

9.4 Total Internal Reflection

From partial refraction to the physics of trapped light.

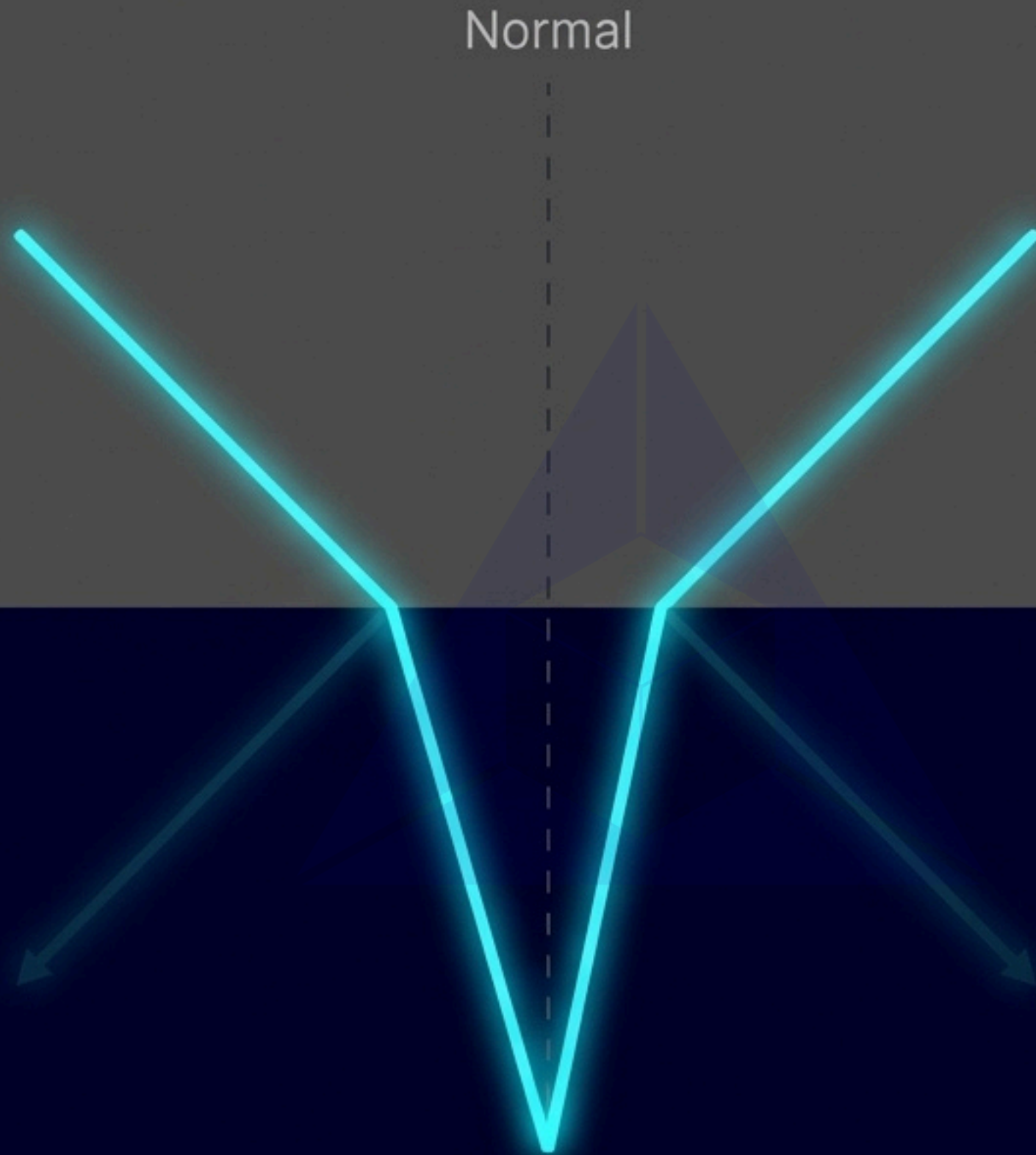
Cinematic Ray Progression

The Setup: Denser to Rarer

When light travels from an optically denser medium to a rarer medium at the interface, it is partly reflected back and partly refracted.

Angle of Refraction (r) > Angle of Incidence (i)

The refracted ray bends strictly away from the normal.

