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Integrated Optics - Refractive Index

Apparatus Available :

- Spectrometer
- Spirit Level
- Magnifying glass
- Glass prism
- Sodium Vapour Lamp

Aim :

To determine refractive index of a glass prism using a spectrometer.

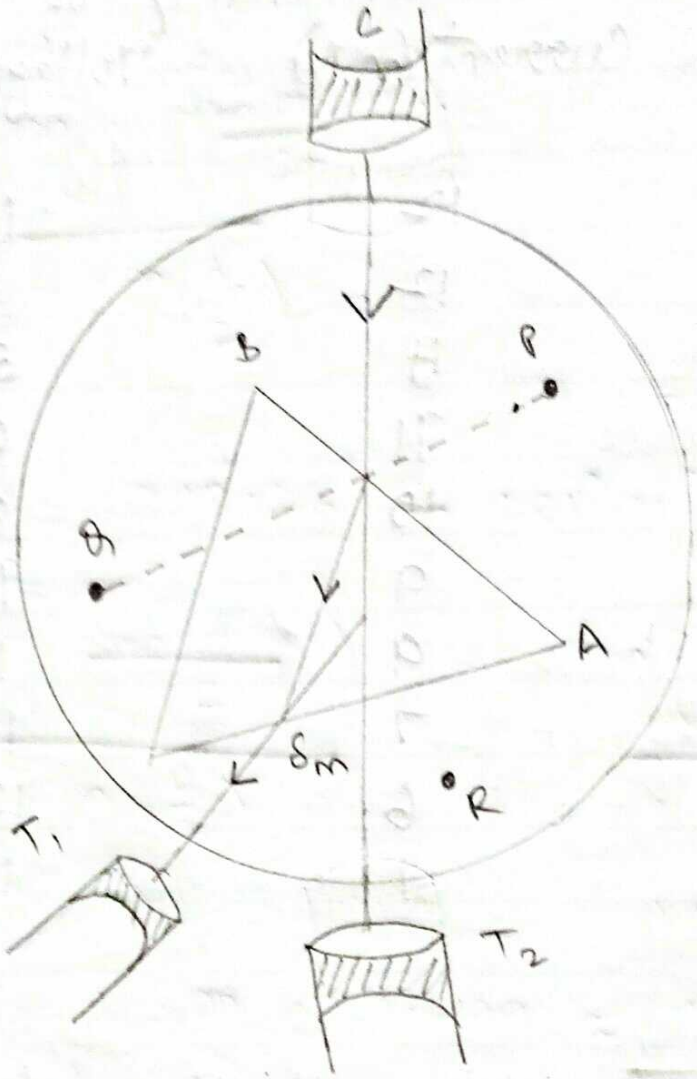
Formulae :

$$\mu = \frac{\sin\left(\frac{A + \delta_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

μ = Refractive Index of glass prism

A = Angle of Prism

δ_m = Angle of Minimum deviation



Determination of angle of minimum deviation

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Calculations :

δ_m for A = $39^\circ \cdot 15' - 1^\circ \cdot 50' = 37^\circ \cdot 25'$

$$\mu = \frac{\sin\left(\frac{\delta_m + A}{2}\right)}{\sin\left(\frac{A}{2}\right)} = \frac{\sin\left(\frac{37^\circ \cdot 25' + 60'}{2}\right)}{\sin 30^\circ}$$

$$= 1.501$$

δ_m for B = $218^\circ \cdot 26' - 181^\circ 11' = 37^\circ 14'$

$$\mu = \frac{\sin\left(\frac{\delta_m + A}{2}\right)}{\sin\left(\frac{A}{2}\right)} = \frac{\sin\left(\frac{37^\circ \cdot 14' + 60}{2}\right)}{\sin 30^\circ}$$

$$= 1.499.$$

$\therefore \mu = 1.500 \approx 1.499 \approx 1.501$

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Tabulation :

Least Count = $\frac{0.5^\circ}{30 \text{ (divisions)}} = 1'$

Angle of prism, A (as obtained earlier) = 60°

Vernier	Reading for min. deviation position R_1			Reading for direct ray R_2			$\delta_m = R_2 \sim R_1$	M
	MSR (deg)	VSR (mins)	TR (deg/min)	MSR (deg)	VSR (min)	TR (deg/min)		
A	39	15	$39^\circ 15'$	1	5	$1^\circ 5'$	$37^\circ 25'$	1.501
B	218	26	$218^\circ 26'$	181	11	$181^\circ 11'$	$37^\circ 14'$	1.499

Result:

The refractive index (at 589.3nm) of the given glass prism is : 1.50 (units)