ASHOKA
Date:
Page No.

Experiment No-2

Polarisation of Light & Brewster's Angle

Aim-

To determine Brewster's angle for a given pair of media using polarised monochromatic light

Formula used-

Snell's Law -

$$\theta = \frac{\mu_2}{\mu_1}$$

Brewster's Law -

$$\theta_B = \tan^{-1} \frac{\mu_2}{\mu_1}$$

Error -

$$\% \text{ error} = \frac{|(\text{experimental value} - \text{expected value})|}{\text{expected value}} \times 100$$

Calculations-

(i) Brewster's angle $= \left| \frac{\theta_1 + \theta_2}{2} \right|$

$$= \left| \frac{|58.11 + |-58.11|}{2} \right|$$

$$= 58.1^\circ$$

ASHOKA

Date:

Page No.

Observations & Calculations –

S. No.	Medium	μ_1	Material	μ_2	θ_1°	θ_2°	Brewster's angle (virtual experiment)	Brewster's angle (expected)	% error
1.	Air	1.0	Topaz	1.607	58.1	-58.1	58.1	58.106	0.010
2.			Crown glass	1.52	56.7	-56.7	56.7	56.659	0.072
3.			Flint glass	1.57	57.5	-57.5	57.5	57.505	0.008

Table I Determination of Brewster's angle from virtual experiment

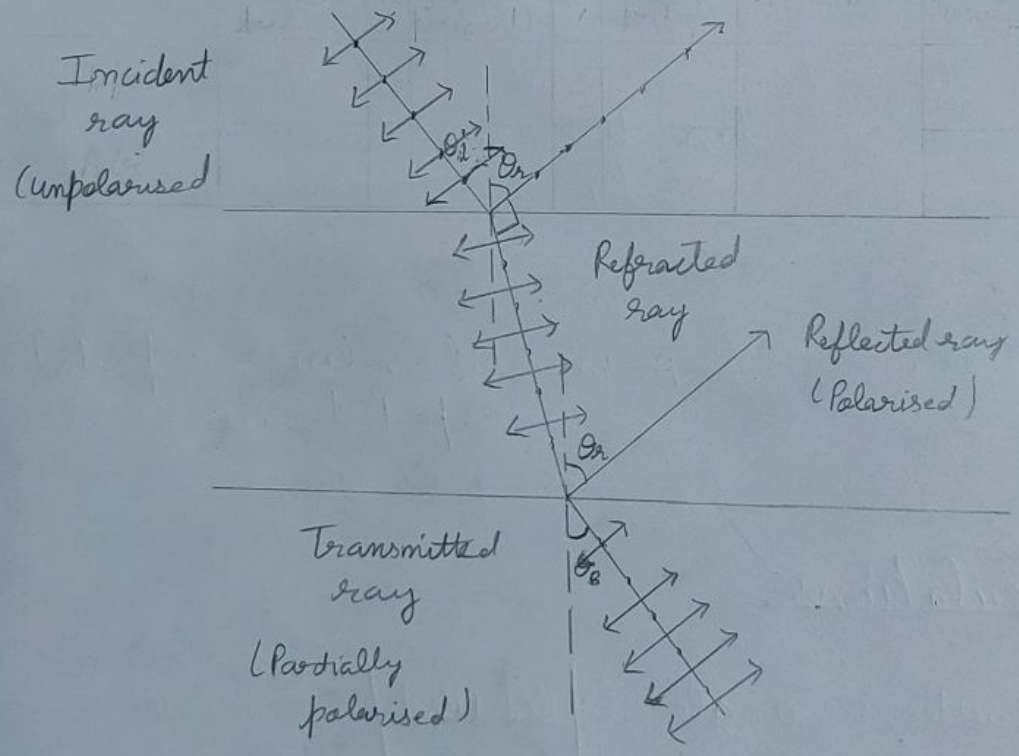


Fig 1. Polarisation of light due to reflection.
↕ and • indicate polarisations parallel and perpendicular to the plane of incidence.

ASHOKA
Date:
Page No.

