

MODULE 4 // INNER TRANSITION METALS

4.5.4 General Characteristics of Lanthanoids

A Diagnostic Overview of Physical, Subatomic, and Chemical Properties.

Physical Diagnostics: The Macro View

Appearance & Conductivity



Silvery white soft metals



Tarnish rapidly in air



Good conductors of heat & electricity

Hardness Scale

Samarium (Sm)

Soft

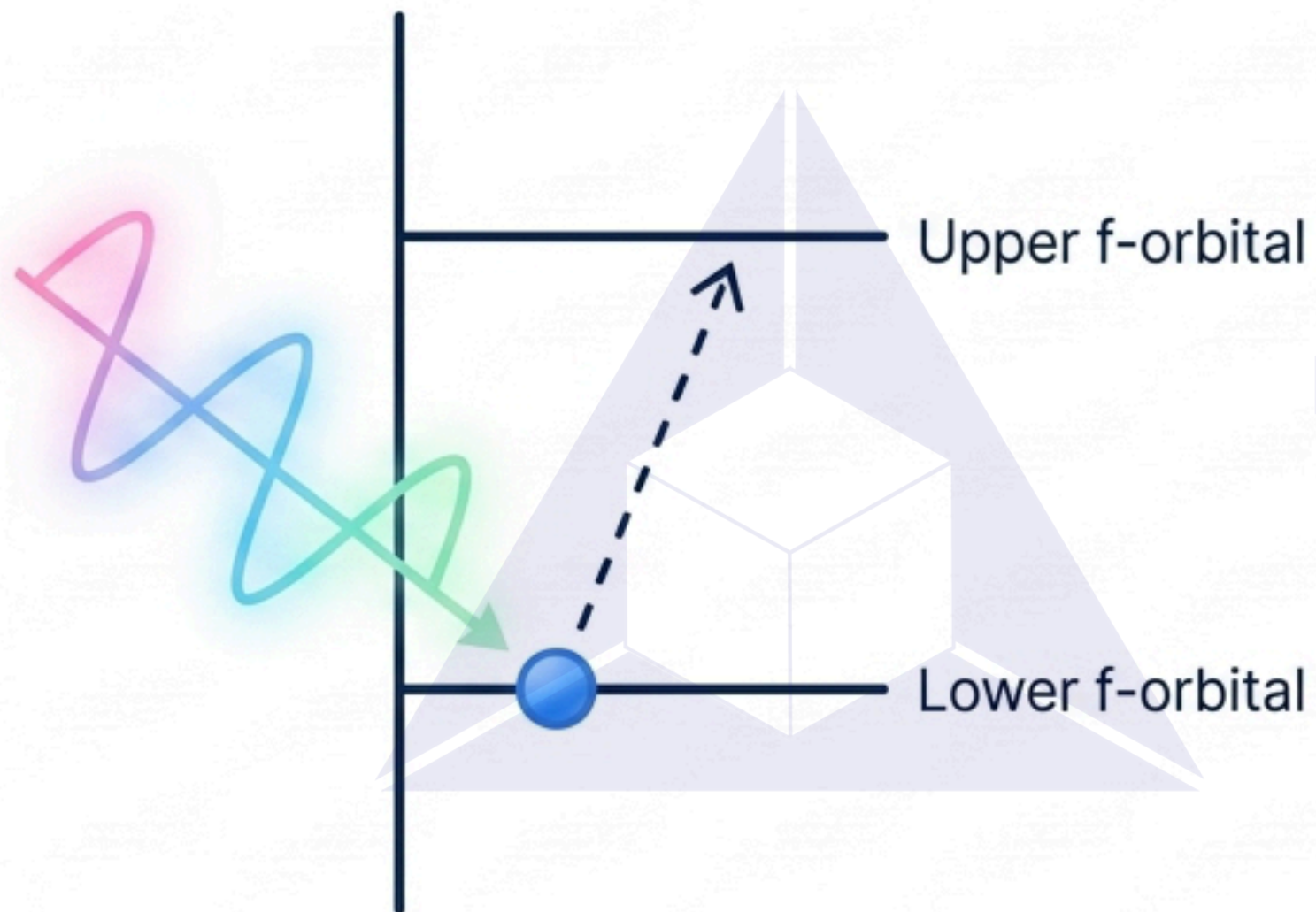
Steel Hard

Melting Point Range

Sm: 1623 K

1000 K - 1200 K
(General)

Origin of Colour: The Subatomic View



Narrow absorption bands due to excitation within the f-level (f-f transitions).

