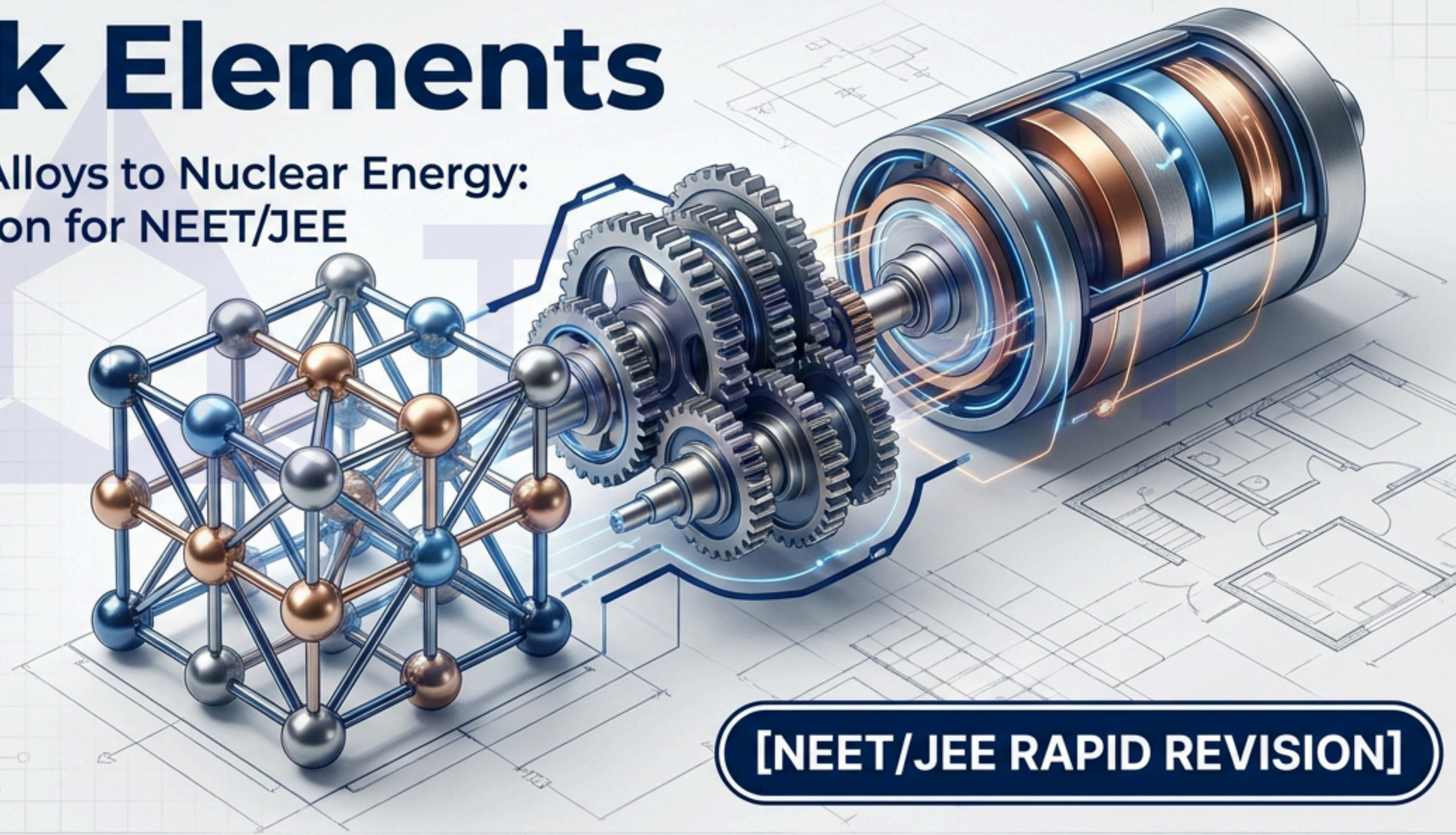
CHAPTER 4.7

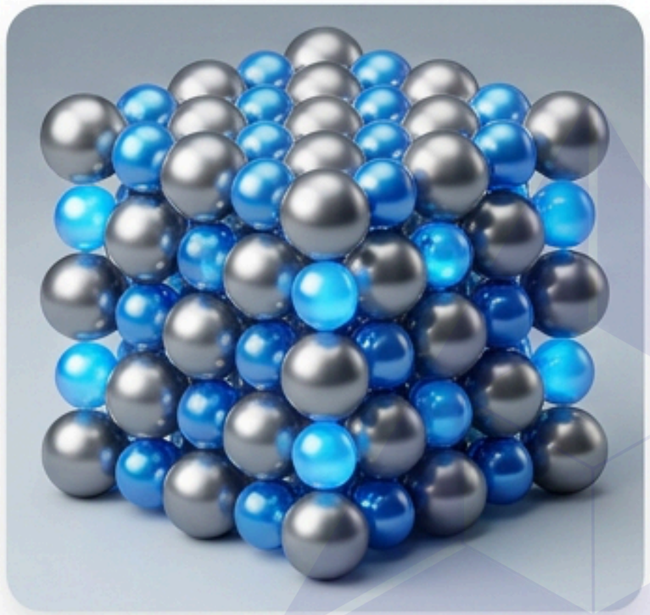
Applications of d- and f-Block Elements

From Industrial Alloys to Nuclear Energy: High-Yield Revision for NEET/JEE



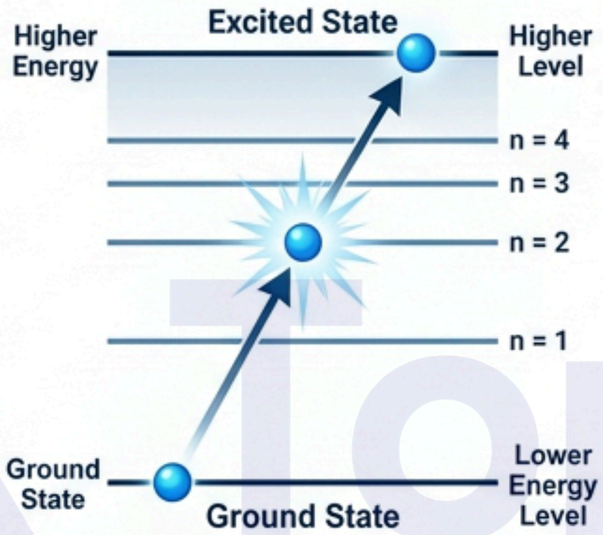
[NEET/JEE RAPID REVISION]

The Elemental Blueprint: Why Are They So Versatile?



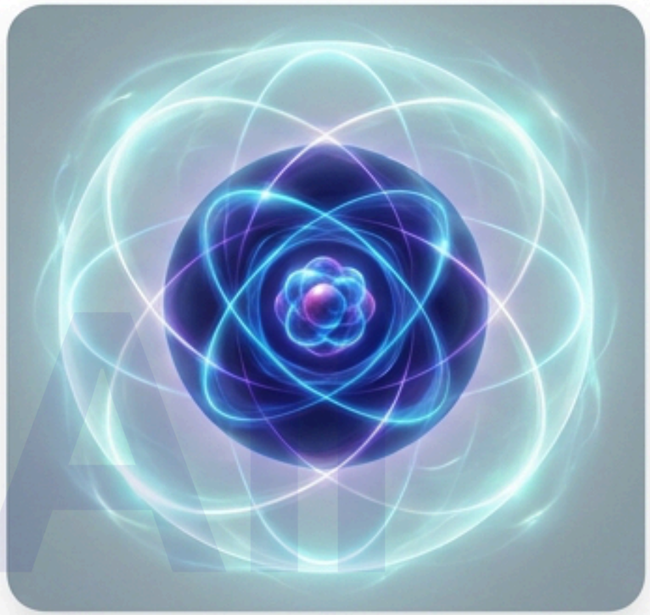
Structural Voids (Alloys)

Transition metals form interstitial compounds, allowing smaller atoms (C, N) to slip into lattice voids, creating ultra-strong alloys like steel.



Variable Oxidation (Catalysts)

The ability to adopt multiple oxidation states and form complex compounds allows them to easily lower activation energy in chemical reactions.



f-Orbital Shielding (Nuclear & Tech)

Complex 4f and 5f electronic configurations enable unique magnetic, fluorescent, and radioactive properties.

