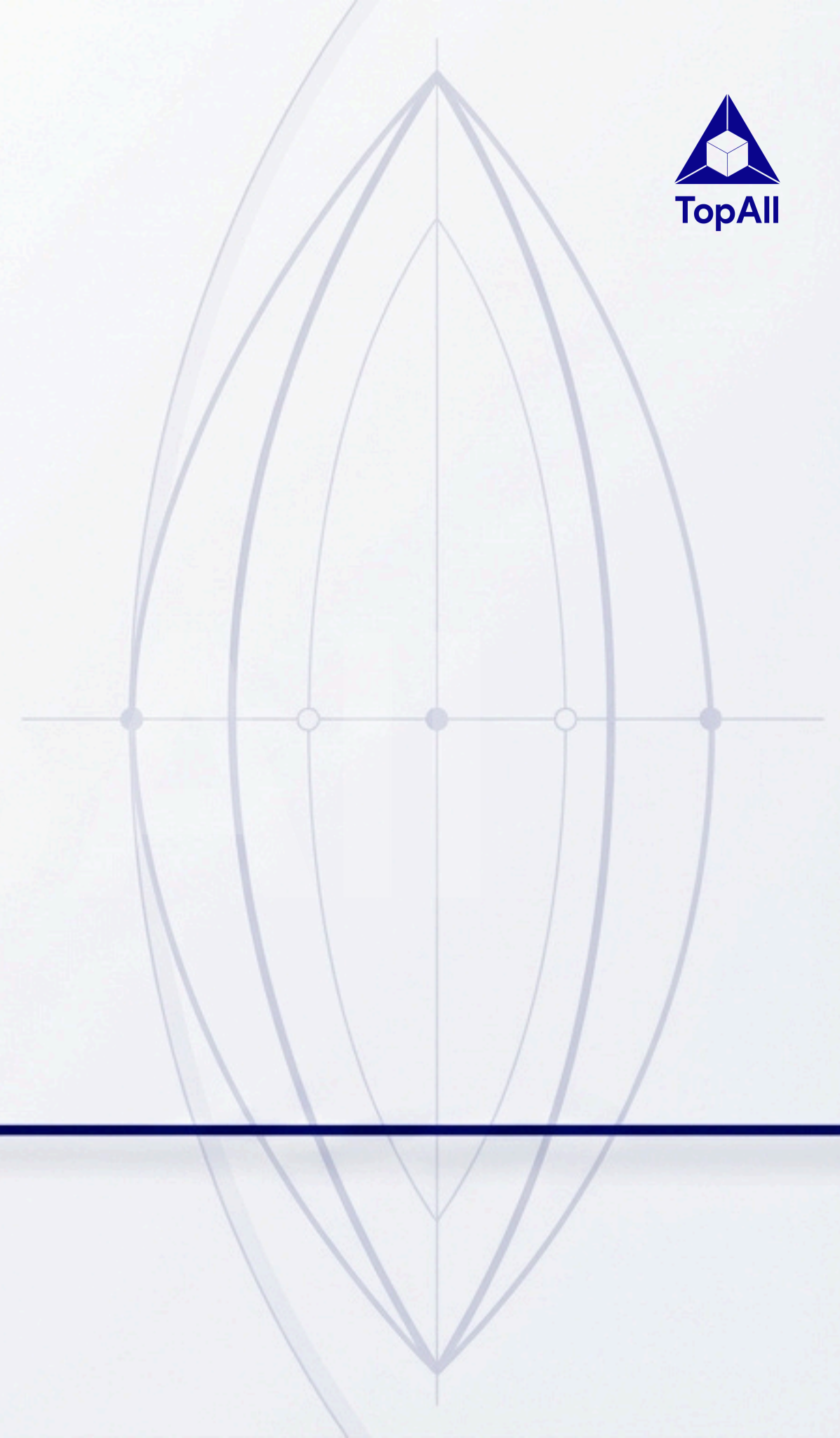


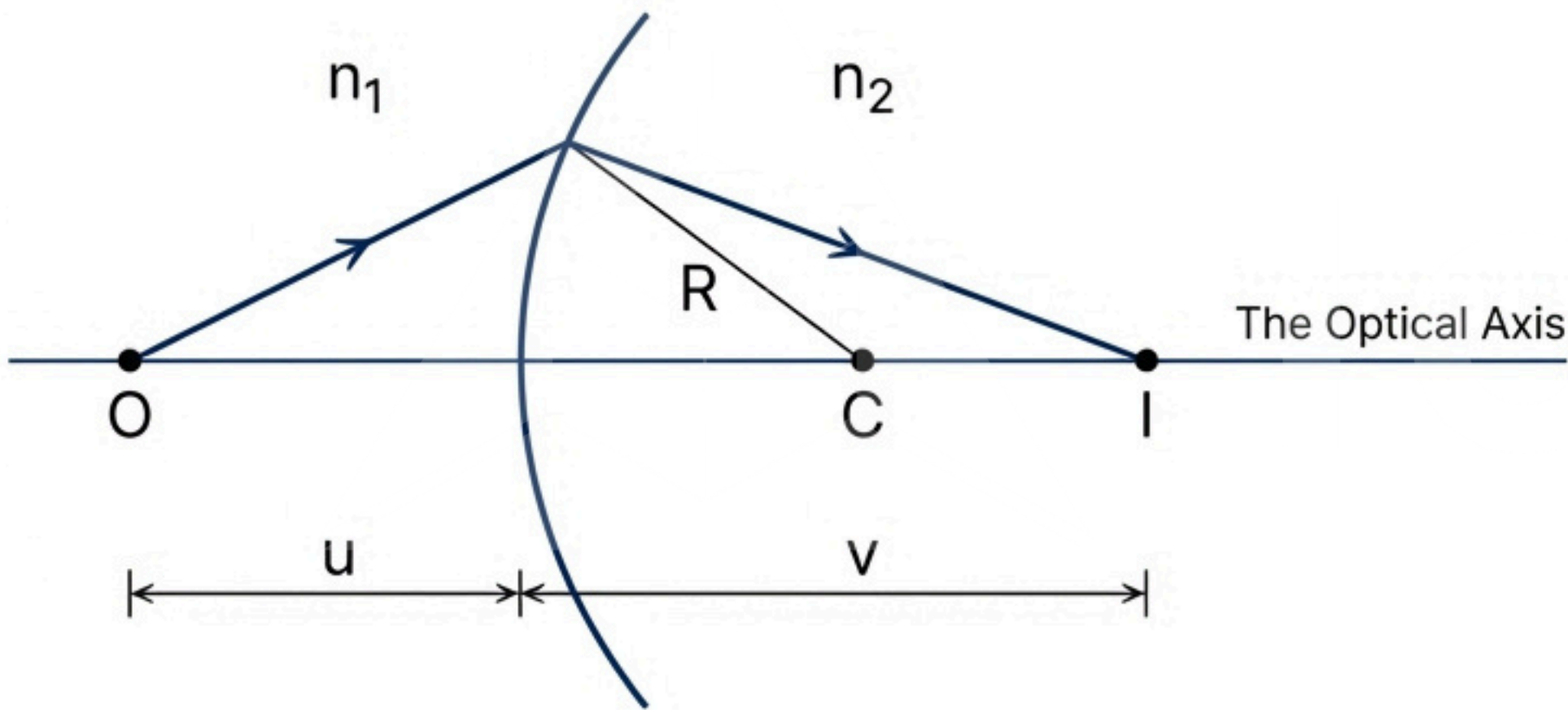
CLASS 12 PHYSICS • CHAPTER 9

9.5 Refraction at Spherical Surfaces and by Lenses

From a single curved boundary to a complete image-forming system.