(ii) $\left|\frac{|\theta_1| + |\theta_2|}{2}\right| = \left|\frac{|56.71| + |-56.71|}{2}\right|$

$= 56.7°$

(iii) $\left|\frac{|\theta_1| + |\theta_2|}{2}\right| = \left|\frac{|57.51| + |-57.51|}{2}\right|$

μ_2 / μ_1

(i) Medium – Air ($\mu = 1$) Material – Tapaz ($\mu = 1.607$)

$\frac{\mu_2}{\mu_1} = \frac{1.607}{1} = 1.607$

(ii) Medium – Tapaz ($\mu = 1.607$) Material – Air (1)

$\frac{\mu_2}{\mu_1} = \frac{1}{1.607} = 0.622$

Expected Brewster's Angle –

For (i) $\tan^{-1}\left(\frac{\mu_2}{\mu_1}\right) = \tan^{-1}(1.607) = 58.106$

For (ii) $\tan^{-1}\left(\frac{\mu_2}{\mu_1}\right) = \tan^{-1}(0.622) = 31.881.$

Error -

$$\% \text{ error} = \left| \frac{\text{experimental value} - \text{expected value}}{\text{expected value}} \right| \times 100$$

(i) $\% \text{ error} = \left| \frac{58.1 - 58.106}{58.106} \right| \times 100 = 0.010\%$

(ii) $\% \text{ error} = \left| \frac{56.7 - 56.659}{56.659} \right| \times 100 = 0.072\%$

(iii) $\% \text{ error} = \left| \frac{57.5 - 57.505}{57.505} \right| \times 100 = 0.008\%$

