

Physics Investigatory Project

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**To find and compare the angle of
deviation of different liquids using
hollow prism**

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Aim

To find and compare the angle of deviation of different liquids using hollow prism

Variables

Independent variables : Nature of the medium used (Liquid)

Dependent variables : Angle of deviation

Controlled variables : Prism, Positioning of pin, Angle of Incidence

Materials Required

Hollow prism, paper, pencil, ruler, protractor, water, oil, glycerol, laser (source for monochromatic light) and a holder for the light source.

Theory

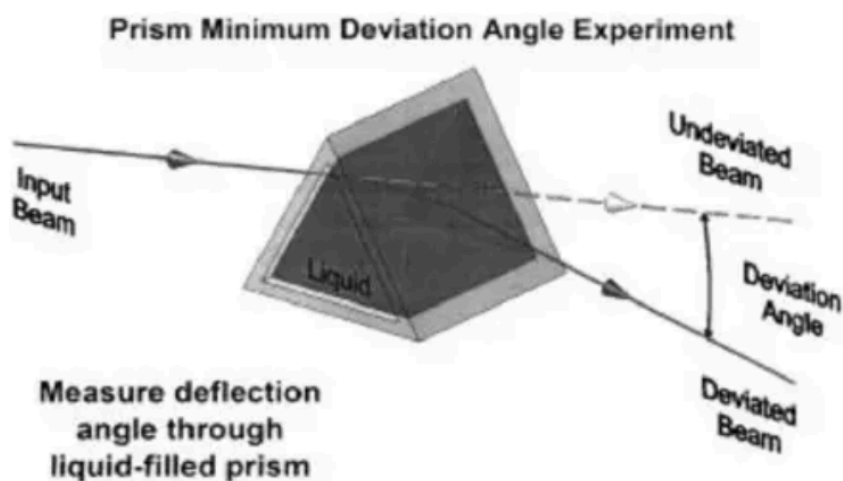
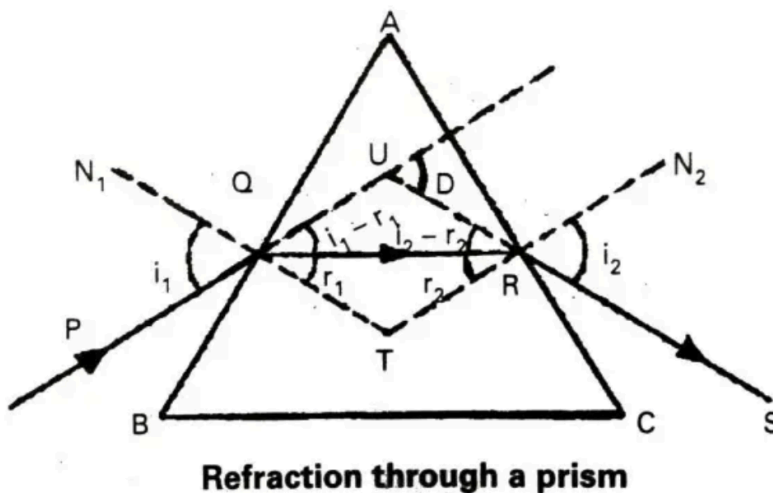
A prism is a transparent optical object with flat, polished surfaces that refract light. Prisms can be made from any material that is transparent including glass and even plastic.

A prism can be used to break light up into its constituent spectral colors. Prisms can also be used to reflect light, or to split light into components with different polarizations.

The refractive index of the liquid is given by the formula:

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

Diagram for Refraction through a prism



Laws of refraction

The incident ray, refracted ray and the normal at the point of incidence all lie on the same plane.

Snell's Law: The relationship between the angle of incidence and the angle of refraction is defined by Snell's law, which states:

$$\frac{\sin \theta_1}{\sin \theta_2} = n_{21} = \frac{n_2}{n_1} = \frac{v_1}{v_2}$$

where n_1 and n_2 are the refractive indices of the first and second mediums.

θ_1 and θ_2 are the angles of incidence and refraction.

