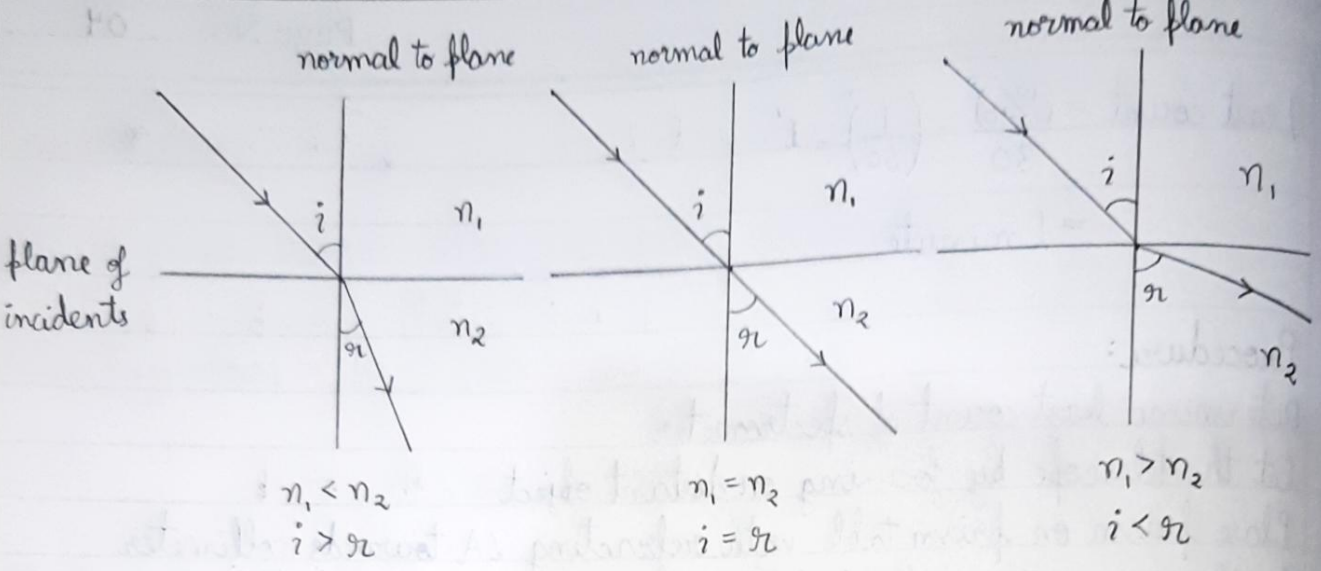
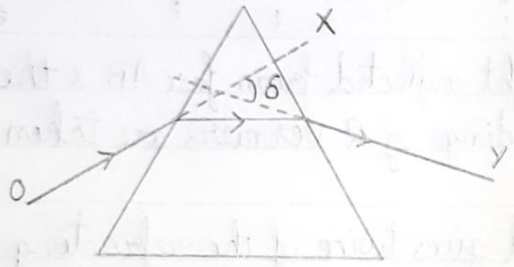
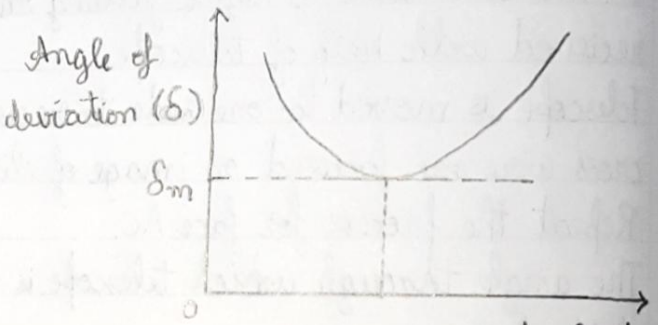




„ Deviation through prism



„ Graph b/w δ & i

Observation table (determining angle of prism):

S.no.		Light reflected from side AB of prism Total = MSR + (LC × VSR)			Light reflected from side AC of prism Total = MSR + (LC × VSR)			Diff. b/w 2 pos^n (2A)	Angle of prism (A) (°)
		MSR	VSR	Total	MSR	VSR	Total		
1.	V_1	240	25	240.416	120	13	120.216	120.2	60.1°
	V_2	59.5	12	59.7	299.5	14	299.733	119.967	59.9835°
2.	V_1	240	6	240.1	120	15	120.25	119.85	59.925°
	V_2	59.5	13	59.716	299.5	21	299.85	119.866	59.933°

Experiment 2.

