UDAAN

2025

Bharat Mata Ki Jai ♡

METALS AND NON-METALS

Occurrence and Extraction of Metals (Metallurgy) – Part II

CHEMISTRY | Lecture - 07

BY: SUNIL BHAIYA

Topics

to be covered

1. Common Steps to Obtain Metal from Ore
2. Extraction of Metals of Low Reactivity
3. Extraction of Metals of Medium Reactivity – Part I


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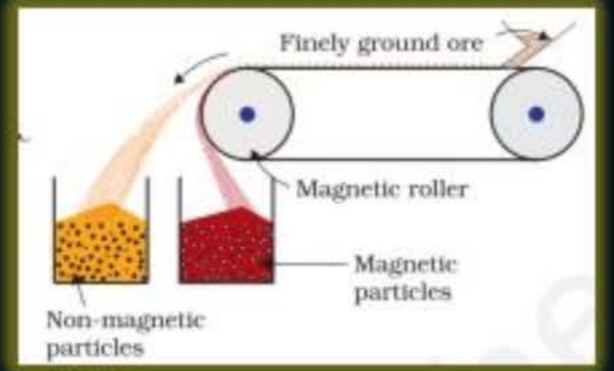
Knowledge Ride On



Common Steps to Obtain Metal from Ore

Knowledge Ride On

Extraction of Metals of Low Reactivity

Knowledge Ride On

Extraction of Metals of Medium Reactivity – Part I

Knowledge Ride On

Insaniyat Ka Gyaan

RIDDLE WALLAH

A word formed by the chemical symbols of elements with atomic number 6, 8, 15 and 16. This is something that terrifies criminals.

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A word formed by the chemical symbols of elements with atomic number 6, 8, 15 and 16. This is something that terrifies criminals.

C O P S

Hey POPS

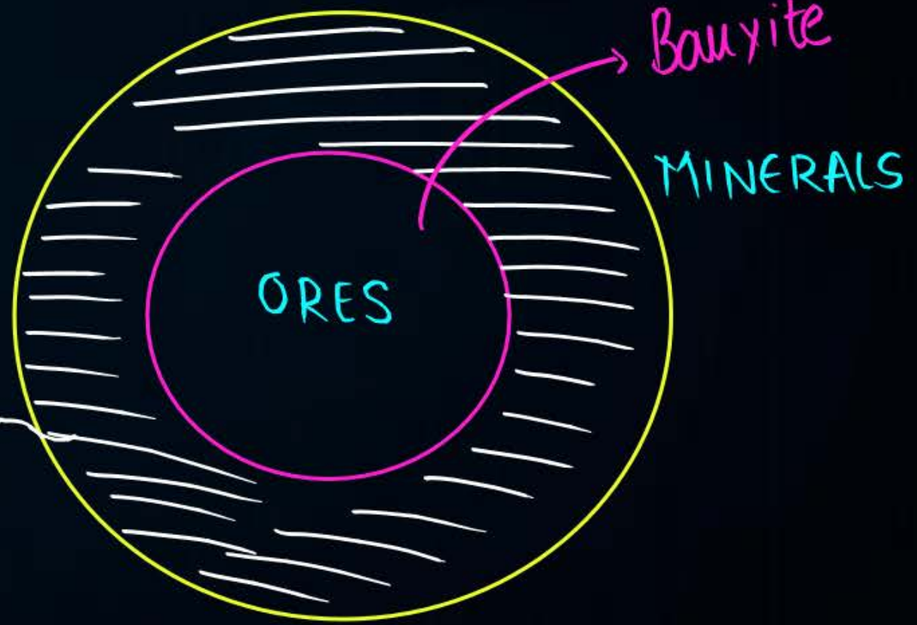
Udaanians be like

Concept Polish (गृहकार्य) – Homework Discussion

Beat Your Brains Out

Can you draw a Venn diagram relationship between minerals and ores?

All ores are minerals but all minerals are not ores.



