

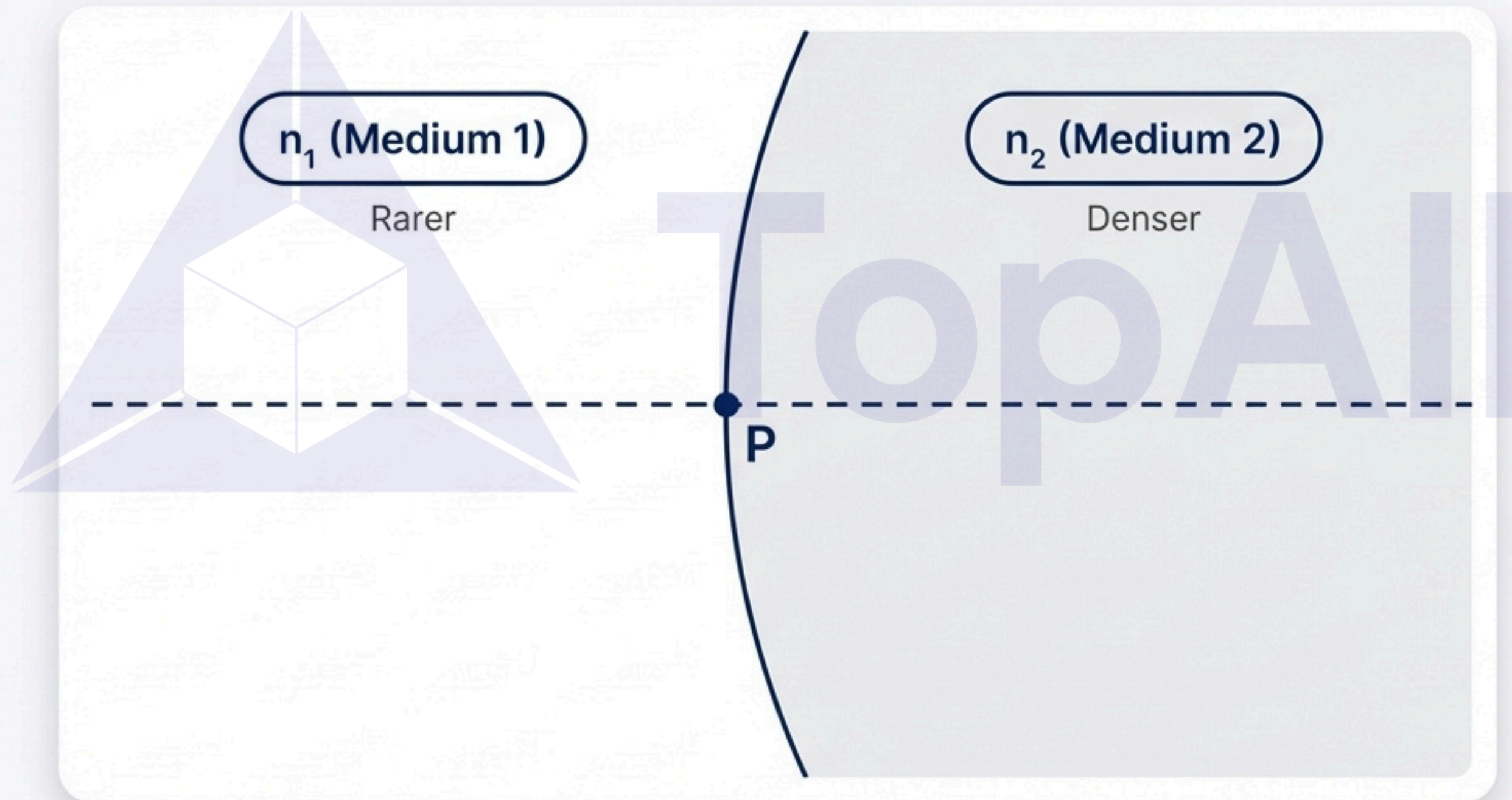
Class 12 Physics • Ray Optics

Refraction at a Spherical Surface

Image Formation & The Spherical
Refraction Formula

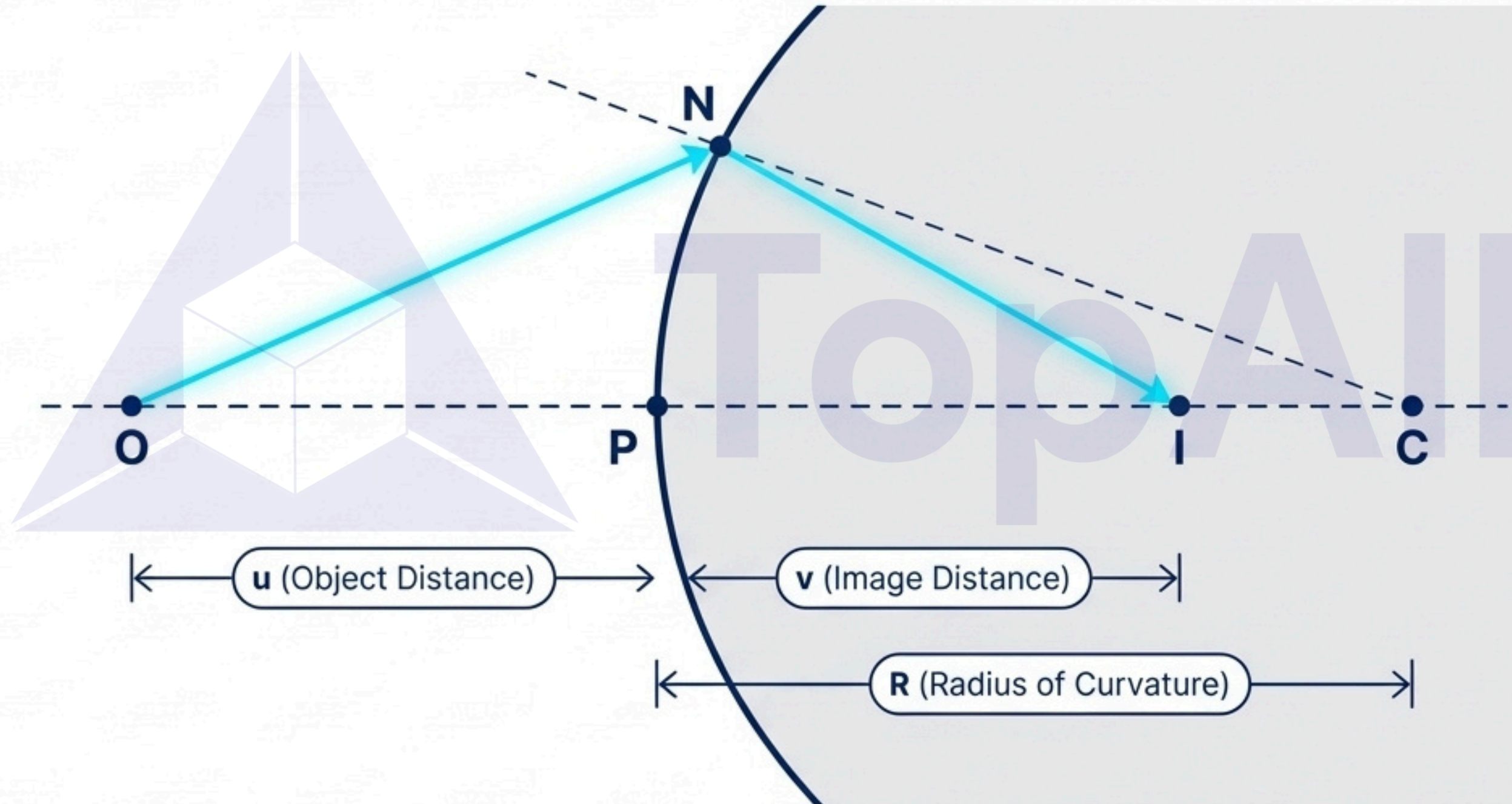
The Physical Boundary

Light travels from a medium of refractive index n_1 into a medium of n_2 across a curved surface.



Mapping the Geometry

Note: All distances are measured from the pole using standard Cartesian sign convention.