Aim:
To determine the refractive index of the material of the prism using the spectrometer.

Apparatus required:
Spectrometer, Glass prism, Sodium lamp, Spirit level, Magnifying glass.

Formula used:
The formula for obtaining the refractive index of prism is,

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

Here, A is the angle of prism &
δ_m is the angle of minimum deviation.

Theory:
When a beam of light strikes on the surface of transparent material (Glass, water, quartz, crystal, etc.), the portion of the light is transmitted and other portion is reflected. The transmitted light ray has small deviation of the path from the incident angle. This is called refraction. Refraction is due to the change of speed of light while passing through the medium. It is given by Snell's law.

$$\frac{\sin i}{\sin r} = \frac{n_2}{n_1} \quad \text{---------- (i)}$$

Observation table (determining angle of minimum deviation):

S.no.		Telescope readings Total = MSR + (LC × VSR)			Direct readings Total = MSR + (LC × VSR)			Diff. b/w 2 positions
		MSR	VSR	Total	MSR	VSR	Total	
1.	V_1	71.5	6	71.6	109	20	109.33	37.733
	V_2	251.5	5	251.583	289	5	289.083	37.5
2.	V_1	71.5	3	71.55	109	15	109.25	37.7
	V_2	251.5	5	251.583	289	19	289.316	37.733

Calculations:

Angle of prism,,

$$\text{Mean } A = \frac{60.1 + 59.933 + 59.925 + 59.9835}{4} = 59.985375^\circ$$

Angle of minimum deviation,,

$$\text{Mean } \delta_m = \frac{37.73 + 37.5 + 37.7 + 37.733}{4} = 37.665^\circ$$

Refractive index of material,,

$$\mu = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin\left(\frac{A}{2}\right)} = \frac{\sin(48.8251825^\circ)}{\sin(29.9926875^\circ)} = \frac{0.7527}{0.4999} = 1.5057$$

$$\mu \simeq 1.5$$

where, i is angle of incident & r is angle of refraction. n_1 is refractive index of first face & n_2 is refractive index of second face.

And speed of light on both face is related to the equation

$$\frac{c_1}{c_2} = \frac{n_2}{n_1} \quad \text{(ii)}$$

c_1 is velocity of wave in first face & c_2 is velocity of wave in second face.

The refractive index of material of prism can be calculated by equation

$$n = \frac{\sin\left(\frac{A+D}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

where, D is angle of minimum deviation,
here D is different for different colour.

Least count of spectrometer:

One main scale division (N) = 0.5° = 30 minute

Number of divisions on vernier (V) = 30

Least count (LC) = $\frac{N}{V} = \frac{30}{30}$ = 1 minute

Procedure:

1. Determine least count of spectrometer.
2. Set the telescope by focusing on distant object.
3. Determine angle of the prism
4. Rotate vernier table so that light from the collimator falling on one of the face of prism & energes through other face.

Teacher's Signature : _____

5. The telescope is turned to view the refracted image of slit on other face.
6. The vernier table is slowly turned in such a direction that the image of slit is move directed towards the directed ray.
7. It will be found that at a certain position, image is stationary for some moment.
8. Note the readings on main scale & vernier scale.
9. Carefully remove the prism from prism table.
10. Turn the telescope parallel to collimator & note direct ray readings.

Result:

Angle of the prism = 59.98°
Angle of minimum deviation = 37.665°
Refractive index of material of prism = 1.5057 ≃ 1.5

Precautions:

1. Light coming from slit should be narrow and bright.
2. Telescope must be focused.
3. Readings of vernier scale should be taken carefully.
4. Prism table should be leveled with a spirit level before placing prism.

Sources of error:

1. Zero error of vernier calliper is not taken into account.
2. Prism table is not levelled properly.
3. Parallax error should be taken in account & must be removed.