Colourless Ions

Empty
Subshell

$f0$ (La^{3+} ,
 Ce^{4+})

Full
Subshell

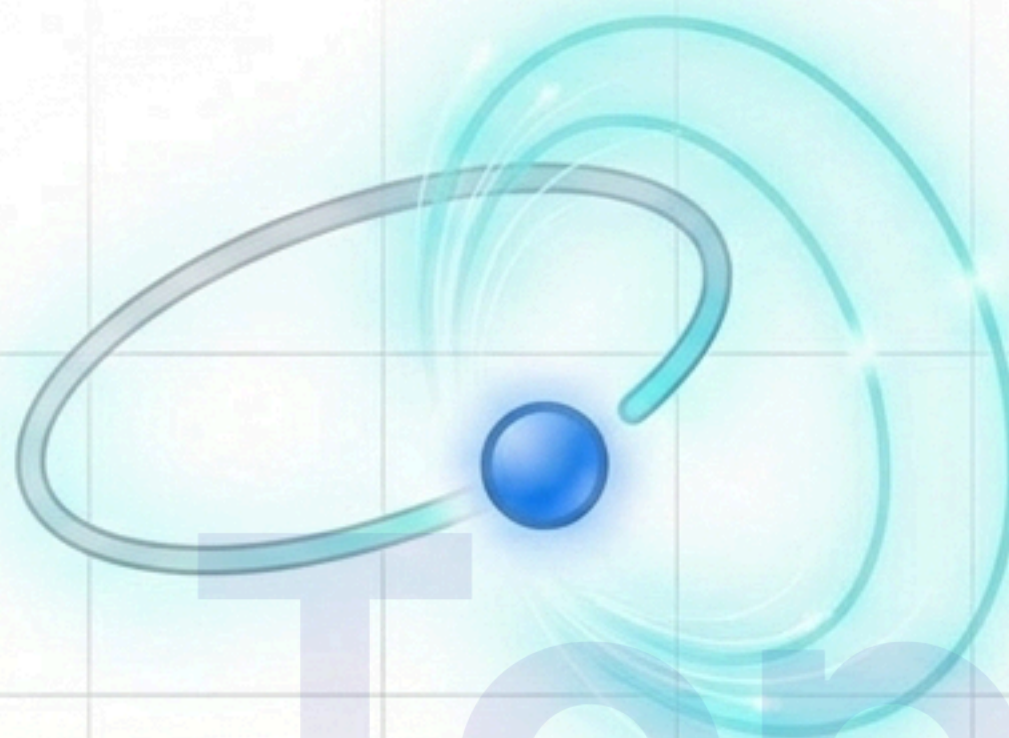
$f14$ (Lu^{3+} ,
 Yb^{2+})

Coloured Ions

Partially
Filled

Formula Chip
 $f1$ to $f13$ (all other trivalent ions)

Magnetic Behaviour Profile



Paramagnetic

Bulk of Lanthanoid ions.

Caused by unpaired f-electrons

Diamagnetic

The definitive exceptions.

$f0$ (La^{3+} , Ce^{4+})

$f14$ (Lu^{3+} , Yb^{2+})



You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



Turn theory into marks with **unlimited MCQs, smart analysis, and focused revision.**

