CLASS Notes	
Class: XII	**Topic:** (i) Angle of minimum deviation (ii)Refractive index of a liquid
Subject: PHYSICS PRACTICAL	

EXPERIMENT NO.12

- **AIM OR OBJECTIVE:** To determine angle of minimum deviation for a given prism by plotting a graph between angle of incidence □ and the angle of deviation □.
- **APPARATUS USED:** Drawing board, a white sheet of paper, a prism, four drawing pins, pencil, half metre scale, office pins, graph paper and a protector.
- **THEORY OR FORMULA USED :**
  - **Angle of prism –** the angle between the two refracting surfaces, is called the angle of prism.
  - **Angle of deviation –** the angle through which a ray of light turns away from its original path on passing through a prism, is called angle of deviation
  - The least value of angle of deviation is known as the angle of minimum deviation.
  - The refractive index of the material of the prism is given by

$$\square = \frac{\sin\left(\frac{\square + \square_{\square}}{2}\right)}{\sin\frac{\square}{2}}$$

Where
$\square_{\square}$ = angle of minimum deviation A = angle of the prism.

- **RAY DIAGRAM**

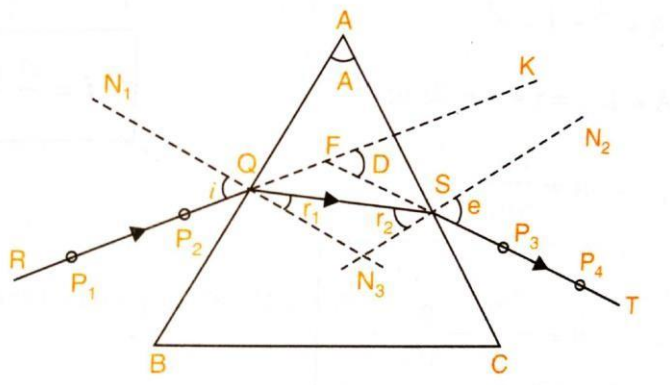

Fig. 9.02. Refraction through a prism.

- **PROCEDURE :**
  - White sheet of paper is fixed on a drawing board with the help of drawing pins.
  - A straight line XY parallel to the length of the paper is drawn nearly in the middle of the paper.
  - Three points Q_1, Q_2, Q_3 are marked at suitable distances on the straight line XY.
  - And the normal is drawn at these points.
  - Straight lines making angles of 35^0, 40^0, 45^0 and so on, with the normal drawn at each of these points.

- The prism angle A is measured with the help of protector and noted.
- Now prism is kept over the line with its edge over it so that normal lies at the centre of its edge.
- Two or more pins are fixed vertically over the line making an angle 35^0 with the normal. The distance between the pin should be 5 cm or more.
- The images of these pins are observed through the prism and the positions of heads so adjusted that there is no parallax between the two pins.
- Keeping head position fixed two more pins are placed so that all 4 pins seems to be in same line.
- Incident ray and emergent Ray are marked and the angle between them is measured which gives the angle of deviation.
- Same procedure is repeated for other angles and angle of deviation is determined.
- All the observations are recorded in observation table.

➢ **OBSERVATION :**

Angle of prism 'A' =……..

S.No.	Angle of incidence ∠□	Angle of deviation ∠δ
1.	35^0	
2.	40^0	
3.	45^0	
4.	50^0	
5.	55^0	
6.	60^0	

➢ **GRAPH : (**to be drawn and pasted on the left side of observation table)

➢ **CALCULATIONS: (leave some space to calculate refractive index of prism.)**

➢ **RESULT :**

- Graph indicates that as the angle of incidence (□) increases, the angle of deviation (□) first decreases and attains a minimum value and then starts increasing for further increase in the angle of incidence
- Angle of minimum deviation □□ =……
- Refractive index of the material of the prism μ = …….

➢ **PRECAUTIONS :**

- The angle of incidence should lie between 35^0 to 60^0
- The pins should be fixed vertical.
- The distance between two pins should not be less than 5 cm.
- Arrowheads should be marked to represent the incident and emergent Ray
- The same Angle of prism should be used for all observations

➢ **SOURCES OF ERROR :**

- Pin pricks may be thick.
- Measurement of angles maybe wrong.