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Industrial Alloys & Structural Supremacy

Iron & Steel Production

Reduction of iron oxides

↓

Removal of impurities

↓

Addition of Carbon + Alloying Metals

- [Cr]
- [Mn]
- [Ni]



Brass

Copper + Zinc



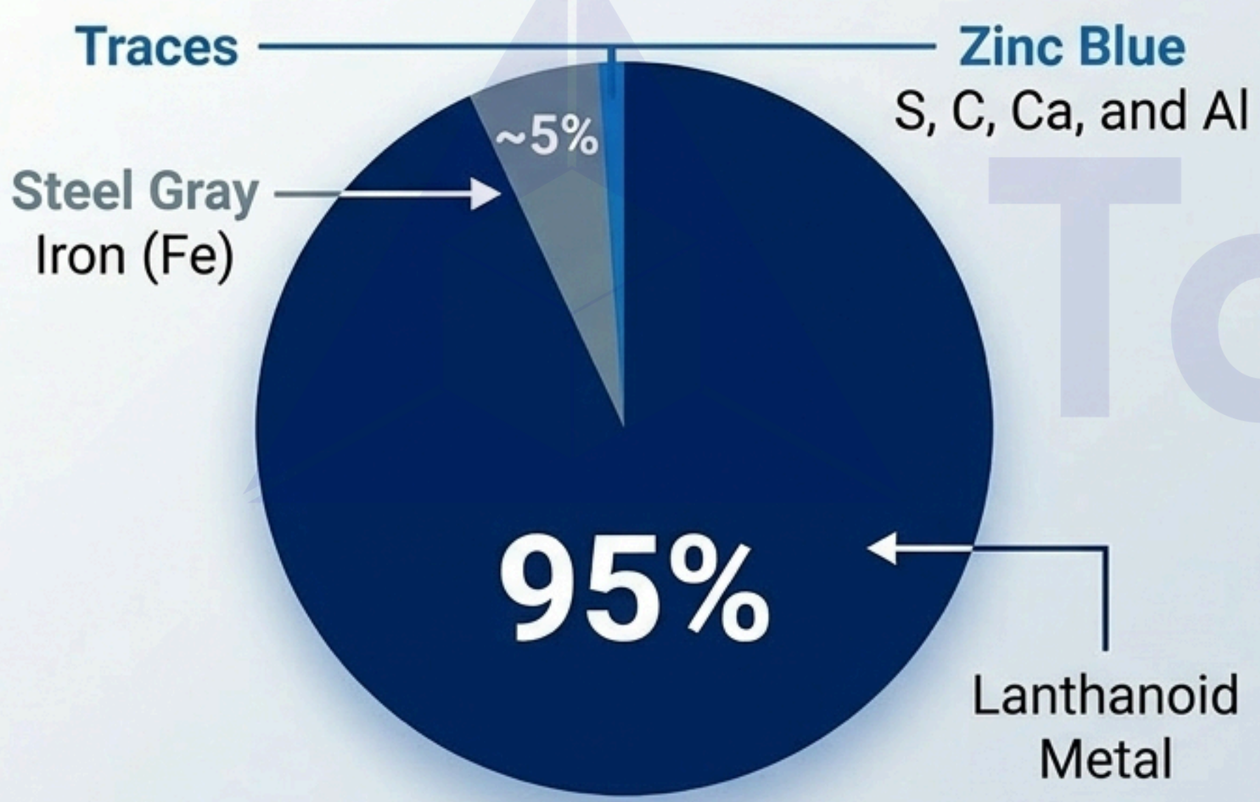
Bronze

Copper = Tin

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High-Yield Focus: The Mischmetall Alloy

Infographic Blueprint





Use-case 1:
Mg-based alloys



Use-case 2:
Bullets & Shells



Use-case 3:
Lighter flints

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- Free Study Material, Videos & Infographics
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- Climb the Leaderboard Among Fellow Aspirants
- Practice Unlimited MCQs for NEET & JEE
- Get Clear Explanations, Not Just Marks
- Track Your Performance Smarter

The Evolution of Coinage Metals (Group 11)

Traditional / Collection



Silver and Gold are largely restricted to historical and collection items today.

