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EXPERIMENT - 1

Aim:

To determine Cauchy's constant of the given prism.

Apparatus:

Spectrometer, magnifying glass, prism, mercury vapour lamp, prism clamp.

Theory:

Cauchy's Equation is an empirical relationship b/w the refractive index and wavelength of light for a particular transparent material. It is named for the mathematician Augustin-Louis Cauchy, general form:

$$n(\lambda) = A + B/\lambda^2 + C/\lambda^4 + ----$$

If the refractive indices n1 and n2 for any two wavelength λ_1 and λ_2 are determined by spectrometer the Cauchy's constant A and B can be calculated.

Procedure:

↳ Performing the simulator:

1. Focus the telescope on distant objects.
2. When focus is correct, start button is activated, click it.
3. Switch on the light source.
4. focus on the slit focus width slider.

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5. Adjust the slit width using slit width slider.
6. coincide the slit width cross wire in the telescope.

↳ To determine the angle of prism

1. prism table is rotated in which the sharp edge of the prism is facing towards the collimator.
2. Rotate the telescope in one direction up to which the reflected ray is shown through the telescope.
3. Note corresponding main scale and vernier scale reading the both vernier.
4. Rotate the telescope in opposite direction to view the reflected image of the collimator from second face of the prism.
5. Note corresponding main scale and vernier scale reading.
6. find the difference b/w two readings i.e. θ.
7. Angle of prism, $A = \theta/2$.

↳ To determine Cauchy's Constant

1. Rotate the vernier table to face light one one face of prism.
2. Turn the telescope to each refracted ~~ray~~ color, note readings.
3. Remove the prism, hence note direct ray reading.
4. find angle of prism minimum deviation of various colors.
5. find refractive index of each.
6. Draw graph of μ along y-axis and $1/\lambda^2$ along x-axis.

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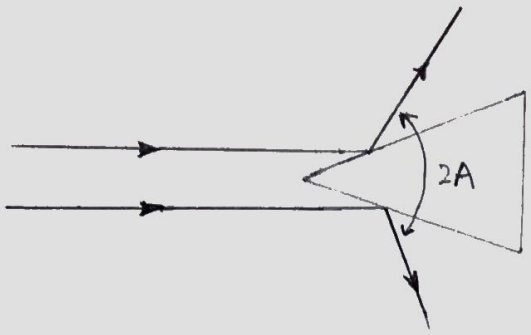


	V_1			V_2		
	MS	VS	TOTAL	MS	VS	TOTAL
light from one face	289.5	10	289°40′	110	10	110°10′
light from another face	50	40	50°40′	229.5	0	229°30′

Calculation :

$2A = V_1 - V_1' = 360 - (289°40' - 50°40')$

$2A = 121$

$A = 60°30'$.

$2A = V_2 - V_2' = 229°30' - 110°10'$

$2A = 119°20'$

$A = 59°40$.

$$\text{Average } A = \frac{60°30' + 59°40'}{2} = 60°05'$$

angle of prism = $60°05'$.

Spectral colors	Reading at minimum δ		Direct Reading		Difference δm (mean)	μ	$1/\lambda^2$ ($\times 10^2 m^{-2}$)
	V_1	V_2	V_1	V_2			
Red	70°12′	250°11′	109°03′	289°04′	38°52′	1.50	2.36
Yellow	69°44′	249°32′	109°03′	289°04′	39°25′	1.51	2.988
Green	69°23′	249°31′	109°03′	289°04′	39°36	1.520	3.353
Blue	69°02′	249°11′	109°03′	289°04′	39°57′	1.5245	5.265
Indigo	68°36	248°35′	109°03′	289°04′	40°28	1.53	6.103

Calculation:

$$\mu_{Red} = \frac{\sin\left(\frac{60°02 + 38°52'}{2}\right)}{\sin\left(\frac{60°02}{2}\right)} = \frac{\sin(49.45)}{\sin(30°01')} = \frac{0.75983}{0.50024} = 1.52$$

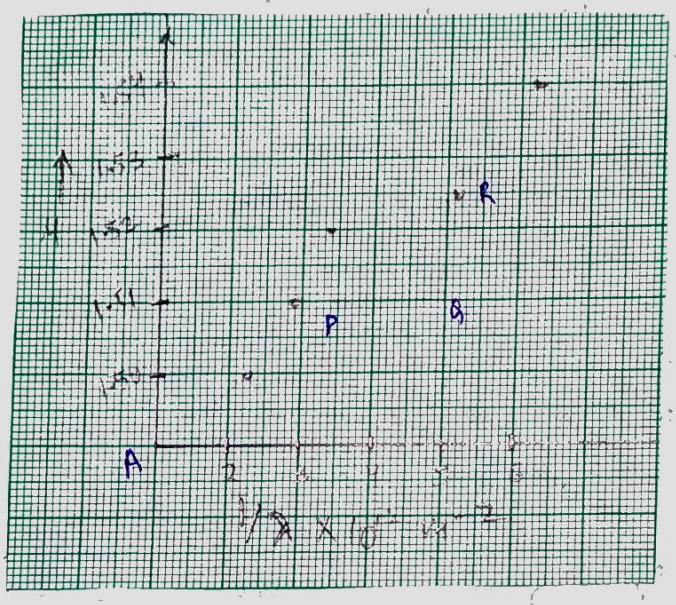
$$\mu_{Yellow} = \frac{\sin(49.53)}{\sin(30.01)} = 1.51$$

$$\mu_{green} = 1.52$$

$$\mu_{Blue} = 1.52$$

$$\mu_{violet} = 1.53$$

Graph (u vs $1/x^2$)



A = 1.50

B = QR/PQ = $\dfrac{1.52 - 1.51}{2.388 - 2.366}$ = 0.0160

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Observations :

Least count of Spectrometer = $\frac{N}{V} = \left(\frac{1}{60}\right)^{\circ}$.

$\because$ N = 1 MSD = $\left(\frac{10}{20}\right) = \left(\frac{1}{2}\right)^{\circ}$

$\because$ V = 30

Angle of prism = $60^{\circ}\,02'$.

Cauchy's Constant, A = 1.50.

B = 0.0160.

Result :

Cauchy's formula has been verified.

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