EXPERIMENT NO.13

- **AIM OR OBJECTIVE:** To find refractive index of a liquid (water) by using convex lens and plane mirror.
- **APPARATUS USED :** A convex lens, a plane mirror, water in a beaker, an optical needle, an iron stand with clamp, plane mirror and half metre scale
- **THEORY OR FORMULA USED :**

If f_1 and f_2 be the focal length of glass convex lens and liquid lens and f be the focal length of their combination then,

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} \quad \text{or} \quad \frac{1}{f_2} = \frac{1}{f} - \frac{1}{f_1}$$

Liquid lens formed is a Plano-concave lens with $f_1 = f$ and $f_2 = \infty$

From lens makers formula

$$\frac{1}{f_2} = (\mu - 1)\left[\frac{1}{f_1} - \frac{1}{f_2}\right]$$

We have,

$$\frac{1}{f_2} = \frac{(\mu - 1)}{f} \quad \text{or} \quad \mu = 1 + \frac{f}{f_2}$$

Putting value of f_2, μ can be calculated.

- **RAY DIAGRAM**

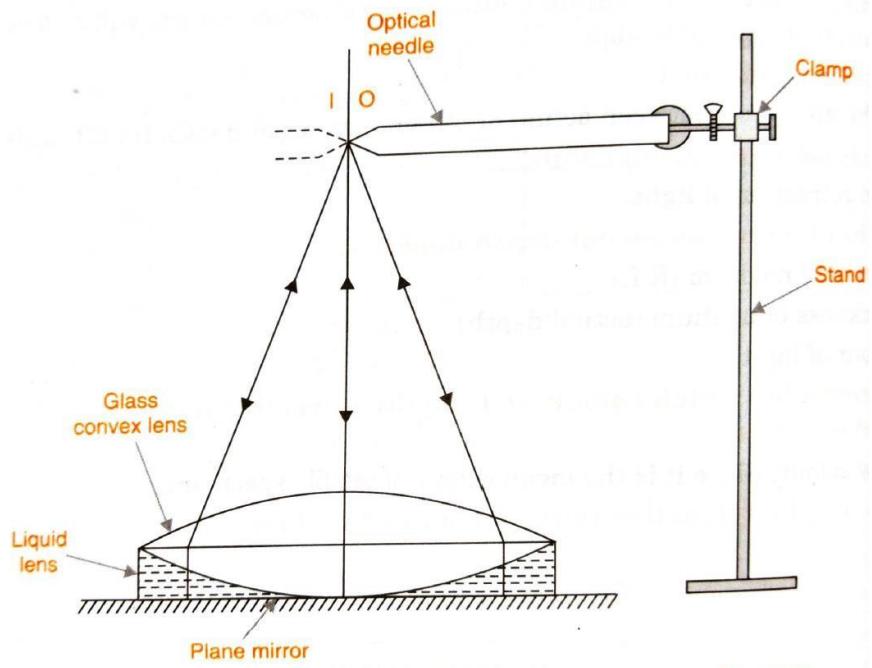

Fig. Focal length of glass convex lens and liquid lens combination.

- **PROCEDURE :**
  - One convex lens is taken and its focal length is determined
  - A plane mirror is placed on the horizontal base of the iron stand and the convex lens is placed on the plane mirror.
  - Optical needle is placed in the clamp of the stand and caps horizontally above the lens at a distance equal to its focal length.
  - The tip of the needle is brought at the vertical principal axis of the lens so that tip of the needle appears touching the tip of its image.

- Parallax is removed between tip of the needle and its image

- Distance is measured between tip and the upper surface of the lens by using a half metre scale
- Then the distance is measured between tip and the surface of plane mirror.
- Observations are recorded in observation table.
- A few drops of water is taken on a plane mirror and convex lens is kept over it and Plano concave liquid lens is formed between the plane mirror and convex lens
- Again the parallax is removed between the tip of the needle and its image
- All the distances are measured again as done earlier.
- All the observations are recorded in observation table.

➢ **OBSERVATION :**

Rough focal length of the given convex lens =… ..... cm

Arrangement	Distance of needle tip			Focal length □ (□□)
	From lens surface □1 (□□)	From plane mirror □2 (□□)	Mean □ = (□1 + □2)/2	
Without liquid				□1 =…….
With liquid				□ =…….

Radius of curvature R =… ..... cm

➢ **CALCULATIONS: (leave some space to calculate refractive index of prism.)**

$\frac{1}{□_2} = \frac{1}{□} - \frac{1}{□}$ = ··· … … … … … … … … … … … … … … … … ..

$\mu = 1 + \frac{□_1}{□_2}$ = ··· … … … … … … … … … … … … … … … … …

➢ **RESULT:** Refractive index of water μ = …….

➢ **PRECAUTIONS :**

- Liquid is taken to be transparent.
- Only few drops of liquid should be taken so that its layer is not thick.
- Parallax should be removed tip to tip.

➢ **SOURCES OF ERROR :**

- Liquid may not be quite transparent
- The parallax may not be fully removed

(This sheet is prepared from home)