Modern Utility (UK Example)



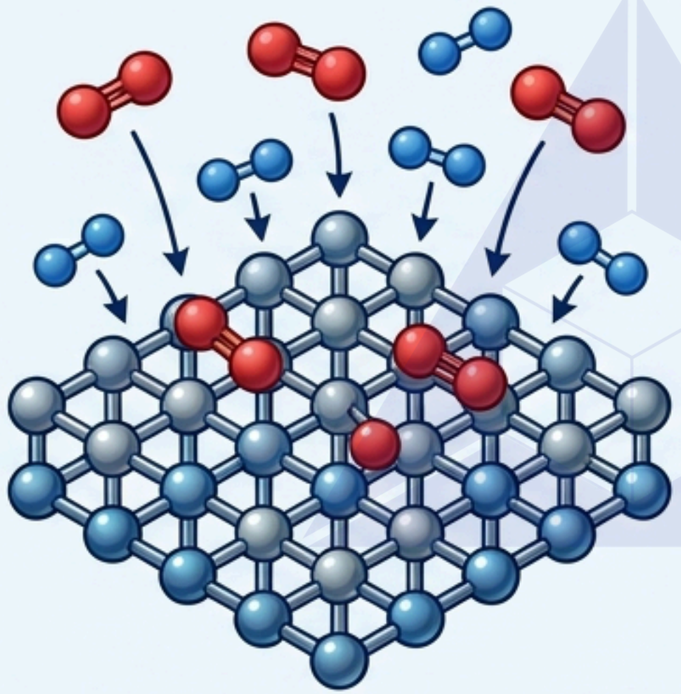
Contemporary UK ‘copper’ coins are a **copper-coated steel core**.

Contemporary UK **‘silver’** coins are a blended **Cu/Ni alloy**.

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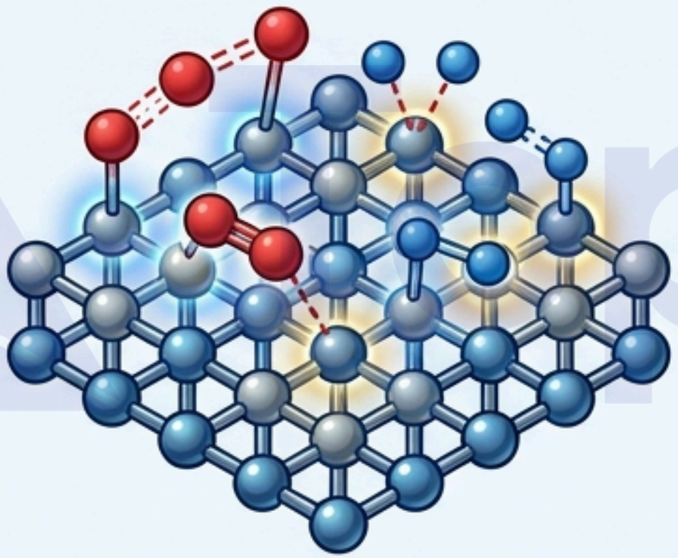
Transition Metals as Catalysts: The Mechanism

Step 1: Adsorption



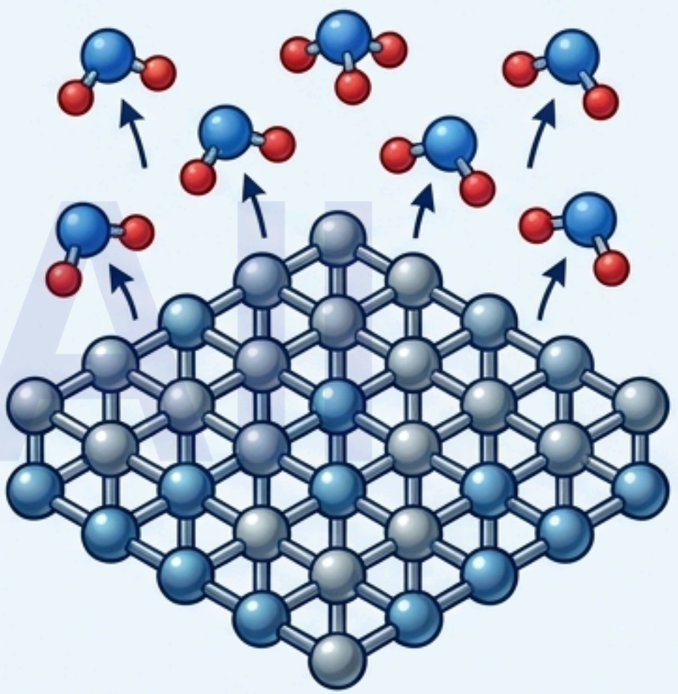
Solid surface catalysts provide a surface area for reactant adsorption.

Step 2: Complex Formation



Variable oxidation states allow temporary complex formation, lowering activation energy.

Step 3: Desorption



Product is released, freeing the catalyst surface for the next cycle.