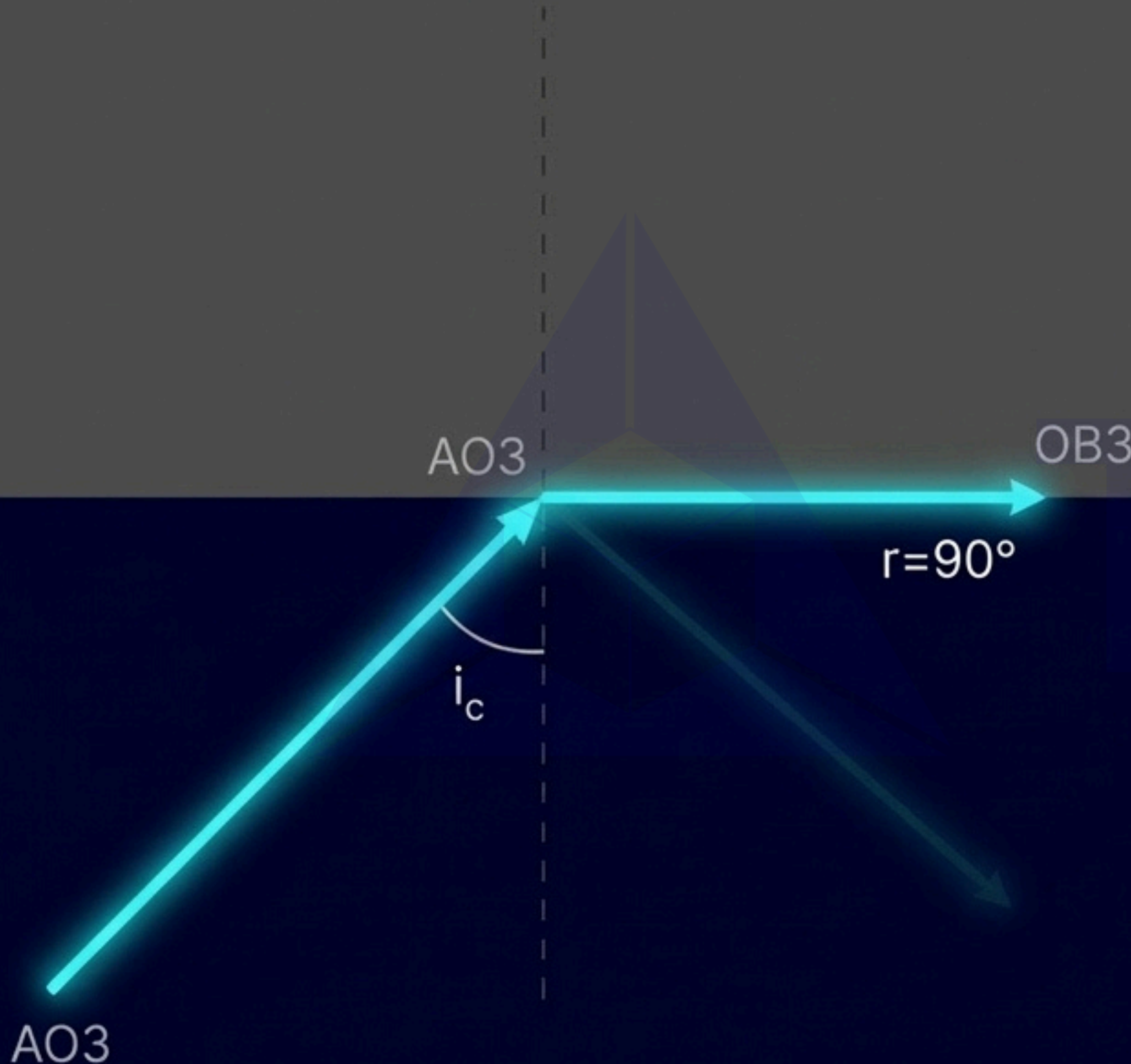


The Threshold: Critical Angle (i_c)

The specific angle of incidence where the angle of refraction reaches exactly 90° ($\pi/2$). The refracted ray grazes the surface interface.

$$\sin i_c = n_{21}$$

(where n_{21} is the refractive index of the rarer medium with respect to the denser medium, or $n_{12} = 1/\sin i_c$)