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

$$E=mc^2$$



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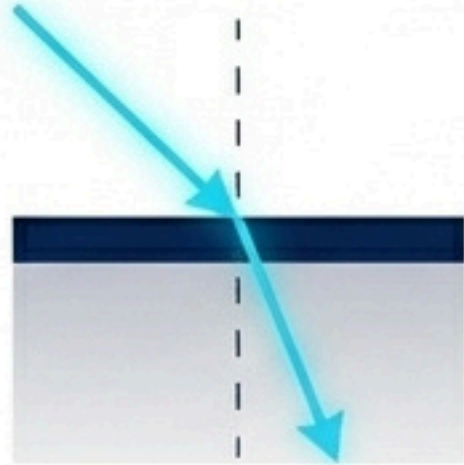
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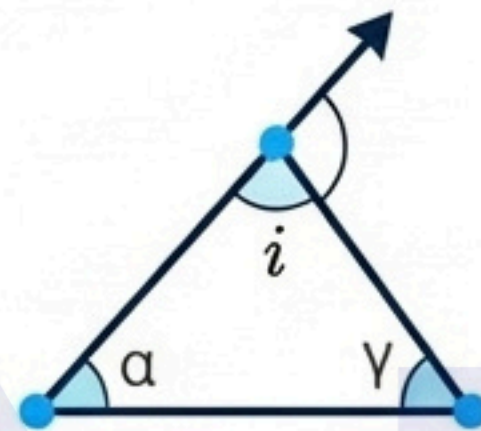
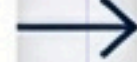
Derivation Logic



Snell's Law

$$n_1 \sin i = n_2 \sin r$$

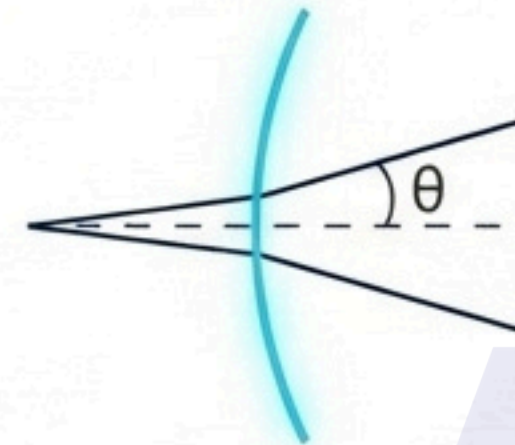
Dictates how light bends at the boundary.



