Experiment No. 4
Polarization and Brewster's angle

Aim :

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

Formula used :

$$\frac{\sin\theta_i}{\sin\theta_t} = \frac{\mu_2}{\mu_1} \quad \text{(Snell's law)}$$

$$\tan\theta_B = \frac{\mu_2}{\mu_1}$$

where θ_i = angle of incidence

θ_t = angle of reflection

θ_B = Brewster's angle

Question : What is the working principle of polaroid sunglasses?

Answer : When we are wearing polaroid glass lenses, or sunglasses, the surface blocks the glare by filtering out the horizontal light waves that don't fit through the chemical laminate pattern.

Teacher's Signature

Conclusion :

Hence the brewster angle for a given point of media using polarised light is determined.

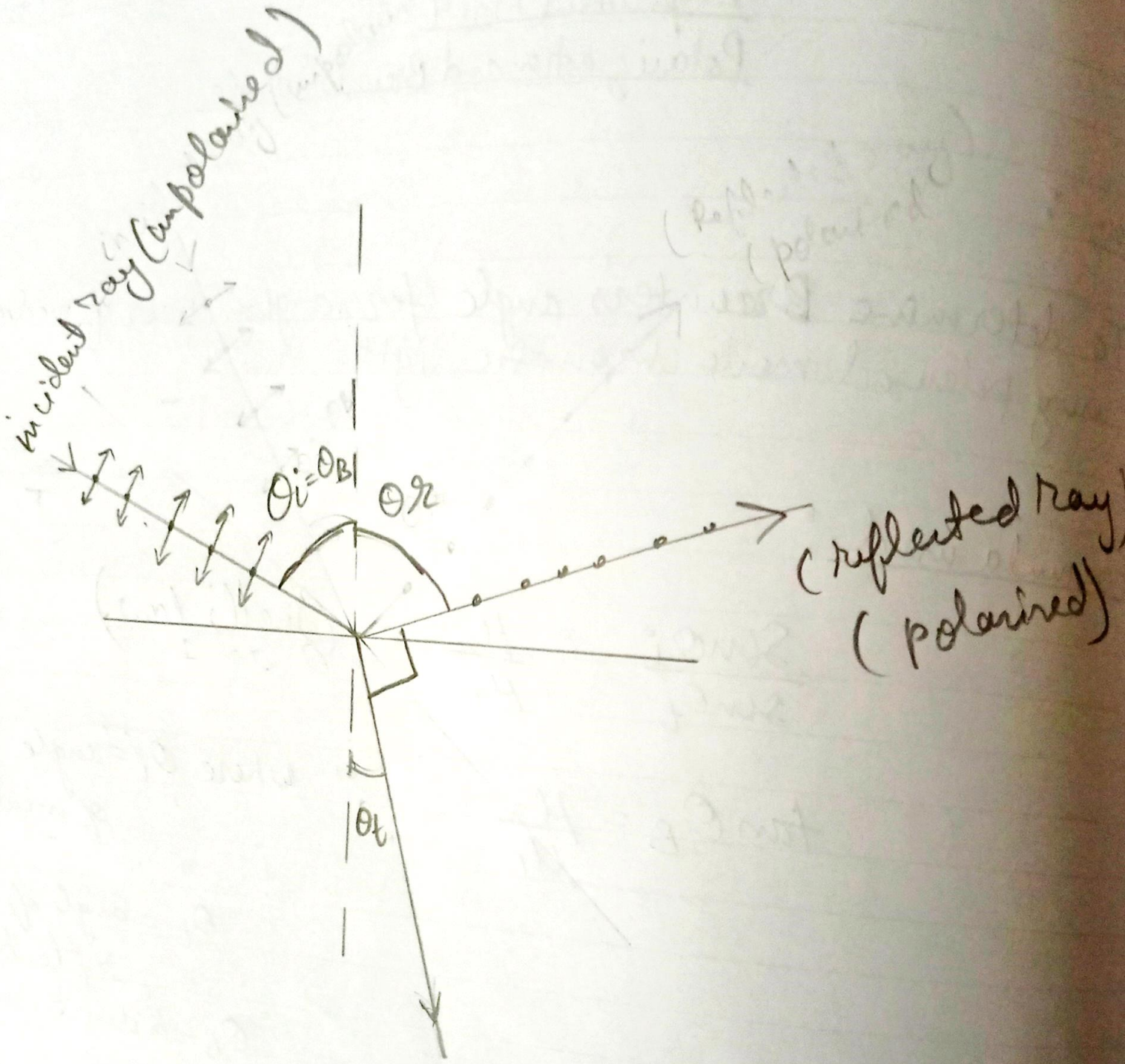
Table 1. Determination of Brewster's angle from virtual experiment