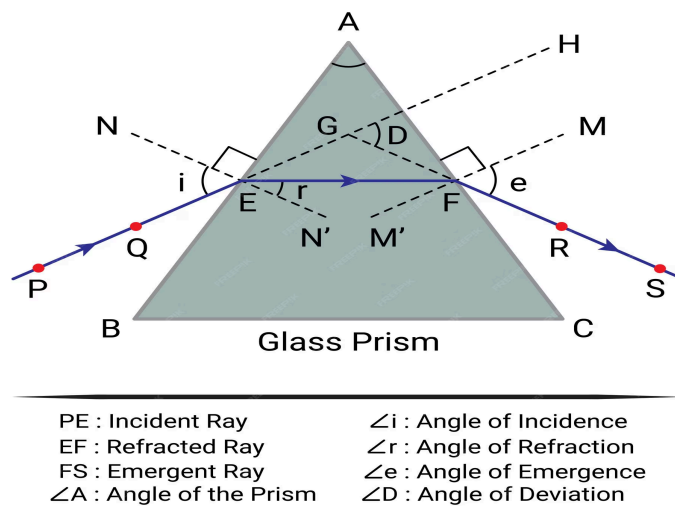
v_1 is the speed of light in medium 1 (air) and v_2 is the speed of light in medium 2.

n_{21} is the speed of light in medium 2 compared to medium 1.

Procedure

- Fix a white sheet of paper on the drawing board with the help of pins.
- Keep the prism on the paper and draw its outline as $\triangle ABC$.
- Drop a normal PQ on the side AB.
- Draw the angle of incidence in accordance with the normal PQ and draw a line to the prism which will be the incident ray's path.
- Place the prism filled with a given sample of liquid on the marked outline ABC.
- Now use a laser light and angle it so that the beam follows the marked incident ray. Use a pencil to mark 2 spots on the refracted ray's path.

- Remove the prism and draw the line joining the points so obtained.
- Mark the diagram as shown in the figure on the next page.
- Repeat this with different liquids.



Observations

Water			
Sr No	Angle of Incidence	Angle of Deviation	Angle of Prism
1	45°	23.00°	60°
2	45°	22.00°	60°
3	45°	23.50°	60°

Mean Angle of Deviation: 22.83°

Observations

Glycerol			
Sr No	Angle of Incidence	Angle of Deviation	Angle of Prism
1	45°	30.00°	60°
2	45°	29.50°	60°
3	45°	31.00°	60°