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The Catalyst Master Matrix

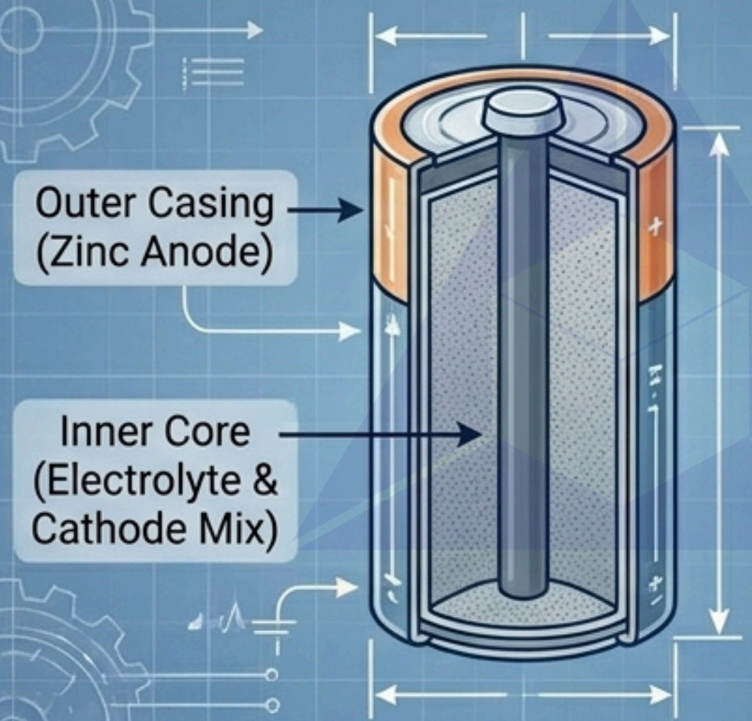
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Process	Catalyst	Application
Haber's Process	[Finely divided Fe]	Production of Ammonia (NH_3) from N_2/H_2
Contact Process	[V_2O_5]	Oxidation of SO_2 in Sulphuric Acid manufacture
Ziegler Process	[$TiCl_4$ + $Al(CH_3)_3$]	Manufacture of Polyethylene (polythene)
Wacker Process	[$PdCl_2$]	Oxidation of ethyne to ethanal
Catalytic Hydrogenation	[Ni]	Hydrogenation of fats; polymerisation of alkynes/benzene
Petroleum Cracking	[Mixed Ln Oxides]	Hydrocarbon cracking

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Energy Storage: Dry Cells & Rechargeable Batteries

Dry Battery Cells



[MnO_2]

[Zn]

Manganese dioxide acts as a critical depolarizer, while Zinc is used as the anode casing in standard dry battery cells.

Rechargeable Batteries



[Ni / Cd]

The battery industry heavily relies on Nickel and Cadmium for rechargeable Ni-Cd cells.

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Speciality Tech, Pigments & Optics

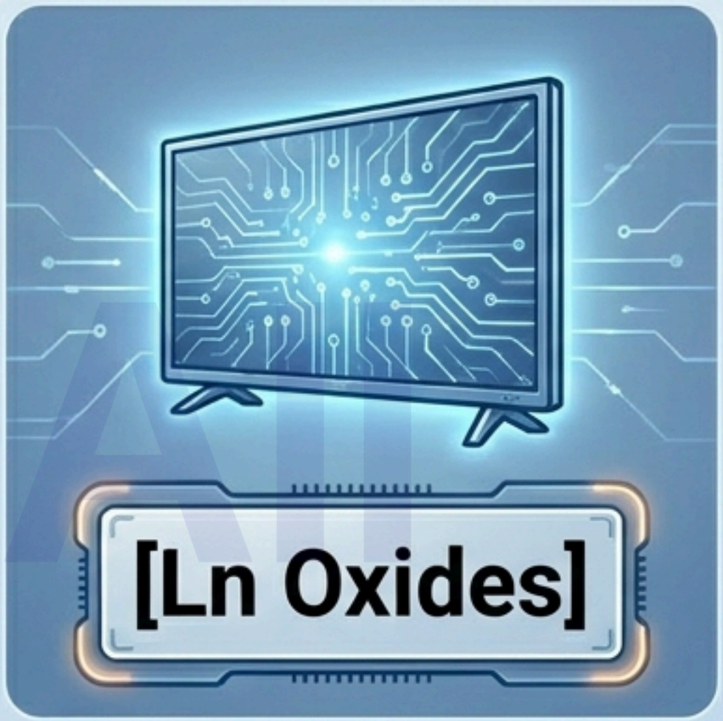
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The photographic industry relies on the special light-sensitive properties of Silver Bromide.