Practice Now



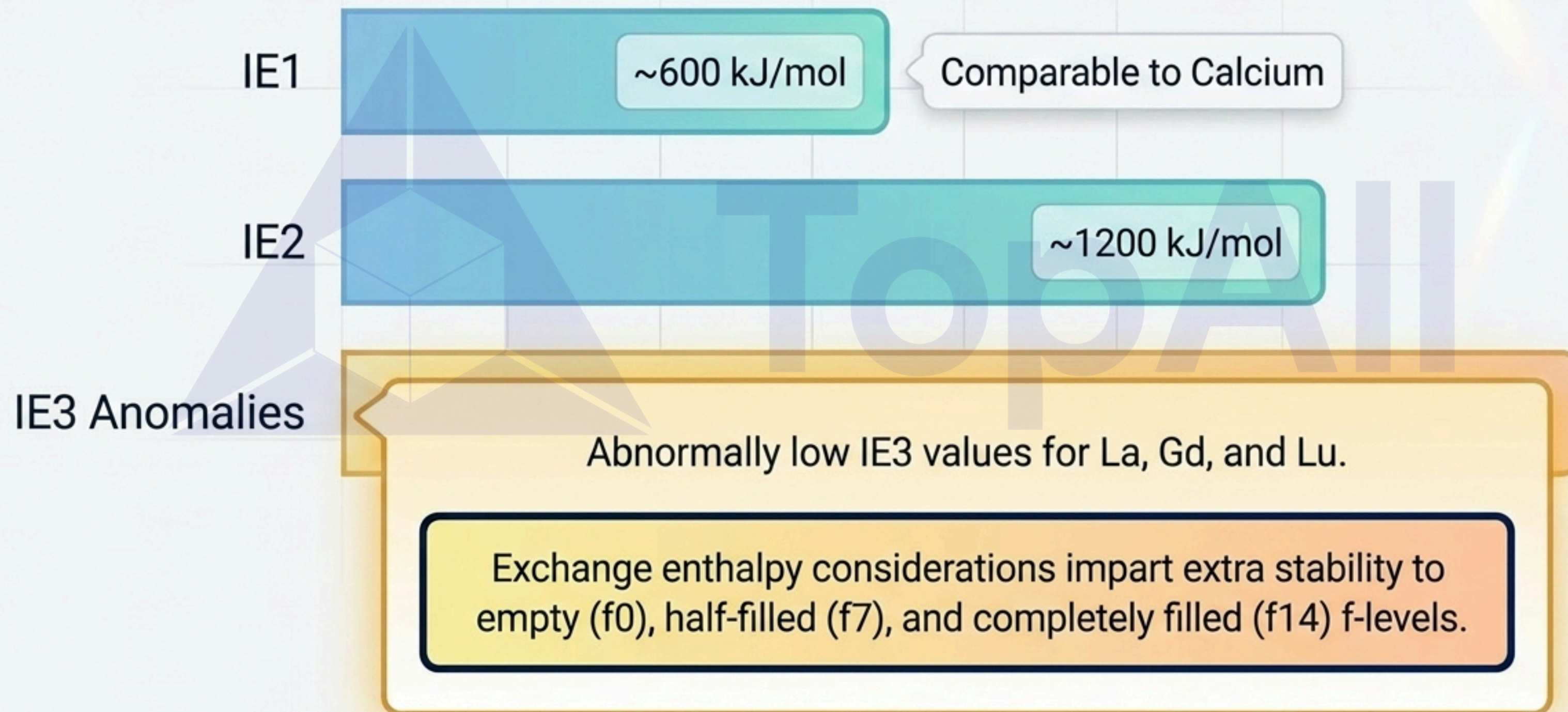
At prep.topall.app

Key Highlights

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



Chemical Energetics: Ionisation Enthalpies



Reactivity Shift & Reduction Potentials

Early Lanthanoids

Late Lanthanoids

Reactive like Calcium (Ca)

Behaves like Aluminium (Al)

Standard Reduction Potentials (E°)



