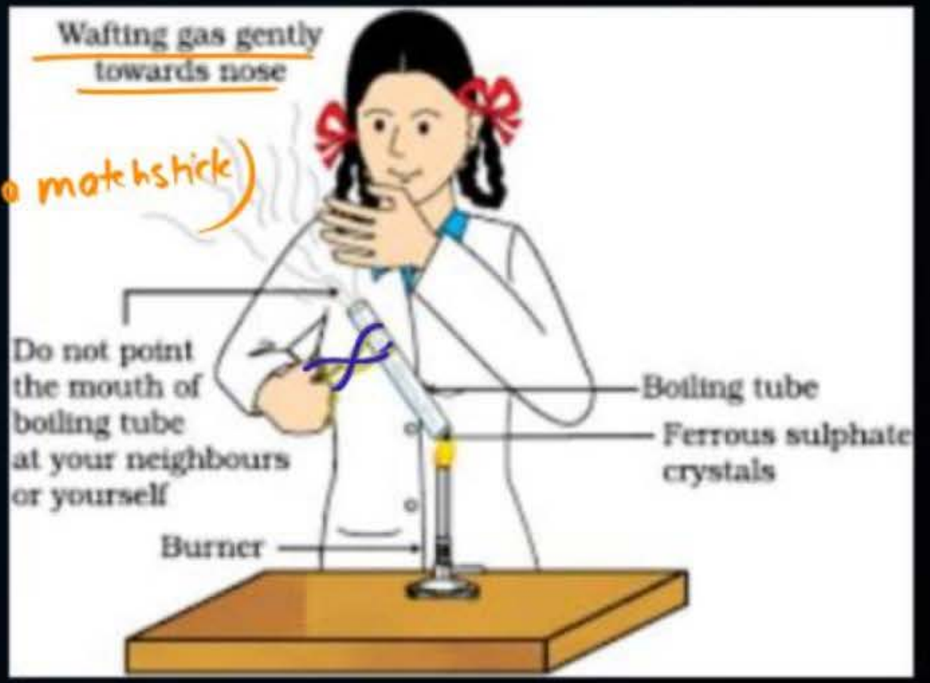
Sense of smell helps to identify gases evolved!

(i) Do not point the mouth of the boiling tube at your neighbours or yourself.

(ii) Waft the gases – Don't sniff them. (Smell similar to that of burning a matchstick)

This is done to confirm the presence of sulphur dioxide and sulphur trioxide gases released.

(iii) Always use a test tube holder while heating the test tube.



Thermolysis or Thermolytic Decomposition

NCERT → NCERT Exemplar

(ii) Thermolysis of metal nitrates of Ca, Mg, Al, Zn, Fe, Pb, Cu

Metal nitrate $\xrightarrow{\text{heat or } \Delta}$ Metal oxide + Nitrogen dioxide + Oxygen

$$2Pb(NO_3)_2(s) \rightarrow 2PbO(s) + 4NO_2(\uparrow) + O_2(\uparrow)$$

White — Yellow — 'Brown fumes' — Colourless gas

Valency

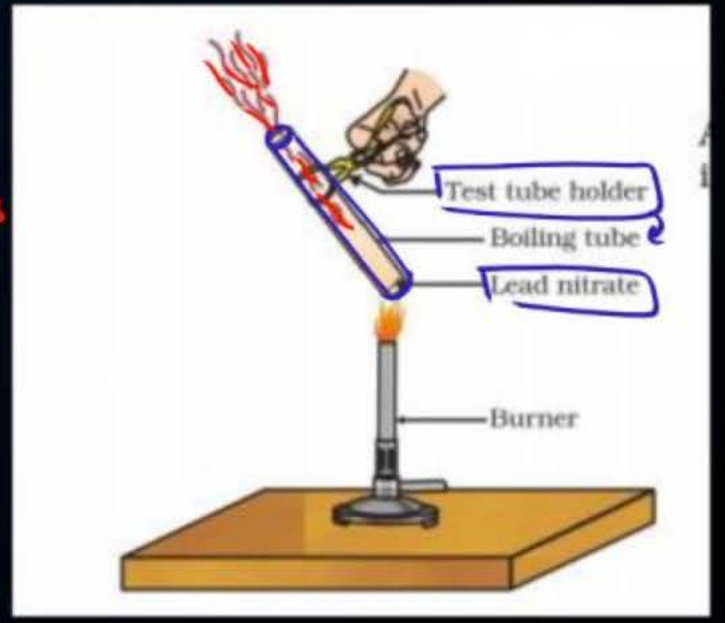
Pb → Pb^{2+} (2), Pb^{4+} (4)

Pb (valency 2) O (valency 1)

Plumbous oxide

PbO

Lead(II) oxide



Observations – Thermolysis of lead nitrate

टूटने की आवाज़

(i) A crackling sound is heard while thermal decomposition of lead nitrate and this process is known as decrepitation.