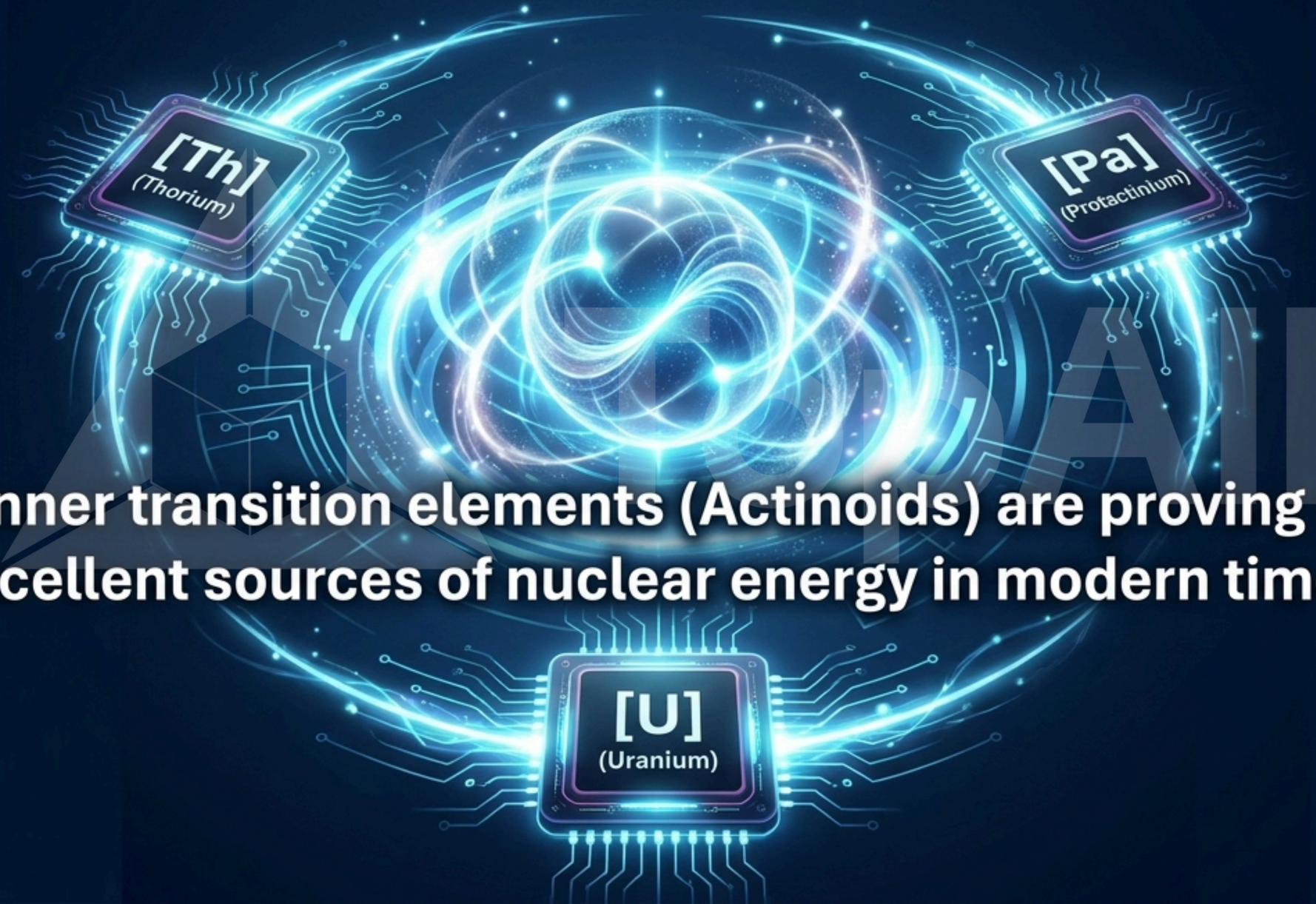


Titanium oxide is manufactured for special purposes as a brilliant white pigment in the paint industry.



Individual Lanthanoid oxides are used as phosphors in television screens and similar fluorescing surfaces.