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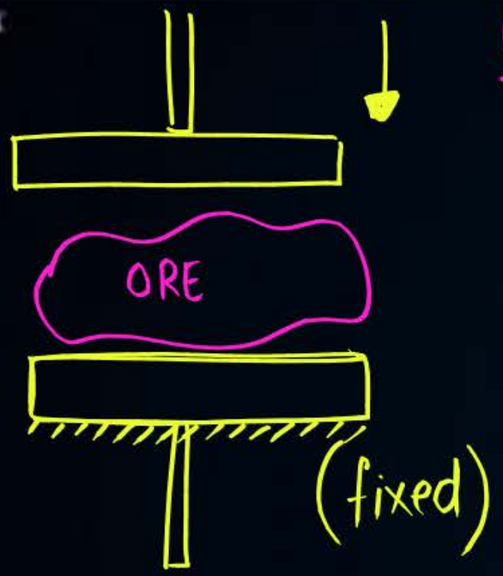
Common Steps to Obtain Metal from Ore

Step I: Crushing and Grinding of Ore

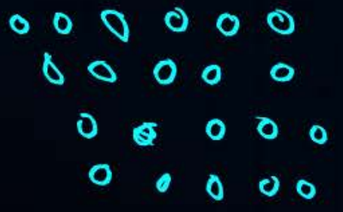
CRUSHING OF ORE

Hammer mill

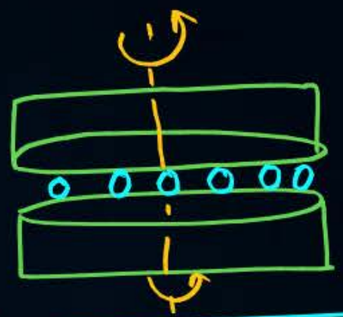


IMPACT FORCE

Converts ore into smaller pieces



GRINDING OF ORE



(Grinder)

ATTRITION / SHEER FORCE

Converts crushed ore into pulverised form or powdered form

Step II: Concentration/Benefaction/Dressing of Ore /Enrichment of Ore

C-I [after removing impurities
concentration of ore (↑) relatively]

Importance

C-II Before extracting the metal, it is important to remove *gangue or matrix*!

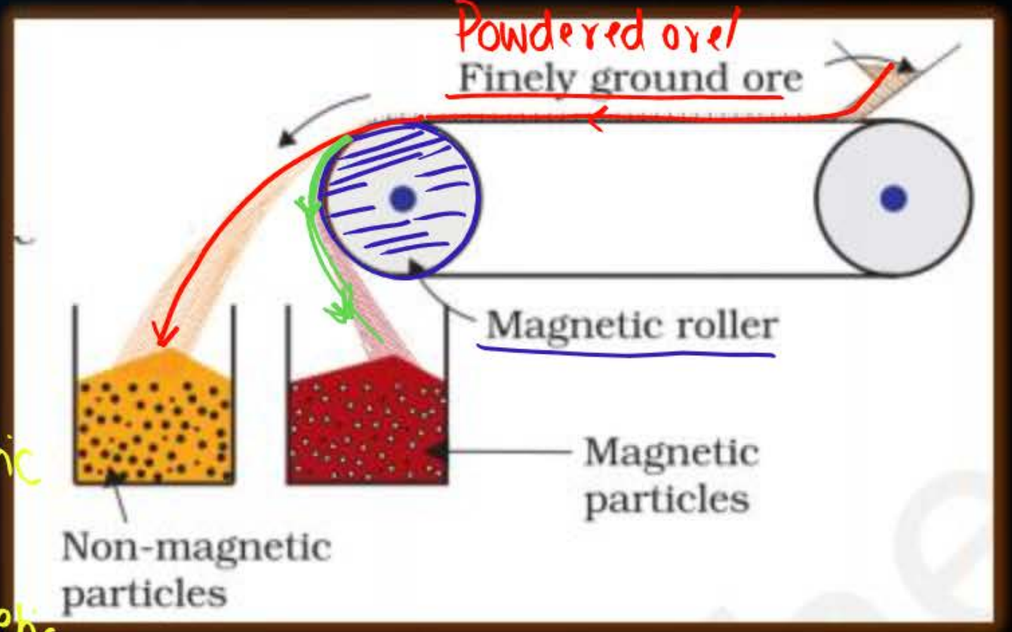
C-III Principle of separation of gangue from ore: *The differences between the physical or chemical properties of the gangue and the ore.*

Step II: Concentration/Benefaction/Dressing of Ore

Principle of separation of gangue from ore: *The differences between the physical or chemical properties of the gangue and the ore.*

One such method is *magnetic separation*!