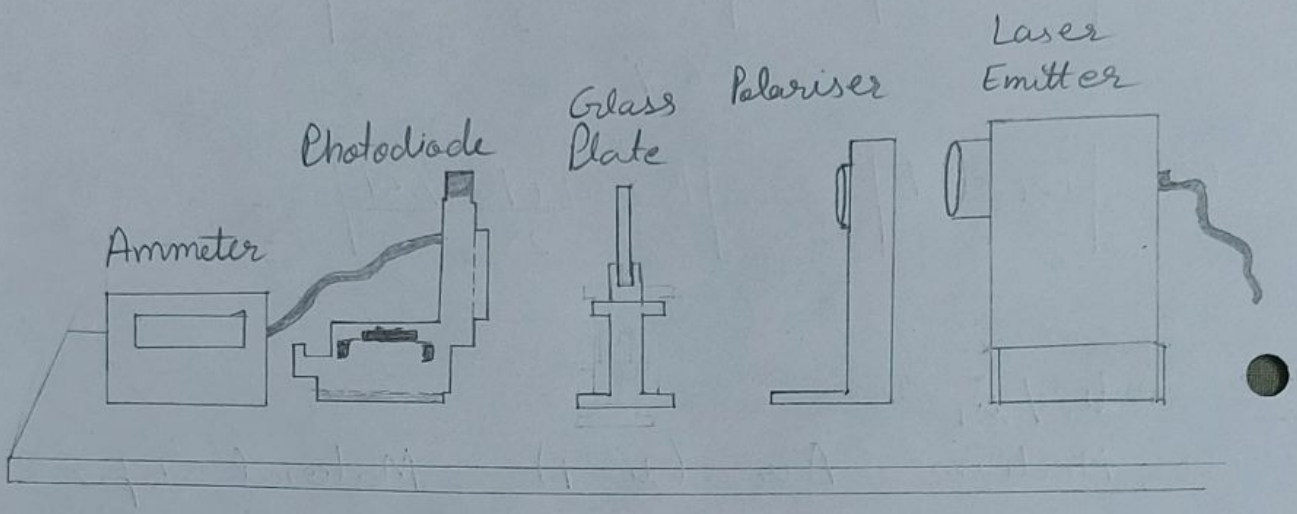
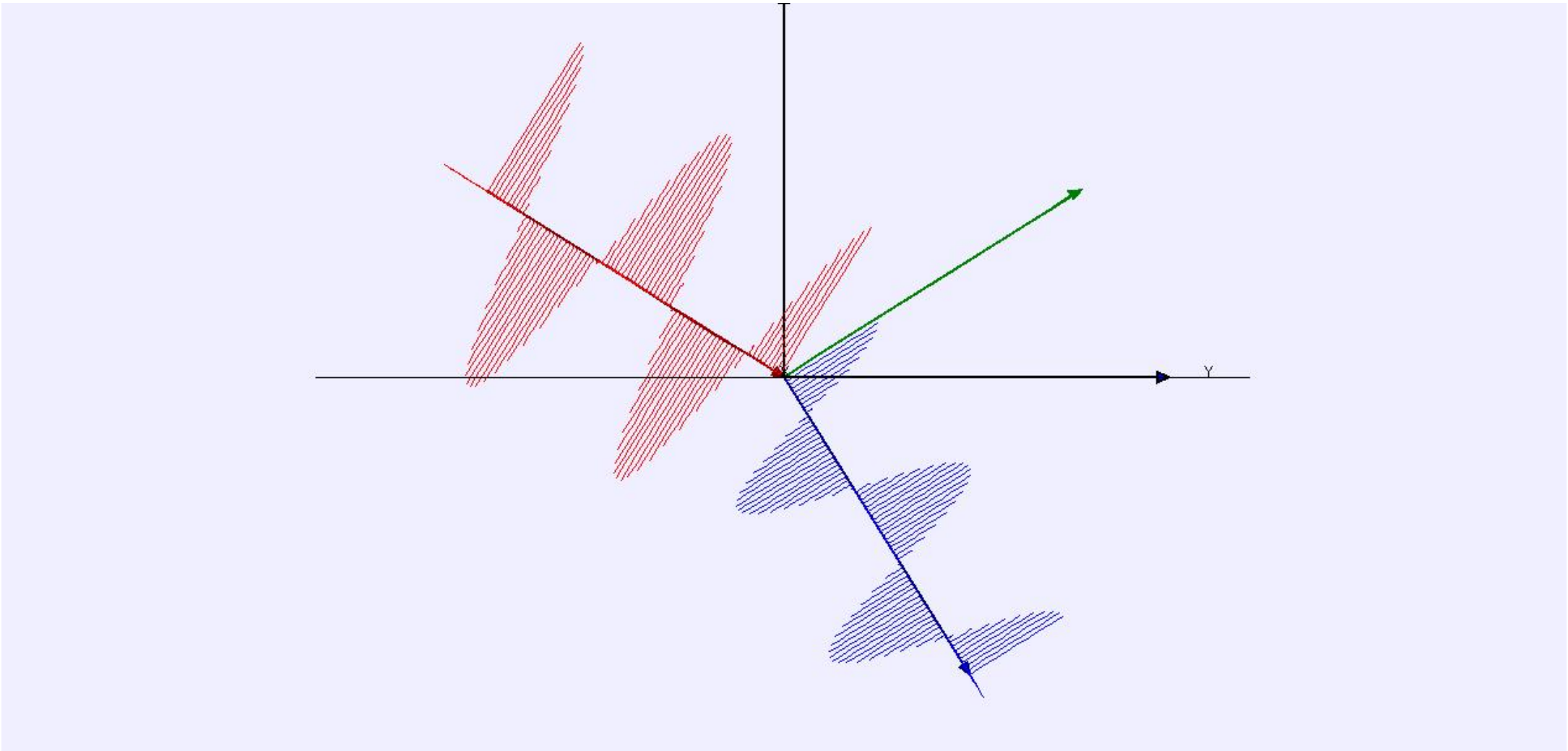