S. No.	Medium	μ_1	Material	μ_2	θ_1°	θ_2°	Brewster's angle (virtual)	Brewster's angle (expected)	% error
1	Air	1	Topaz	1.607	58.14	58.14	58.14	58.10	0.057
2		1	Crown glass	1.52	56.69	56.69	56.69	58.65	0.055
3		1	Flint glass	1.57	57.53	57.53	57.53	57.5°	0.043
4	Carbon	1.001	Topaz	1.607	58.12	58.12	58.12	58.081	0.067
5	di	1.001	Crown glass	1.52	56.68	56.68	56.68	56.633	0.083
6	Oxide	1.001	Flint glass	1.57	57.52	57.52	57.52	57.479	0.071

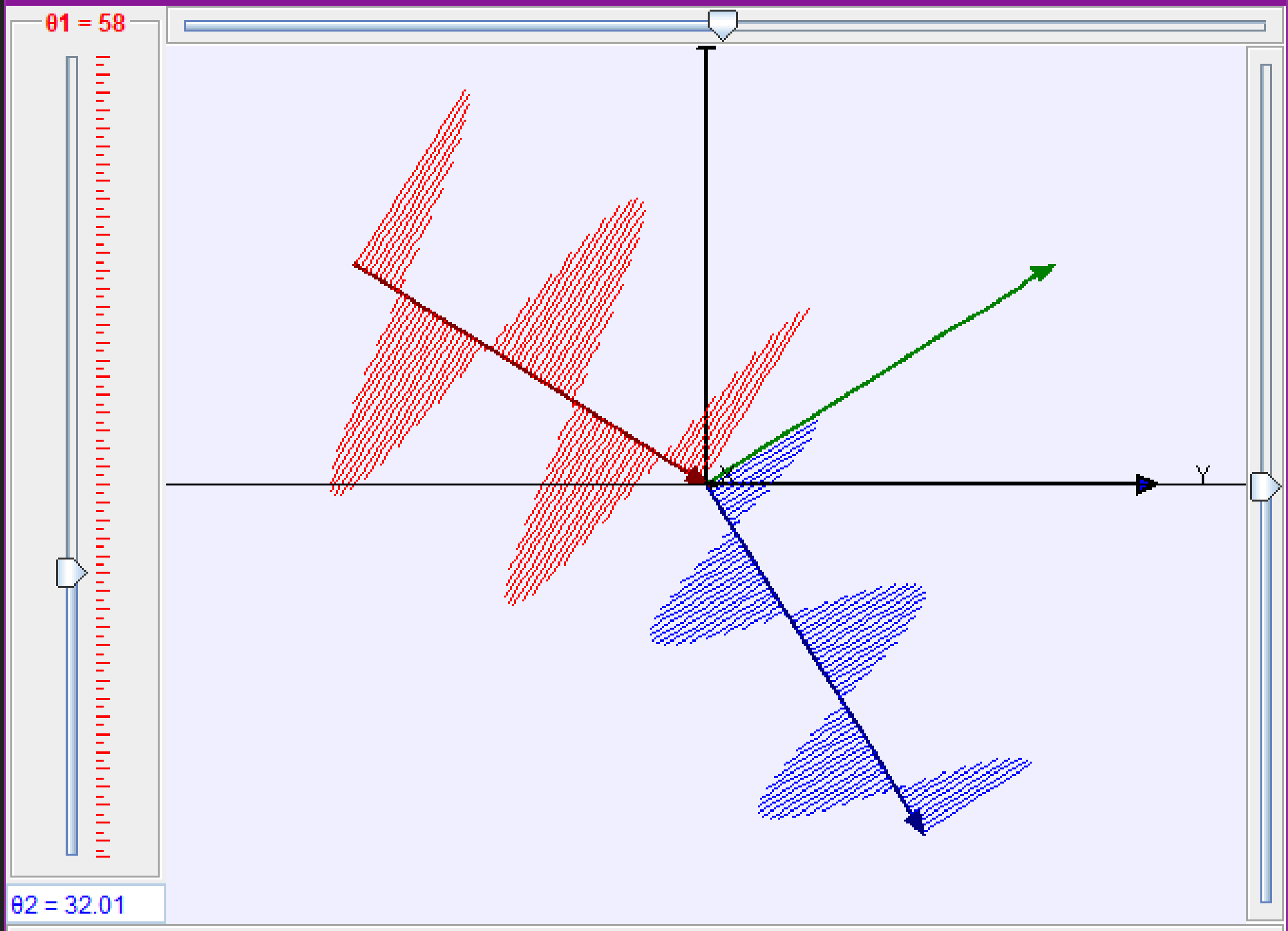
Table 2. Brewster's angle from visualization tool