When ore is magnetic while gangue is not & vice-versa. → ex: ORE : magnetic
gangue : non magnetic



Step III: Extraction of Metals from Concentrated Ore

(i) Extraction of low reactivity metals *(At low in the reactivity series of metals)* → 'Cu, Hg & Ag'

(ii) Extraction of medium reactivity metals *(At middle in the reactivity series of metals)* → (Zn, Fe & Pb)

(iii) Extraction of high reactivity metals *(At top in the reactivity series of metals)* → (K, Na, Ca, Mg & Al)

(iv) *Note: Least reactivity metals like Gold and Platinum are found in the free/native state.* / pure state

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Extraction of Metals of Low Reactivity

Step III: Extraction of Metals From Concentrated Ore (Metals of Low Reactivity)

Step I & IInd will be same as discussed!

Cu, Hg and Ag are metals of low reactivity. Let's discuss how Copper and Mercury are extracted from their most common ores, i.e. sulphide ores.

Ore	Copper	Mercury
	Cu_2S (Copper glance)	HgS (Cinnabar)

Give a Thought

It is easy to extract metal from its oxide ~~or~~ rather than its carbonate and sulphide.

A. YES

B. NO

Give a Thought

Crushing & Grinding of ore
↓
Concentration of ore → Oxide ore → extraction of metal
Carbonate or sulphide ore → extraction of metal

It is easy to extract metal from its oxide or its carbonate and sulphide.

A. YES

B. NO

It is easy to extract a metal from its oxide rather than sulphide or carbonate. So, carbonate or sulphide ores are first converted into oxides.

Extraction of Metals of Low Reactivity

Roasting: Strongly heating the sulphide ore in excess of air (oxygen (20.95 v.)) below melting point of metal.

C-I

C-II

In case of metals of low reactivity the metal oxide automatically reduces to metal on action of heat.

Roasting

Metal sulphide + Oxygen (excess of air) $\xrightarrow{\text{heat}}$ Metal oxide + Sulphur dioxide gas

Metal oxide $\xrightarrow{\text{heat}}$ Metal + Oxygen

'AUTO-REDUCTION'

C-II

Extraction of Metals of Low Reactivity – Copper (Cu)

from Cu_2S [Copper glance]

Step I and II: Crushing and Grinding of Ore; Concentration of Ore

Concentrated ore

Step III: Roasting

$$2Cu_2S(s) + 3O_2(g) \xrightarrow{\Delta} 2Cu_2O(s) + 2SO_2(g)$$

Step IV: Auto-reduction

$$2Cu_2O(s) + Cu_2S(s) \xrightarrow{\Delta} 6Cu(s) + SO_2(g)$$

Step V: Refining of Metal

Purification of metal

Extraction of Metals of Low Reactivity – Mercury (Hg)

↳ from cinnabar (HgS)

Step I and II: Crushing and Grinding of Ore; Concentration of Ore

Step III: Roasting

Concentrated ore

$$2HgS(s) + 3O_2(g) \xrightarrow{\Delta} 2HgO(s) + 2SO_2(g)$$

Step IV: Auto-reduction

$$HgS(s) + 2HgO(s) \xrightarrow{\Delta} 3Hg(l) + SO_2(g)$$

(liquid)

(Thermolysis) →

$$2HgO(s) \xrightarrow{\Delta} 2Hg(l) + O_2(g)$$

(liquid)

(**) Hg gives oxygen even faster than Cu as it is less reactive

Step V: Refining of Metal / Purification of metal

Summary of All Steps – Metals of Low Reactivity

Step I
Crushing and Grinding of Ore

Step II
Concentration of Ore

(Concentrated ore)