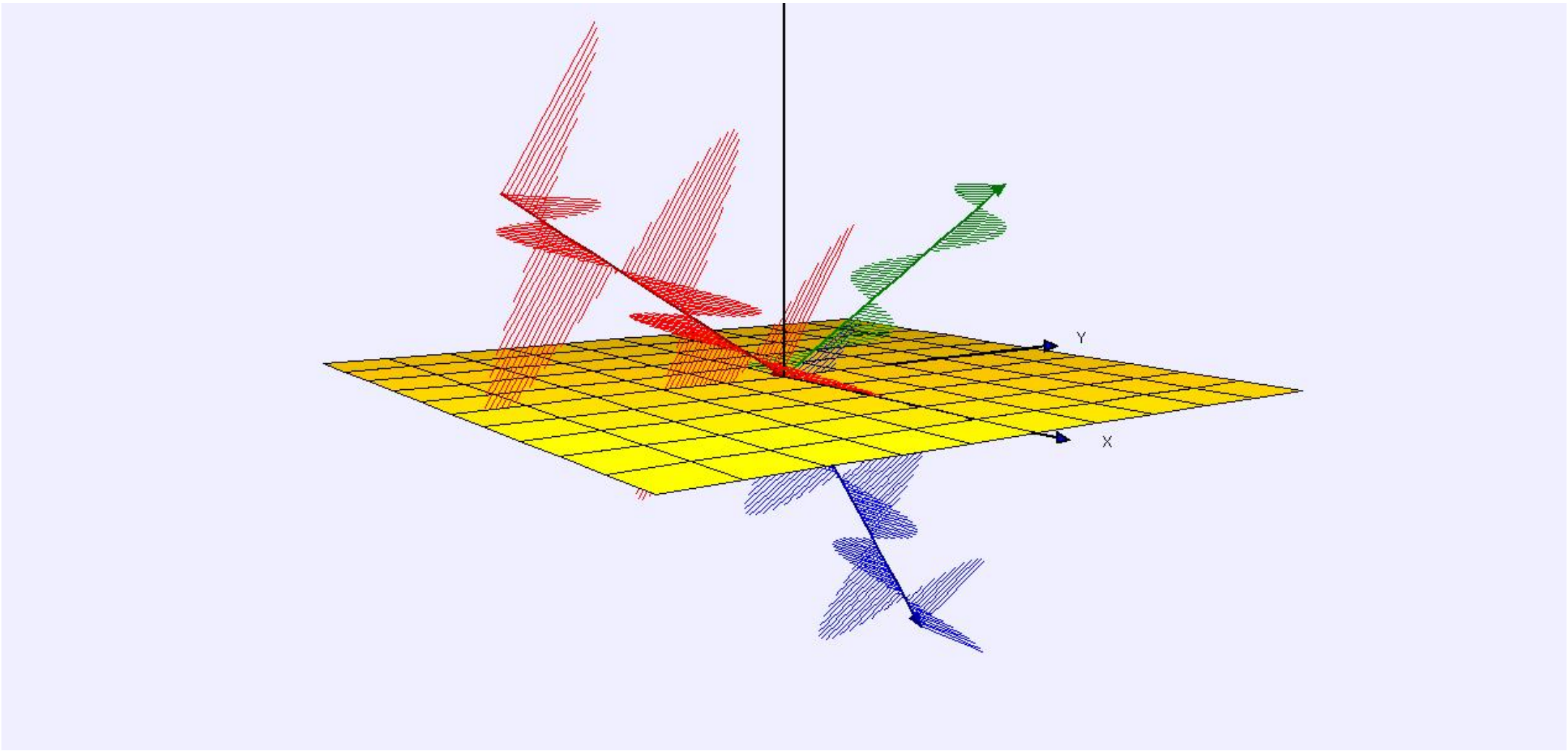