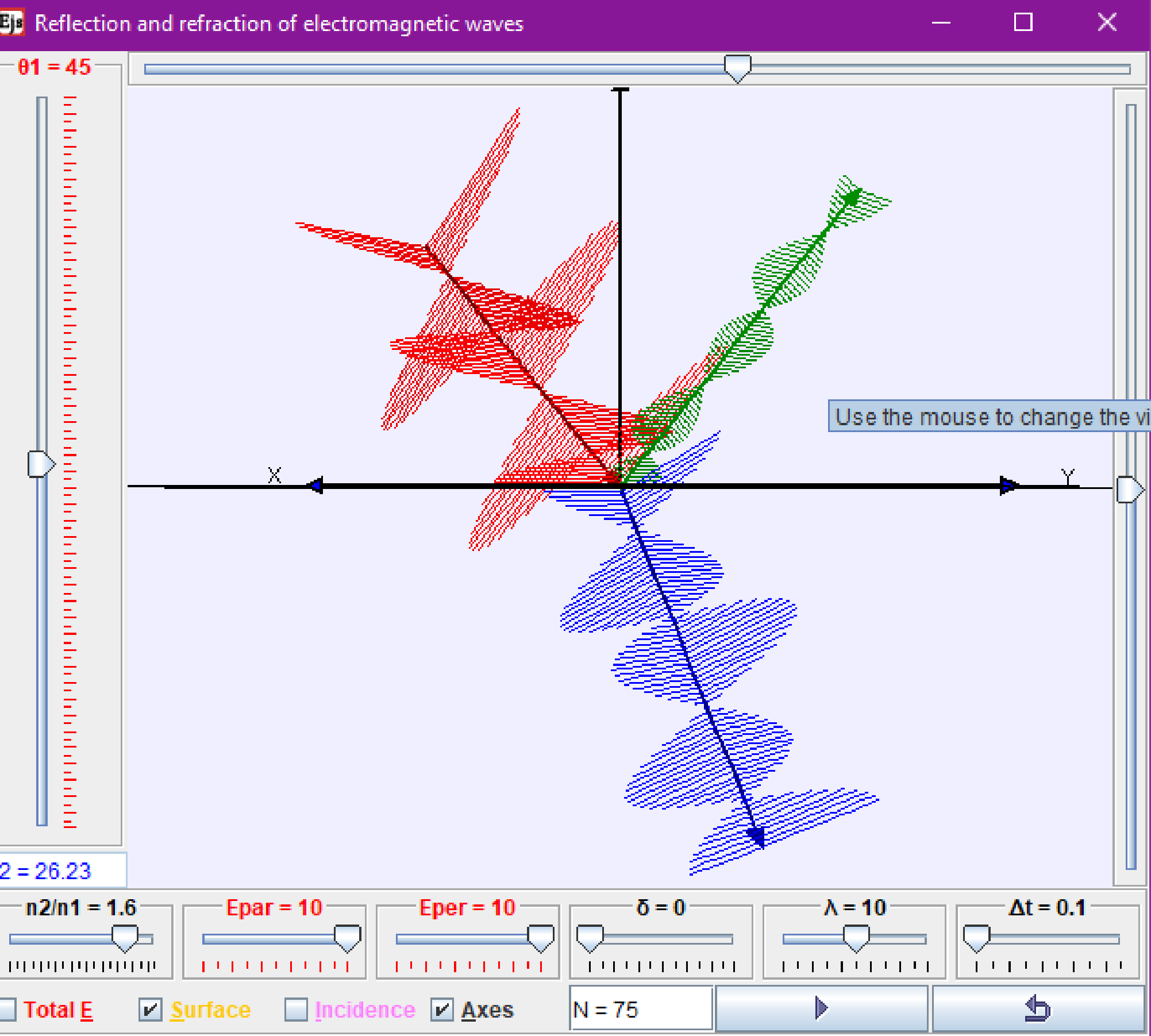
S. No.	Medium	Material	μ_2/μ_1 set in vis. tool	Brewster's angle (experiment)	Brewster's angle (expected)	Sum $\theta_{B_1}^\circ + \theta'^\circ_{B_1} =$	Brewster's angle (vis. tool)	Sum $\theta^\circ_{B_2} + \theta'^\circ_{B_2} =$
1	Air	Topaz	1.607	57.64	$\theta_{B_1}^\circ = 58.1$	89.9	$\theta^\circ_{B_2} = 58$	89
2	Topaz	Air	0.62	N.A	$\theta'^\circ_{B_1} = 31.8$		$\theta'_{B_2} = 31$	

for % error $=$ $\dfrac{|\text{experimental value} - \text{expected value}|}{\text{expected value}} \times 100$


incident ray (unpolarised)
$\theta_i = \theta_B$
θ_r
(reflected ray)
(polarised)
θ_t