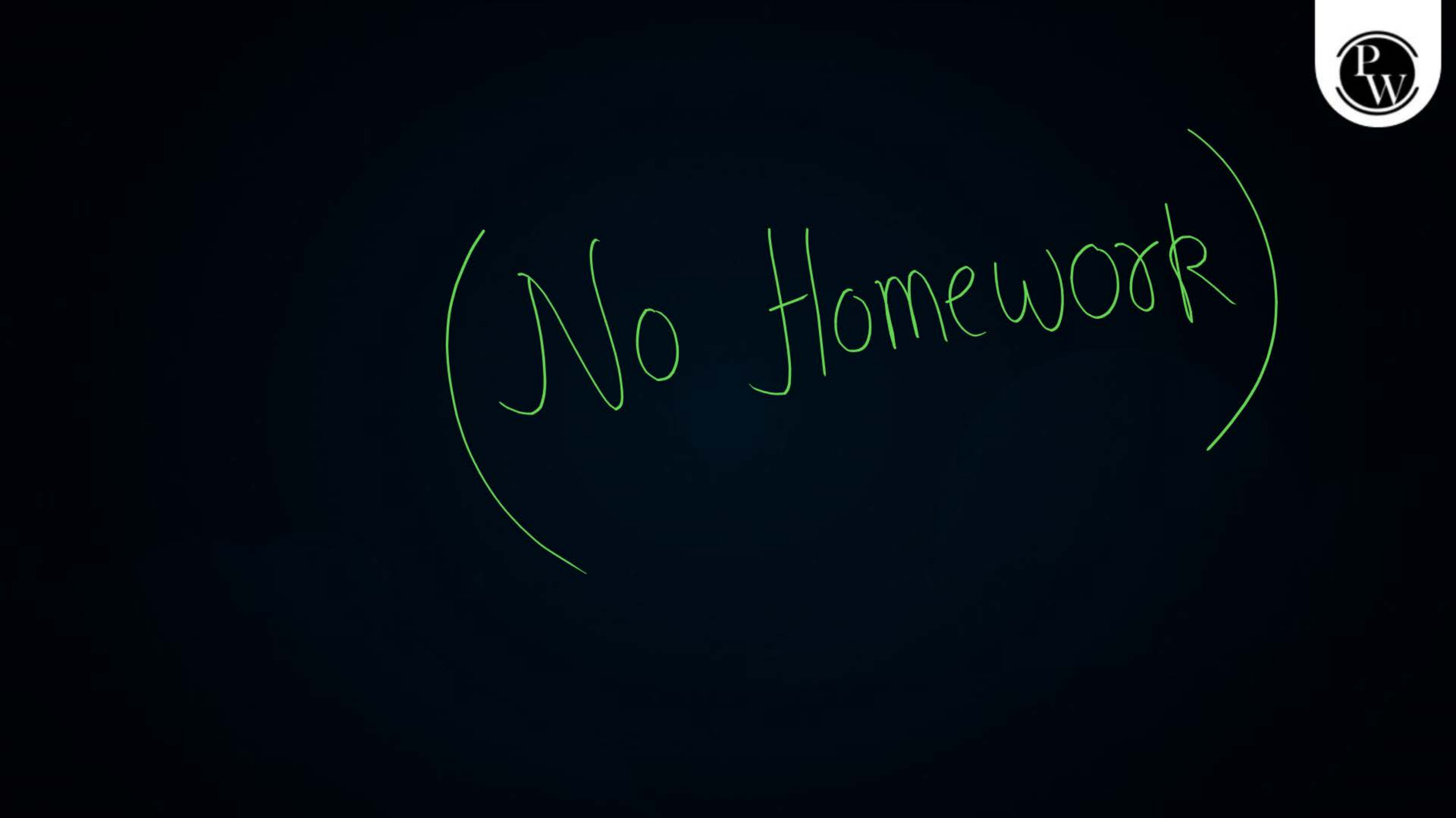
Step III
Roasting (Sulphide Ore)