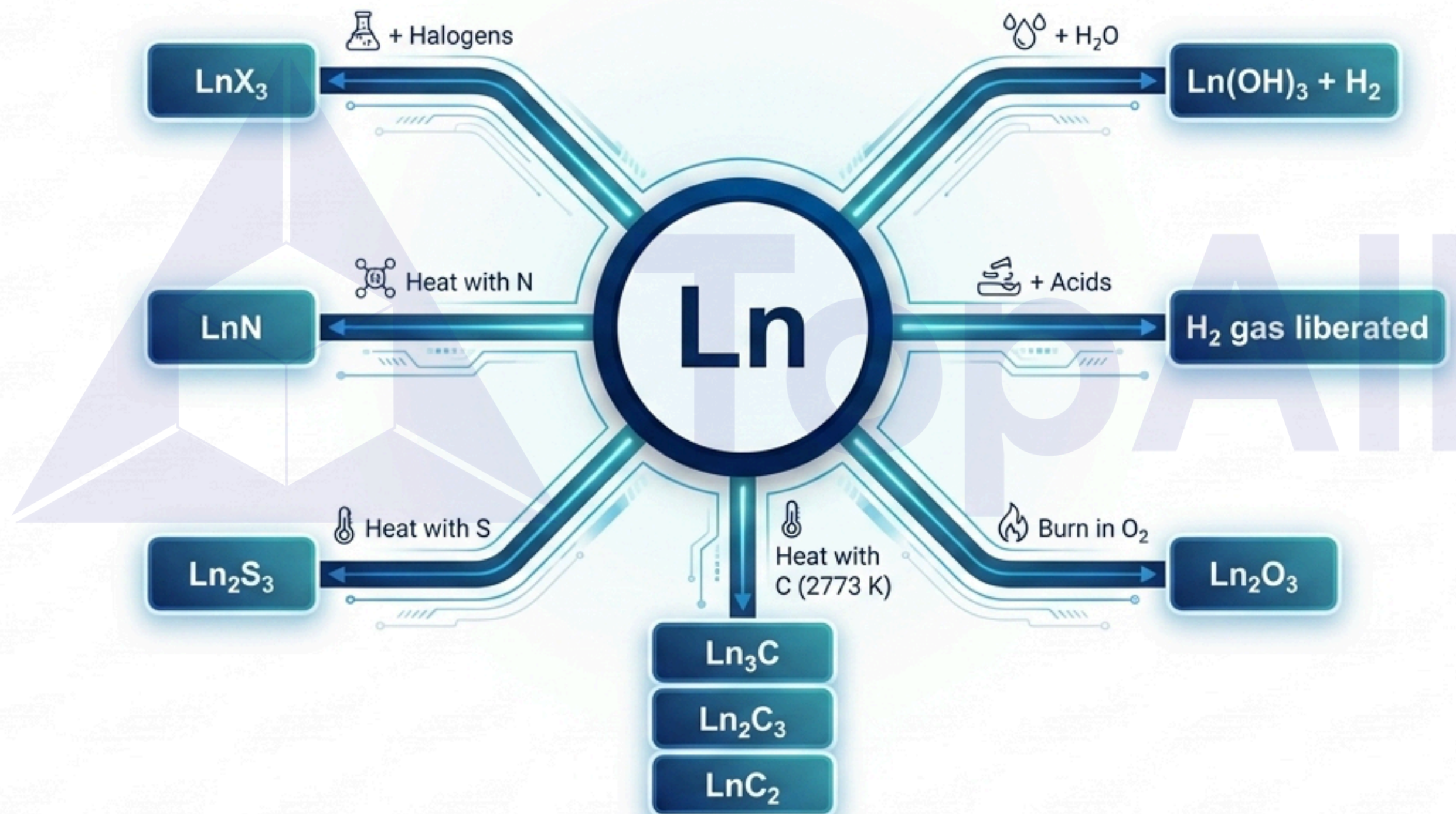
-2.0 V

-2.5 V

Europium (Eu)