(ii) Brown fumes of nitrogen dioxide are evolved.

(iii) A yellow residue of lead oxide is left behind in the test tube.

↳ (something left after a rxn)

Extra Gyaan: PbO is brown when hot, yellow when cold and sticks to the glass tube.

KYA BOLTI PUBLIC

PYQ's Wallah

PW Ka ChemStar!

CBSE 2019

2 g of lead nitrate powder is taken in a boiling tube. The boiling tube is heated over a flame. Now answer the following:

(i) State the colour of the fumes evolved and the residue left.

(ii) Name the type of chemical reaction that has taken place stating its balanced chemical equation.

(i) Brown fumes of nitrogen dioxide and yellow residue of lead oxide.

(ii) Thermal decomposition/Thermolysis is taking place here. This is also an endothermic reaction.

$$2Pb(NO_3)_{2(s)} \xrightarrow{heat} 2PbO_{(s)} + 4NO_{2(g)} + O_{2(g)}$$

Thermolysis or Thermolytic Decomposition

(iii) Thermolysis of calcium carbonate

Reaction takes place in → Lime kiln (चूना भट्टी)

Chemical Reaction

$CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g)$ or (↑)

(C) (C) (C)

Used in cement industry

Burnt lime | lime | quicklime

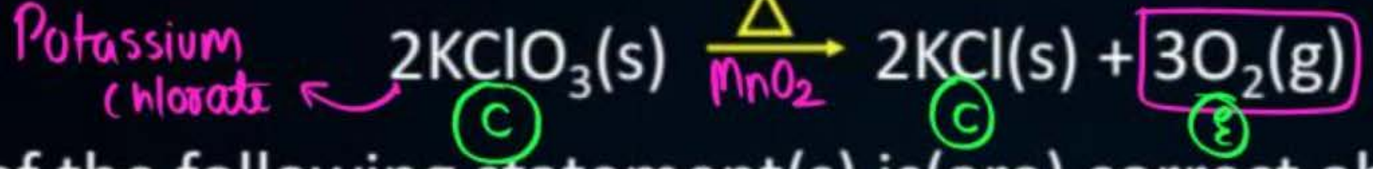
KYA BOLTI PUBLIC

Let's Practice

PW Ka ChemStar!

NCERT Exemplar

The following reaction is used for the preparation of oxygen gas in the laboratory in the presence of heat and catalyst.



Which of the following statement(s) is(are) correct about the reaction?

(A) It is a decomposition reaction and endothermic in nature.

(B) It is a combination reaction.