**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

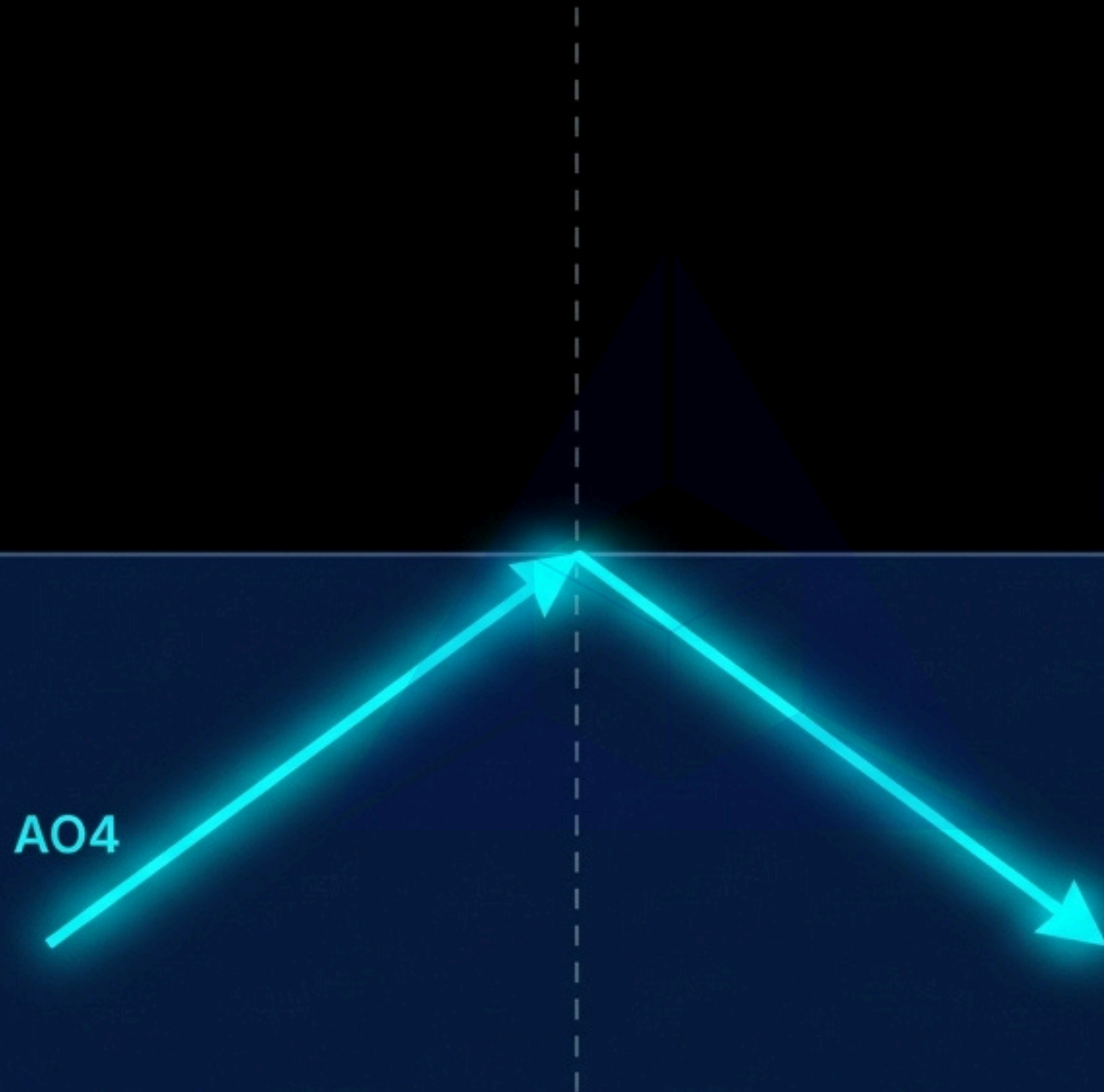


At prep.topall.app

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





Beyond Critical Angle: Total Internal Reflection

If the angle of incidence is increased further ($i > i_c$), Snell's law cannot be satisfied. Refraction becomes mathematically impossible, and the incident ray is totally reflected back.

Zero Transmission

Unlike ordinary reflection from smooth surfaces, TIR loses absolutely no intensity to transmission.

Material Properties & Critical Angles

Higher Optical Density = Lower Critical Angle



Water

RI **1.33**

i_c **48.75°**

Crown Glass

RI **1.52**

i_c **41.14°**

Dense Flint Glass

RI **1.62**

i_c **37.31°**

Diamond

RI **2.42**

i_c **24.41°**

Essential Conditions for TIR

- ✓ 1. Light must travel from an optically denser medium to an optically rarer medium.
- ✓ 2. The angle of incidence must be strictly greater than the critical angle for that pair of media ($i > i_c$).



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