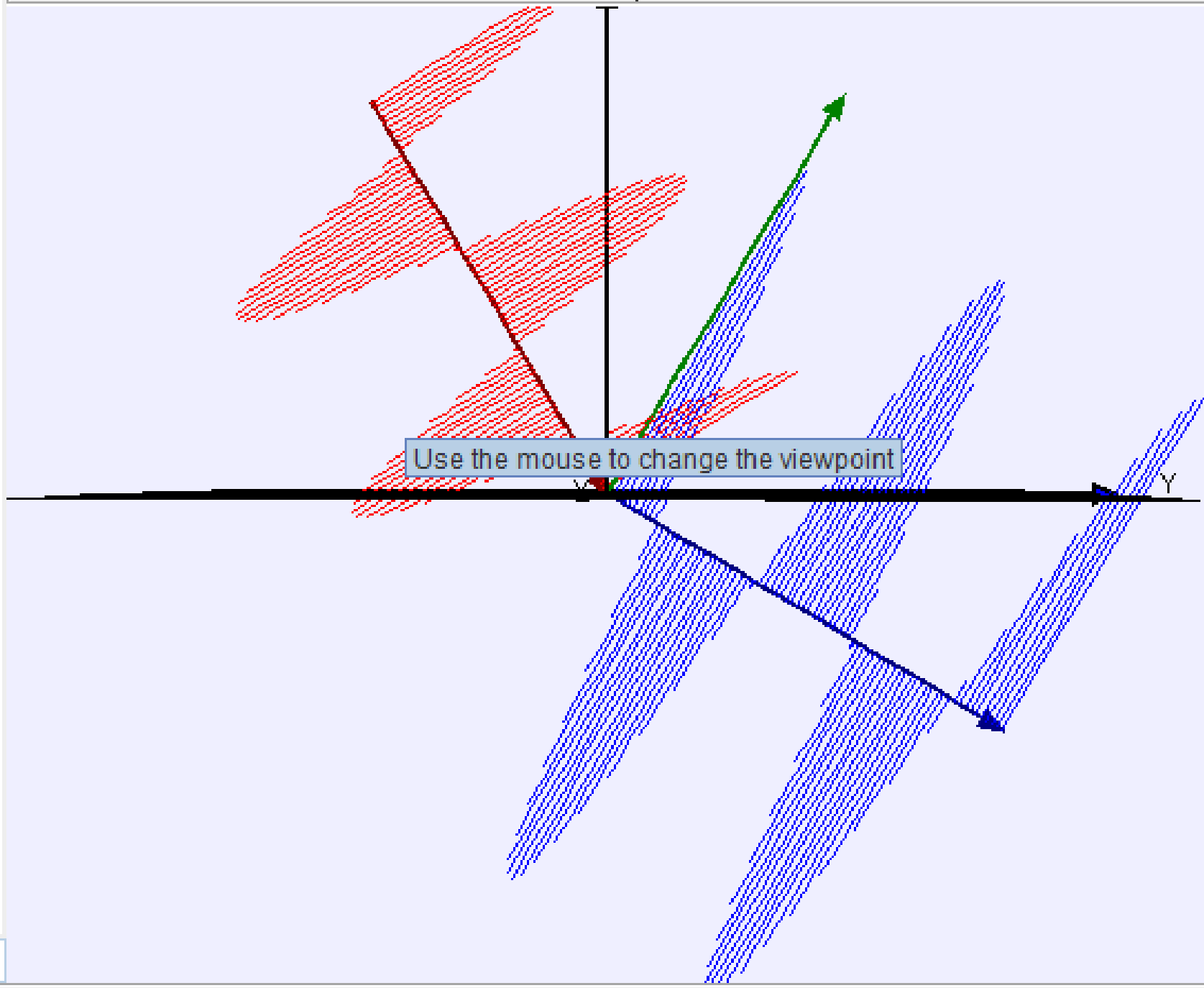
Reflection and refraction of electromagnetic waves




Reflection and refraction of electromagnetic waves
θ1 = 45
2 = 26.23
X
Y
Use the mouse to change the vi
n2/n1 = 1.6
Epar = 10
Eper = 10
δ = 0
λ = 10
Δt = 0.1
Total E
Surface
Incidence
Axes
N = 75

Reflection and refraction of electromagnetic waves

θ1 = 31.01



θ2 = 59.16

n2/n1 = 0.6

Epar = 10

Eper = 0

δ = 0

λ = 10

Δt = 0.1

Total E

Surface

Incidence

Axes

N = 75