Mean Angle of Deviation: 30.16°

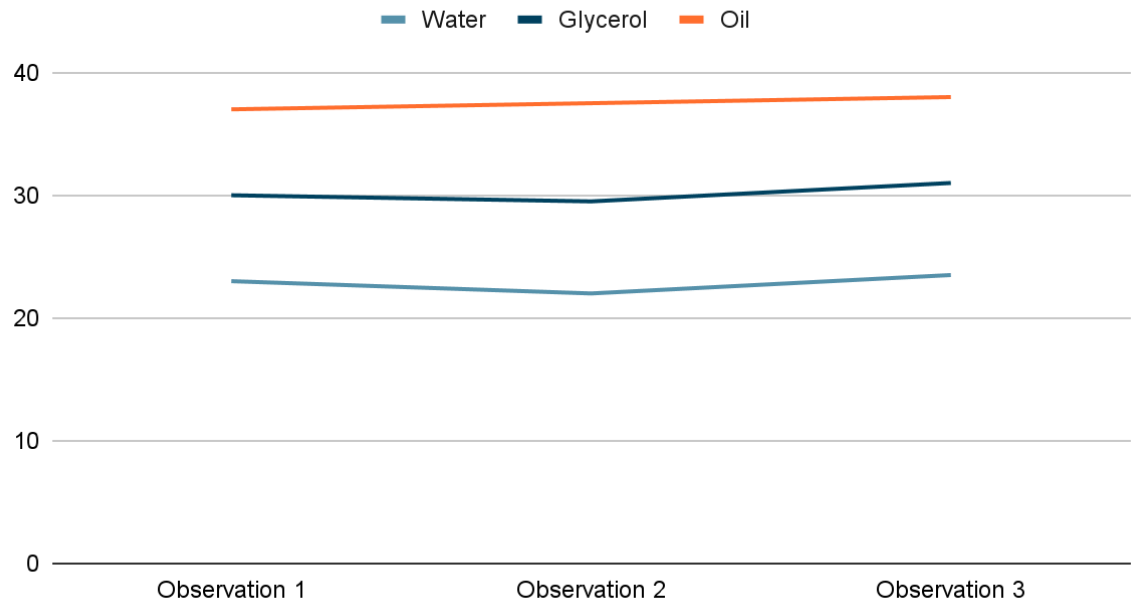
Observations

Oil			
Sr No	Angle of Incidence	Angle of Deviation	Angle of Prism
1	45°	37.00°	60°
2	45°	37.50°	60°
3	45°	38.00°	60°

Mean Angle of Deviation: 37.50°

Graph

Angle of Deviation



Result

1. **Angle of Deviation for water** is 22.83°
2. **Angle of Deviation for glycerol** is 30.16°
3. **Angle of Deviation for oil** is 37.33°

This can be attributed to the densities of the substances. Oil is denser than glycerol and glycerol is denser than water.

Precautions

1. Handle the glass prism with care and place it safely on the platform to avoid damage or breakage.
2. Avoid shining the laser beam in eyes to prevent retina damage.
3. Handle the liquids with care to avoid spillage.

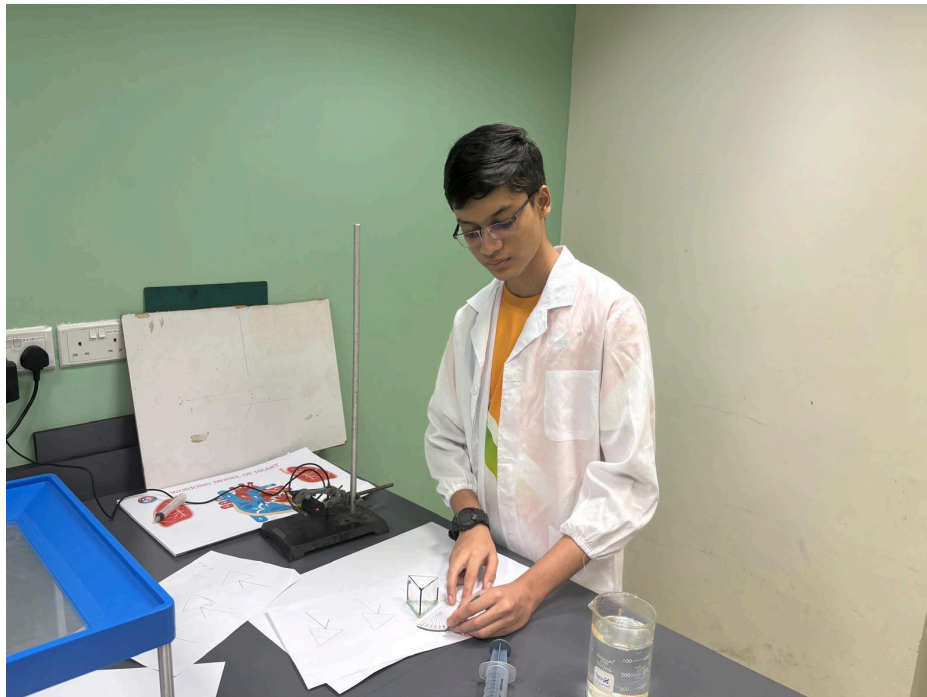
Sources of Error

1. Parallax Error can occur.
2. Angles measured may be inaccurate.
3. Impurities may be present inside the liquid while performing the experiment which may lead to inaccuracies.

Mitigation Techniques

1. Ensure that the readings taken are accurate and recheck calculations.
2. Use clean prisms, and pure liquids only.

Experiment Pictures



Bibliography

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