(C) It is a decomposition reaction and accompanied by release of heat

(D) It is a photo decomposition reaction and exothermic in nature

Electrolysis or Electrolytic Decomposition

C-I

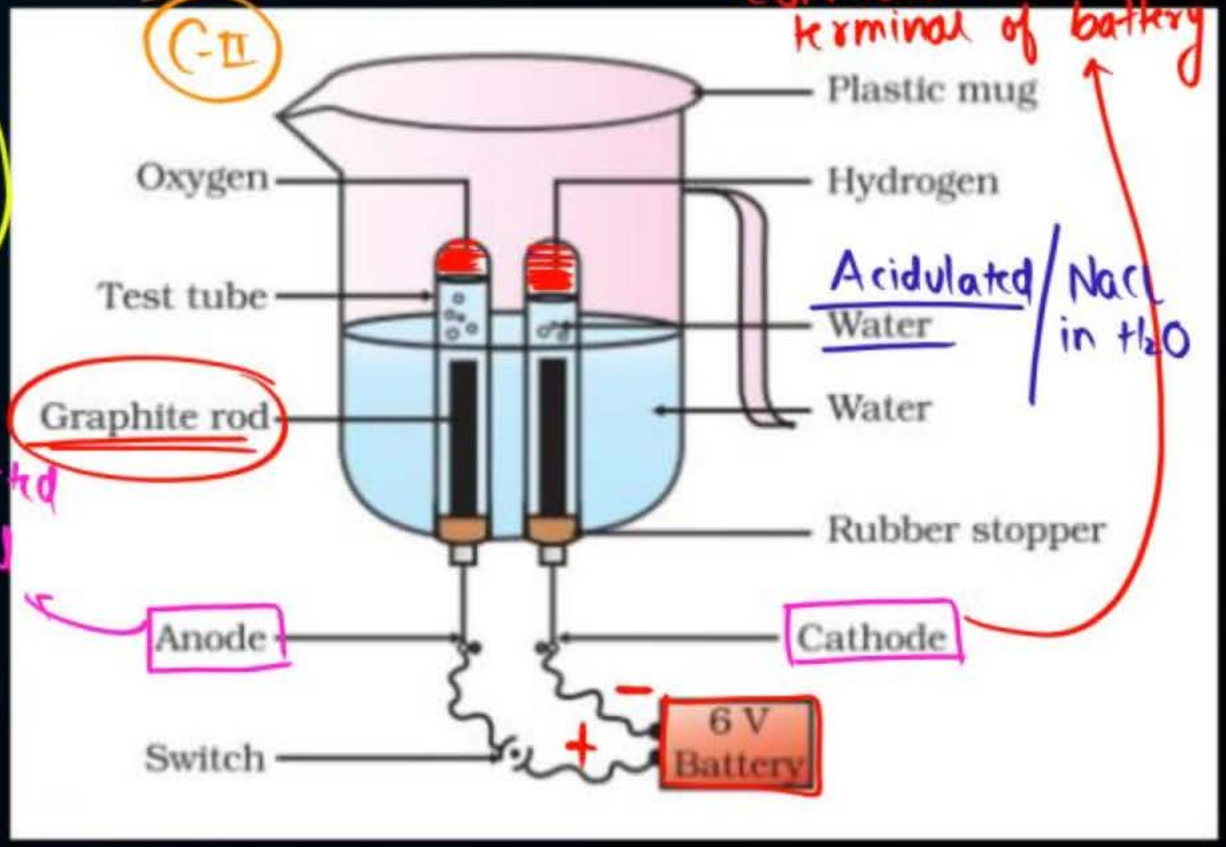
$2H_2O(l) \xrightarrow{\text{Electricity}} 2H_2(g) + 1O_2(g)$

(i) Electrolysis of Water

- Electricity
- breakdown
- H_2O

H_2 & O_2 are produced in ratio of 2:1

C-II



metal electrode connected to -ve terminal of battery

metal electrode connected to +ve terminal of battery

C-III

H_2 → at cathode

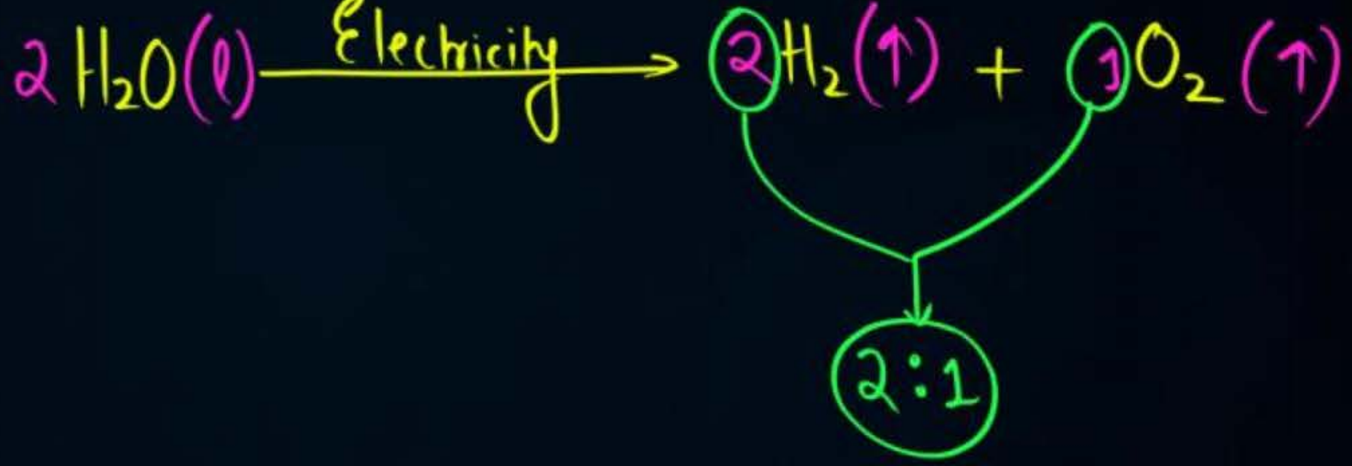
O_2 → at anode

Let's Practice

PW Ka ChemStar!