Triangle Geometry

$$i = \alpha + \gamma$$

Relates ray angles to physical distances using exterior angles.



Paraxial Approximation

$$\tan \theta \approx \theta \approx \sin \theta$$

Assumes a small aperture so angles are nearly flat.



Yields the Refraction Formula

The Spherical Refraction Formula



Refracting Power

(Depends on the difference in indices
and the surface curvature)

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

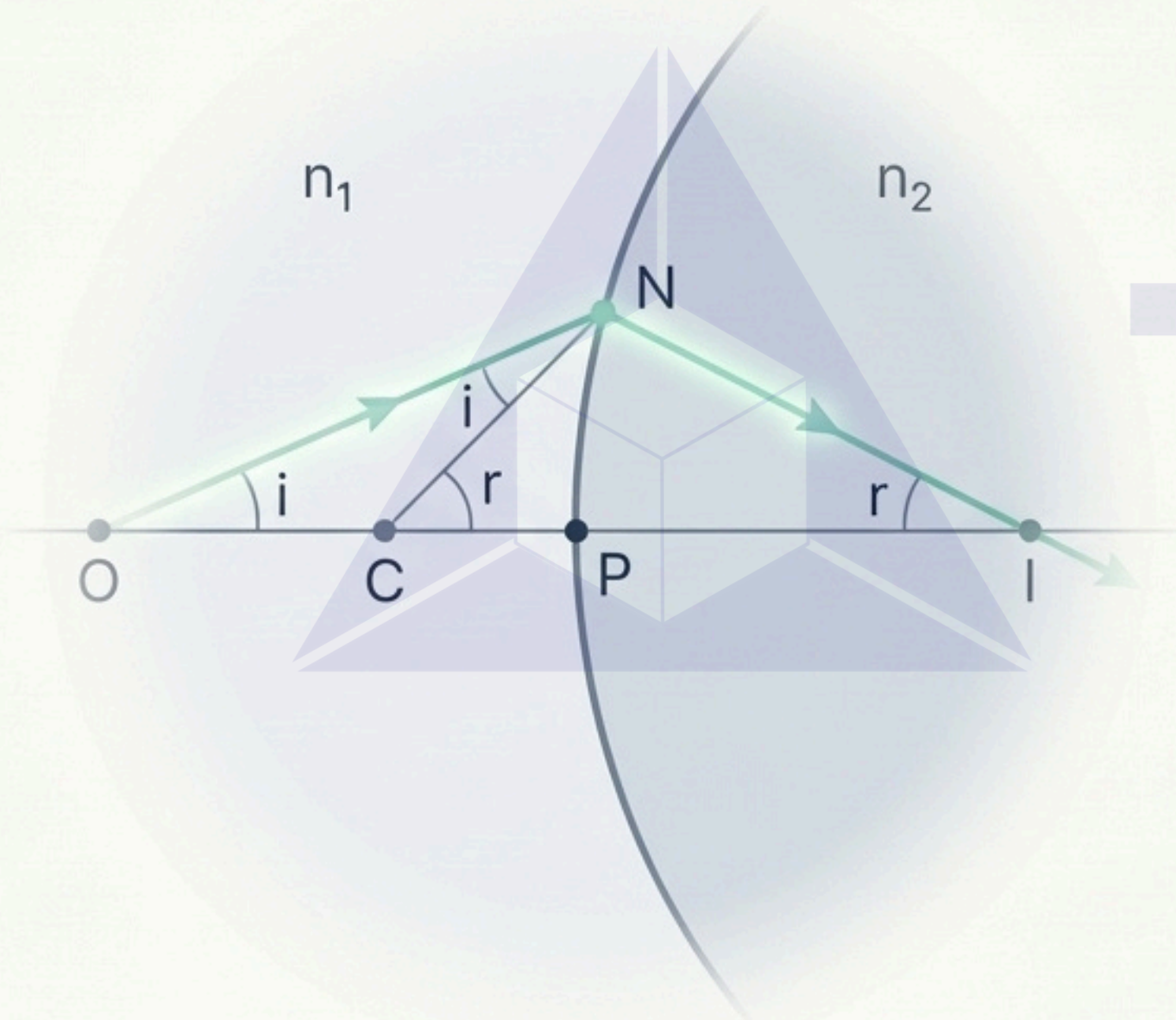
Image Term

(Light's destination in Medium 2)

Object Term

(Light's origin in Medium 1)

Concept Recap



Key Takeaways

- A single formula connects object distance **u** , image distance **v** , and radius of curvature **R** for any spherical surface.
- The bending power depends strictly on the refractive indices **n_1** , **n_2** of the two adjacent media.
- All distances must be applied using standard Cartesian sign convention relative to the pole (e.g., **u** is typically negative).



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