Fig 2. Experimental setup for determination of Brewster's angle.

S. No.	Medium	Material	μ_2/μ_1 set in visualisation tool	Brewster's angle (virtual exp)	Brewster's angle (expected)	Sum $\theta_{B1}^{\circ} + \theta_{B1}^{\circ\prime}$	Brewster's angle (visualisation tool)	Sum $\theta_{B2}^{\circ} + \theta_{B2}^{\circ\prime}$
1	Air	Topaz	1.607	58.1	58.106	89.987	58.11	89.99
2	Topaz	Air	0.622	NA	31.881		31.88	

Table 2. Brewster's angle from visualisation tool.


Y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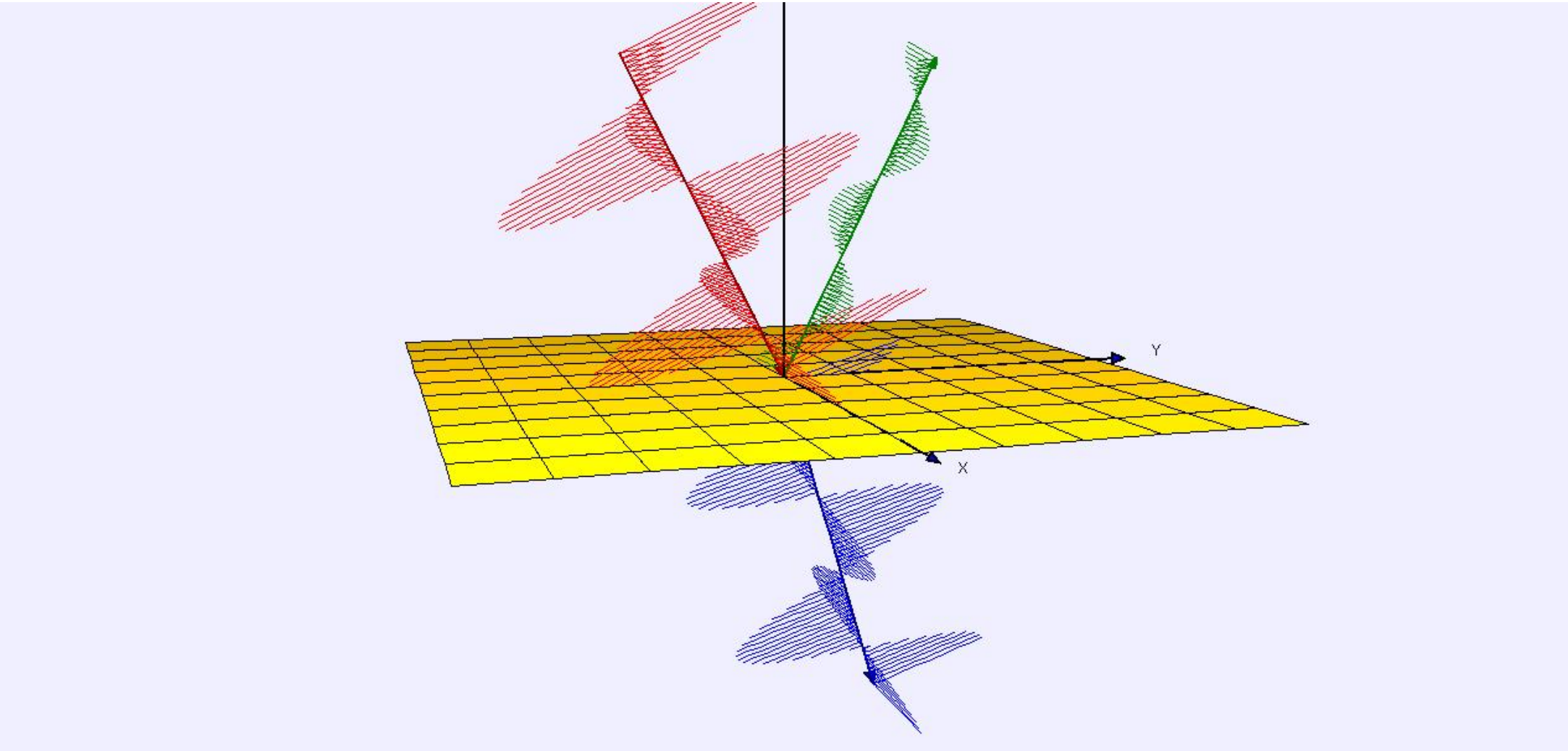
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ASHOKA
Date:
Page No.

Result-

As per the experiment, the Brewster's angle for a given media and material using polarised light is determined.