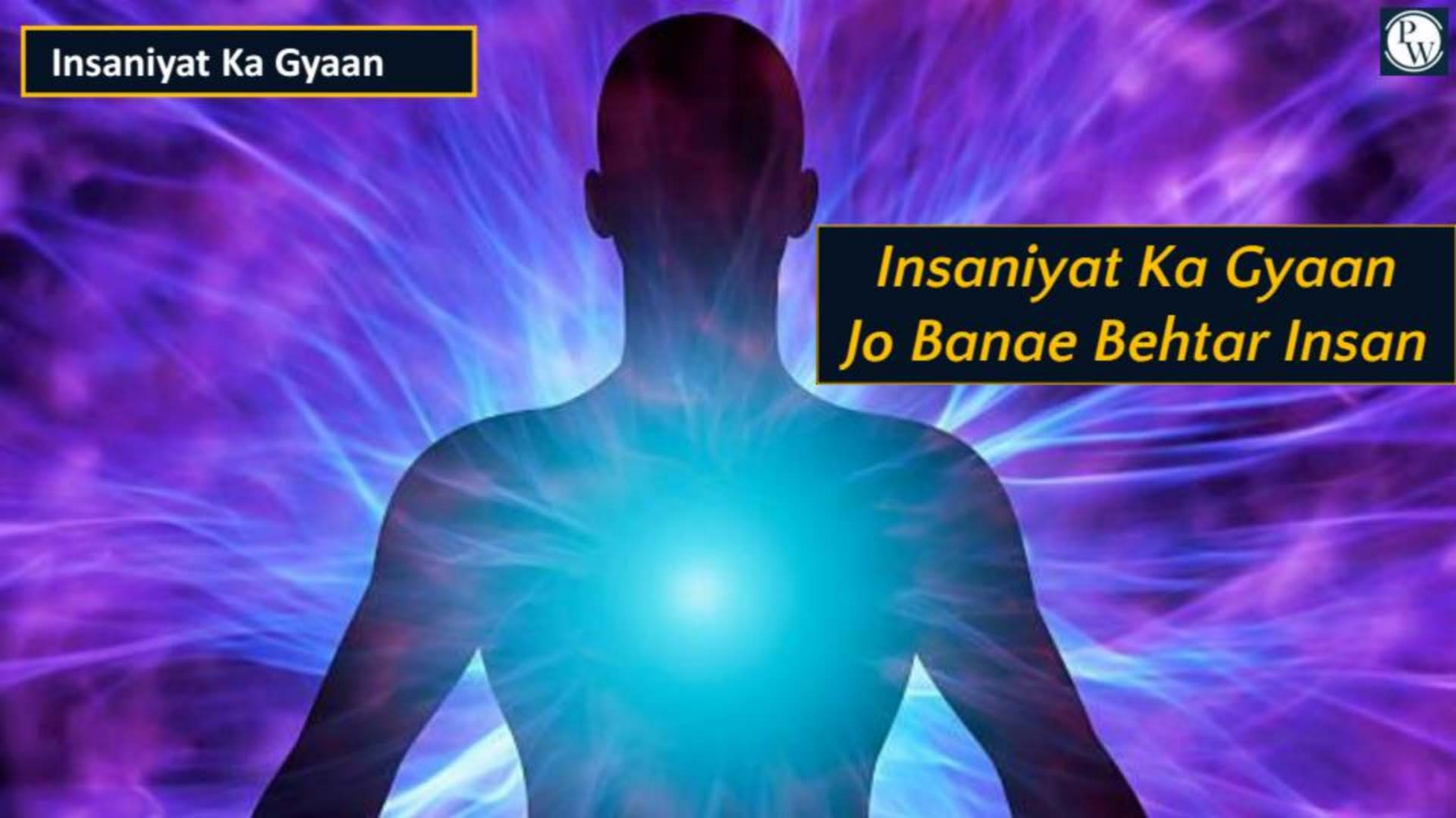
Step IV
Auto-reduction
(Conversion of metal oxide to metal)
(on heat)
(No reducing agent required)

Step V
Refining/Purification of Metal

CBSE Teachers to Udaanians

Concept Polish (गृहकार्य)


(No Homework)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Jo Banae Behtar Insan


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THANK YOU