NCERT Exemplar

Electrolysis of water is a decomposition reaction. The mole ratio of hydrogen and oxygen gases liberated during electrolysis of water is:



A 1:1

B 2:1

C 4:1

D 1:2

Give a Thought

Why acidulated water/water with NaCl is taken?

Give a Thought

Electrolyte
↓
breaks into ions [cations & anions]
& conducts electricity
ex: NaCl, H_2SO_4 etc.

Why acidulated water/water with NaCl is taken?

(Poor conductor of electricity)

Water ionises to a tiny extent giving H^+ and OH^- ions. In order to make water a good conductor of electricity, dilute sulphuric acid/NaCl is added to water which gives H^+ or (H_3O^+) and SO_4^{2-} ions in water. These free ions conduct electricity and speed up the electrolysis of water.

Give a Thought

NCERT activity

What will happen if burning candle is brought close to the mouth of the test tubes?

Give a Thought

What will happen if burning candle is brought close to the mouth of the test tubes?

जलती है पर जलाती नहीं

H_2 → combustible but not a supporter of combustion

When we bring a **glowing candle close** to the mouth of one of the test tubes, the gas in the test tube extinguishes fire and **burns** with a **pop** sound, showing the presence of *hydrogen* in the test tube.

When we bring a burning candle closer to the mouth of another test tube, the candle starts to **burn brightly**, showing that the test tube *contains oxygen*.

O_2 → not combustible but a supporter of combustion

जलती नहीं, जलाती है।

KYA BOLTI PUBLIC

PYQ's Wallah

PW Ka ChemStar!

CBSE 2020

1.In the electrolysis of water:

2.Name the gas formed at anode and cathode.

3.Why is the volume of gas collected at one electrode double than the other?

What would happen if dilute H_2SO_4 is not added to water?

CBSE 2020

1. In the electrolysis of water:
2. Name the gas formed at anode and cathode.
3. Why is the volume of gas collected at one electrode double than the other?
3. What would happen if dilute H_2SO_4 is not added to water?

1. Anode: Oxygen (O_2), Cathode: Hydrogen (H_2)
2. The volume of hydrogen (H_2) formed at cathode will be twice the oxygen (O_2) formed at anode. It can be observed from the below equation:

$$2H_2O(l) \xrightarrow{\text{Electricity}} 2H_2(g) + O_2(g)$$

3. Water ionises to a tiny extent giving H^+ and OH^- ions. In order to make water a good conductor of electricity, dilute sulphuric acid is added to water which gives H^+ or (H_3O^+) and SO_4^{2-} ions in water. These free ions conduct electricity and speed up the electrolysis of water.

Photolysis or Photolytic Decomposition

(i) Photolysis of silver chloride and silver bromide

$$2AgCl(s) \xrightarrow[\text{or } h\nu]{\text{Light / Sunlight}} 2Ag(s) + Cl_2(g)$$

(White) → (Grey) + greenish-yellow gas

$$2AgBr(s) \xrightarrow[\text{or } h\nu]{\text{Light / Sunlight}} 2Ag(s) + Br_2(g)$$

(Yellow) → (Grey) + reddish-brown vapour (gas)

Photosensitive materials

↓

Used in black-and-white photography

At 25 °C (room temp.), Br_2 is a reddish brown liquid. ONLY NON-METAL IN LIQUID STATE

KYA BOLTI PUBLIC

Out of NCERT Gyaan

EXTRA

- Thermal Decomposition of Sugar (At Home)

$C_{12}H_{22}O_{11}(s) \xrightarrow{\text{heat or } \Delta} C_{12}H_{22}O_{11}(l)$ (C) → Physical Change

$C_{12}H_{22}O_{11}(l) \xrightarrow{\Delta \text{ or heat}} 12C(s)$ (E) + $11H_2O(g)$ (C)