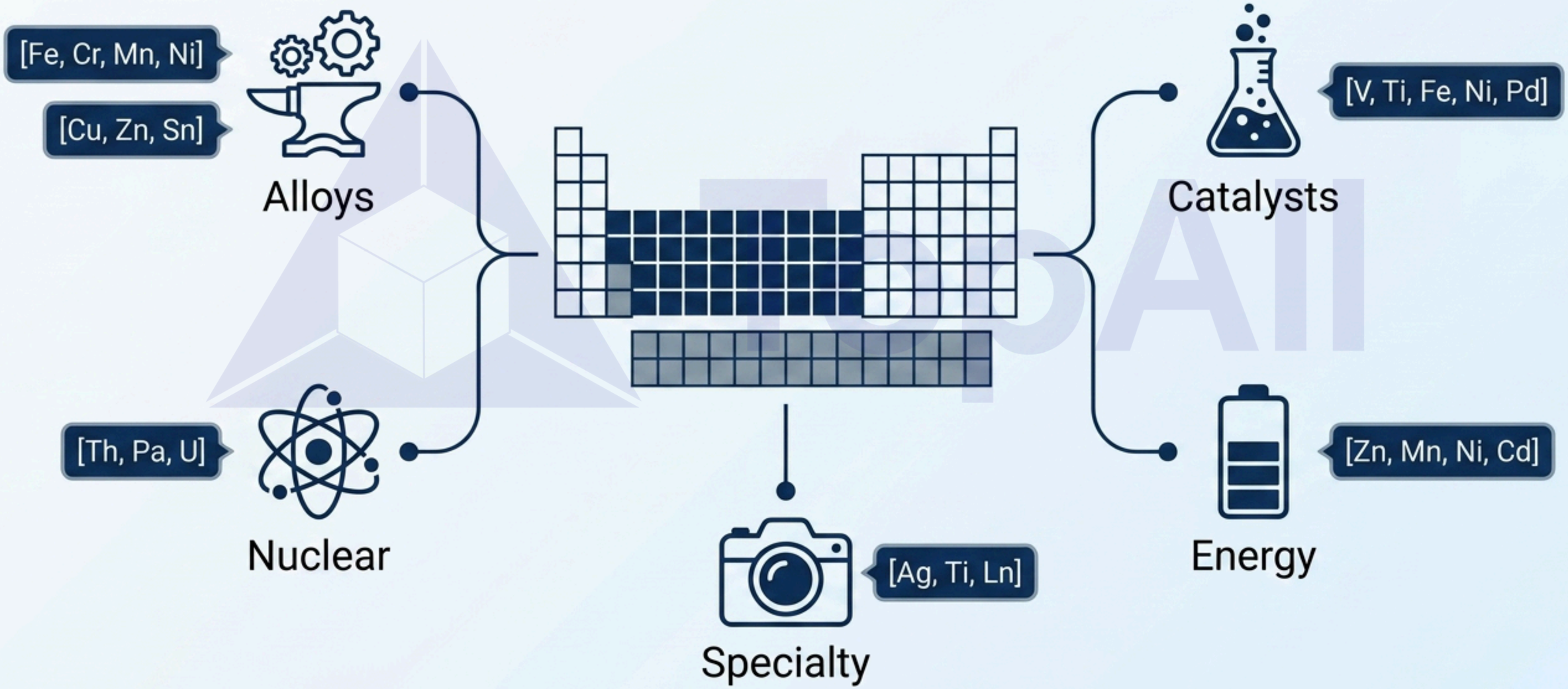
The Inner Transition Elements: Nuclear Power



The inner transition elements (Actinoids) are proving to be excellent sources of nuclear energy in modern times.

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Visual Summary: The Application Landscape



NEET/JEE Exam Traps & Quick Revision

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Watch Out For

- Do not confuse the Ziegler catalyst components. It is strictly [TiCl4 + Al(CH3)3].
- Mischmetall is mostly Lanthanoid (~95%), NOT mostly Iron (~5%).
- Wacker process uses [PdCl2], not Platinum.

Rapid Recall

- [V2O5] -> Contact Process (SO2 oxidation)
- [AgBr] -> Light-sensitive photography
- [MnO2] -> Dry cell batteries
- [Finely divided Fe] -> Haber's Process

Mastering these specific matches guarantees +4 marks in coordination/d-block application MCQs.

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