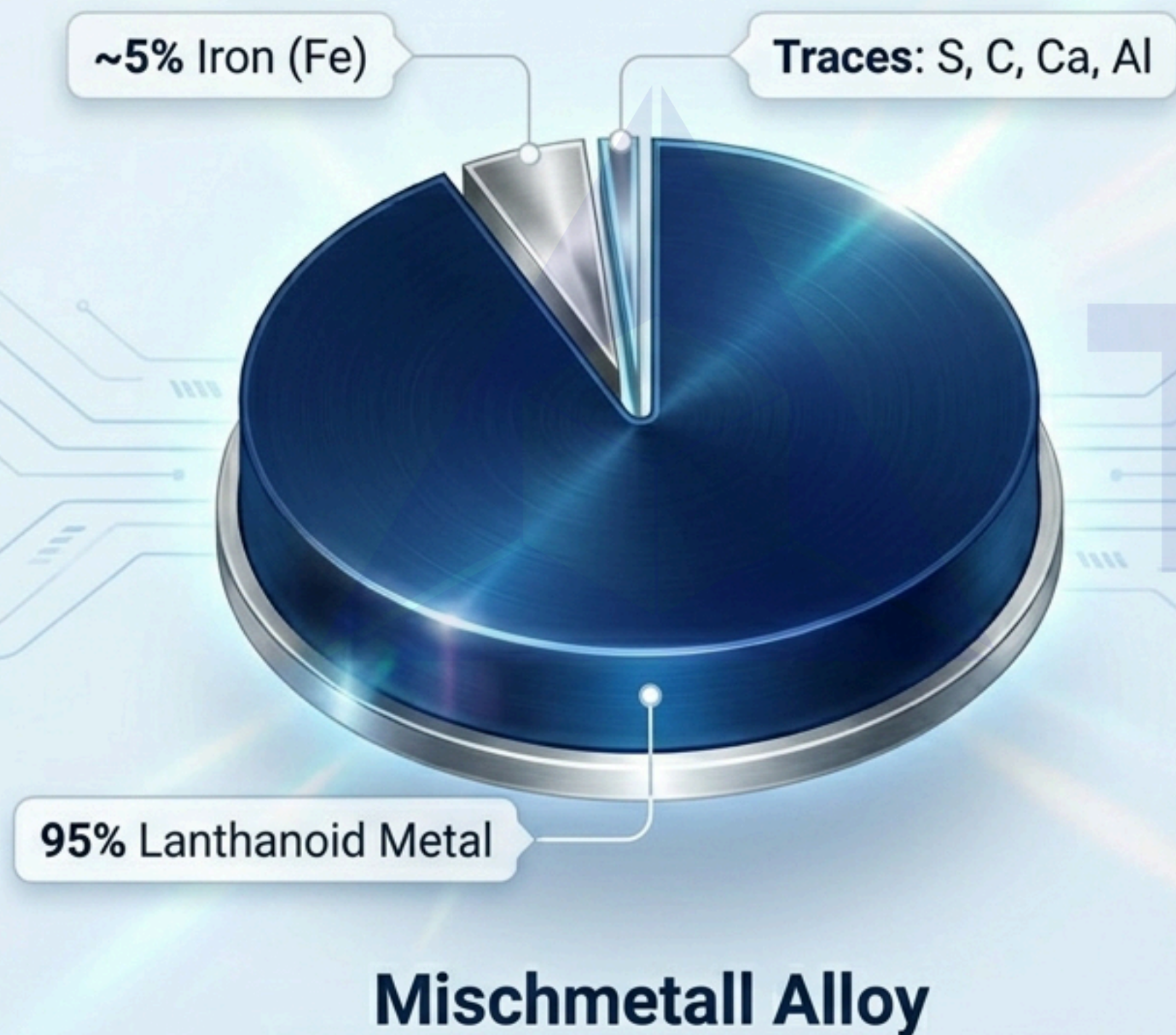
General Range

The Chemical Reactivity Starburst



Hydroxides are definite basic compounds, similar to alkaline earth metal hydroxides.

Industrial Importance & Applications



Mg-Based Alloys: Used for bullets, shells, and lighter flints.



Petroleum Industry: Mixed Ln oxides used as cracking catalysts.



Television Screens: Individual Ln oxides used as phosphors for fluorescing surfaces.

Dashboard Synthesis: Screenshot Summary



Physical Properties

MP: 1000-1200K.

Sm outlier: 1623K & steel hard.

Energetics & Reactivity

IE1/IE2 similar to Ca.

Early Ln = Ca-like | Late Ln = Al-like.

E° = -2.2 to -2.4 V

Eu outlier = -2.0 V

Colour & Magnetism

f_0 / f_{14} = Colourless & Diamagnetic

$f_1 - f_{13}$ = Coloured & Paramagnetic

Mischmetall

95% Ln + 5% Fe + traces.

Industrial use: lighter flints & shells.



EXAM TRAP DASHBOARD

Trap 1: The Samarium Outlier

Don't assume uniform physical traits. Sm is the glaring exception for both hardness (steel-like) and Melting Point (1623 K).

Trap 2: The Empty/Full Subshell Rule

Examiners love testing La^{3+} , Ce^{4+} (f^0) and Lu^{3+} , Yb^{2+} (f^{14}).

Remember: They are BOTH colourless AND diamagnetic.

Trap 3: The Europium Anomaly

Standard reduction potential (E°) is generally -2.2 to -2.4V.

Eu breaks the trend at -2.0V.

Quick Revision: Mental Match-Up



Connect the property to the correct element/concept.

1 95% Ln + 5% Fe

2 Steel-hard & 1623K MP

3 Diamagnetic & Colourless

4 $E^\circ = -2.0V$

5 Reaction with Carbon (2773K)

A Ln_3C , Ln_2C_3 , LnC_2

B Mischmetal

C Europium (Eu)

D Samarium (Sm)

E f_0 and f_{14} ions

1-B, 2-D, 3-E, 4-C, 5-A.



You've Learned the Theory.

Now Let's Test It.

Reading notes gets you knowledge.

Practicing MCQs gets you marks.

That's exactly what TopAll Pro is built for.

Try TopAll Pro Now

What TopAll Pro Does Differently

-  **Stuck? Snap it. Solve it. — Doubts AI**
Photo → step-by-step solution in seconds, 24/7
-  **Your AI Coach finds your blind spots**
Concept-level weakness detection — not just chapter-level
-  **4.5 Lakh+ questions. Never run out.**
13× more content than any other prep app in India
-  **Build your own test in 60 seconds**
Pick a chapter, set difficulty — AI does the rest instantly.
-  **AI Recommendation that helps you improve**
AI Recommendation Analysis your Tests and tell you where you need to improve.



Practice the moment you finish studying
Jump in while the concept is still fresh in your head

4.5L+
MCQs

1.5L+
Students

AI Powered
In-Depth Analysis