Thermolysis of sugar

$12C(s)$ → Sugar charcoal

$11H_2O(g)$ → Water-vapour

Out of NCERT Gyaan

- Thermal Decomposition of Ammonium dichromate

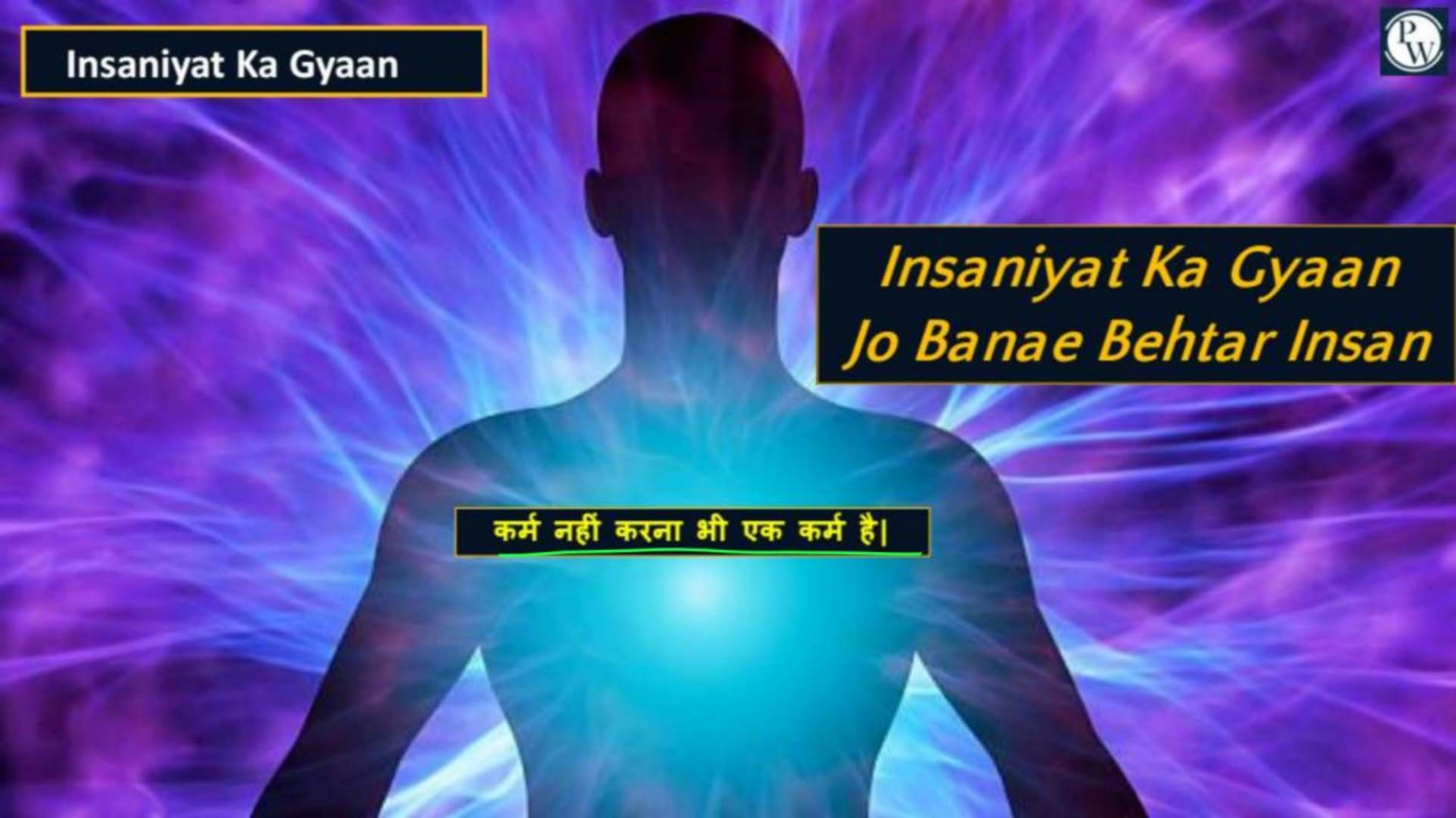
$$\underset{\text{Orange}}{(NH_4)_2Cr_2O_7(s)} \xrightarrow[\Delta]{\text{heat or}} \underset{\text{Chromium(III) oxide}}{Cr_2O_3(s)} + N_2(\uparrow) + 4H_2O(\uparrow)$$

'Green Residue'

Concept Polish (गृहकार्य)

CBSE 2019

What happens during thermolysis of copper nitrate?


Insaniyat Ka Gyaan
Insaniyat Ka Gyaan
Jo Banae Behtar Insan
कर्म नहीं करना भी एक कर्म है।


SUNIL BHAIYA
JOIN MY OFFICIAL TELEGRAM CHANNEL

SUNIL BHAIYA IS ALWAYS THERE FOR YOU.

#sbsathhai

#pwsathhai

THANK YOU