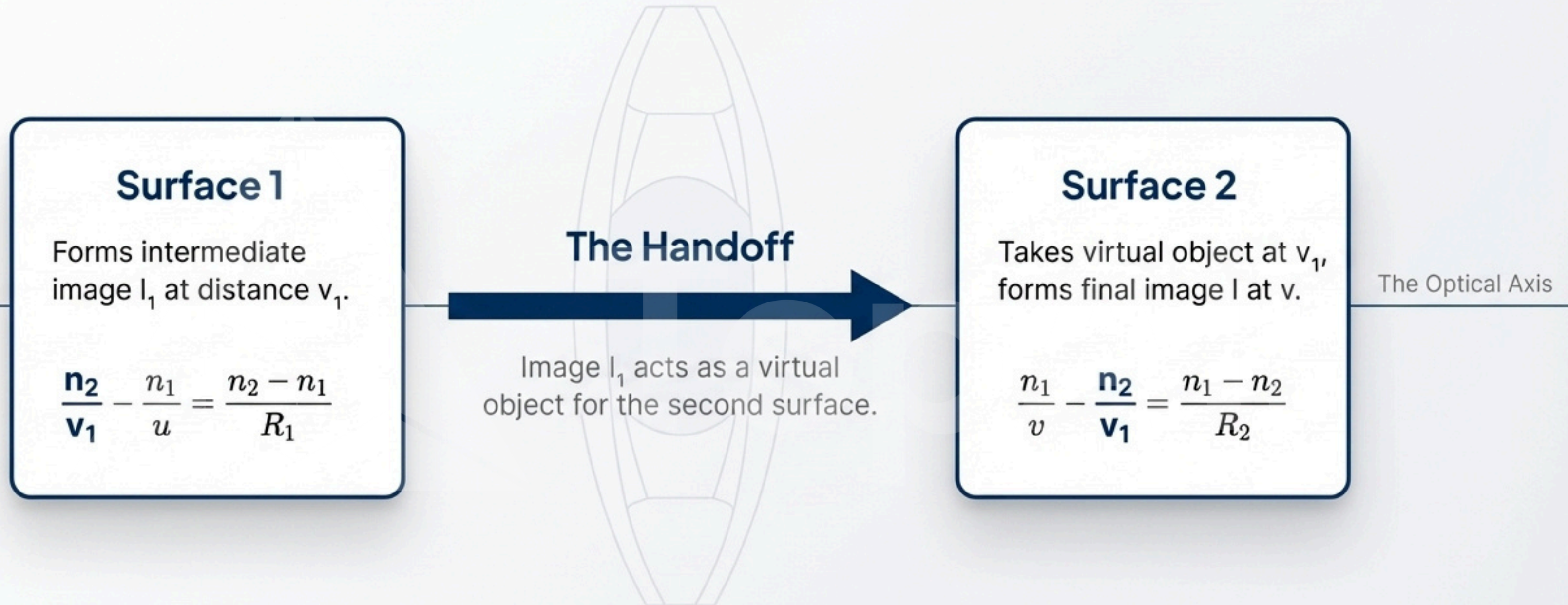
The Foundation: Refraction at a Single Surface



$$\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$$

This equation governs any single curved boundary, assuming a small aperture and paraxial rays.

The Transition: Connecting Two Surfaces





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.**

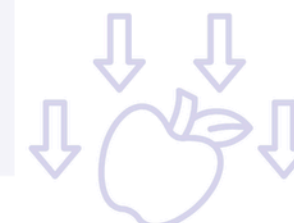
Practice Now



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



Synthesis: The Lens as an Image-Forming System

Row 1	$\frac{\cancel{n_2}}{\cancel{v_1}} - \frac{n_1}{u} = \frac{n_2 - n_1}{R_1}$
Row 2	$+ \frac{n_1}{v} - \frac{\cancel{n_2}}{\cancel{v_1}} = \frac{n_1 - n_2}{R_2}$

The Optical Axis

Lens Maker's Formula

$$\frac{1}{f} = (n_{21} - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

Thin Lens Approximation: We assume the optical centers of both surfaces are coincident ($BI_1 \approx DI_1$).

Conceptual Recap

1. **The Base Unit:** A single spherical surface bends light based on the refractive indices of the media and its radius of curvature.
2. **The Sequential Handoff:** A lens functions as a two-step system. The real or virtual image formed by the first surface acts directly as the virtual object for the second surface.
3. **The Unified System:** By adding the refractive effects of both surfaces (and assuming negligible lens thickness), the intermediate steps cancel out, yielding the Lens Maker's Formula—defining the entire lens by a single focal length (f).



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