TO STUDY BREWSTER'S LAW USING LASER LIGHT

AIM

To determine the of Brewster's angle for glass using a polarized light source.

APPARATUS USED

Laser, Polarizer, Glass plate, Plate holder, Rotational mount, Detector, Current output unit.

THEORY & FORMULA USED

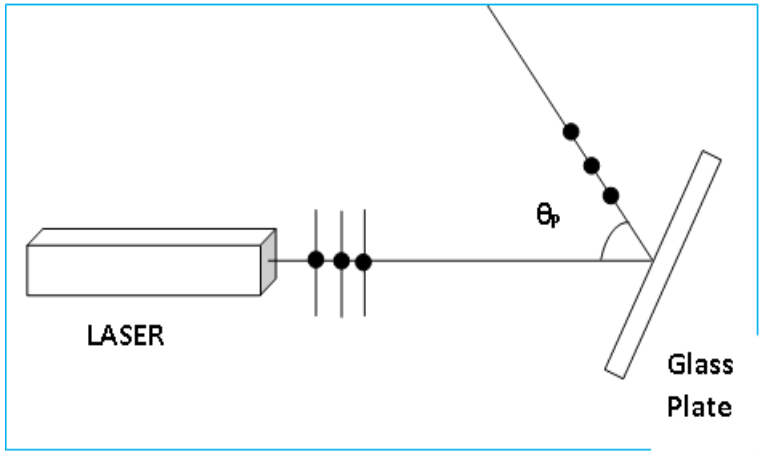
When light travels from one media to another having different refractive indices, some of the light is reflected back from the surface of the denser medium. This reflected ray's intensity changes with change in the angle of incidence at the interface of two media. At one specific angle of incidence of light only perpendicular vibrations of electric field vectors are reflected whereas parallel vibrations are blocked. The angle of incidence for which reflected ray is polarized is called the Polarization angle (θ_P) or Brewster's angle.

Brewster's angle for a given medium is

$$\mu = \tan\theta_P$$

$$\theta_P = \tan^{-1}(\mu)$$

Where μ is refractive index of the medium and θ_p Polarization angle.



PROCEDURE

1. Open the given link in a window

   http://lo-au.vlabs.ac.in/laser-optics/Brewsters_Angle_Determination/experiment.html

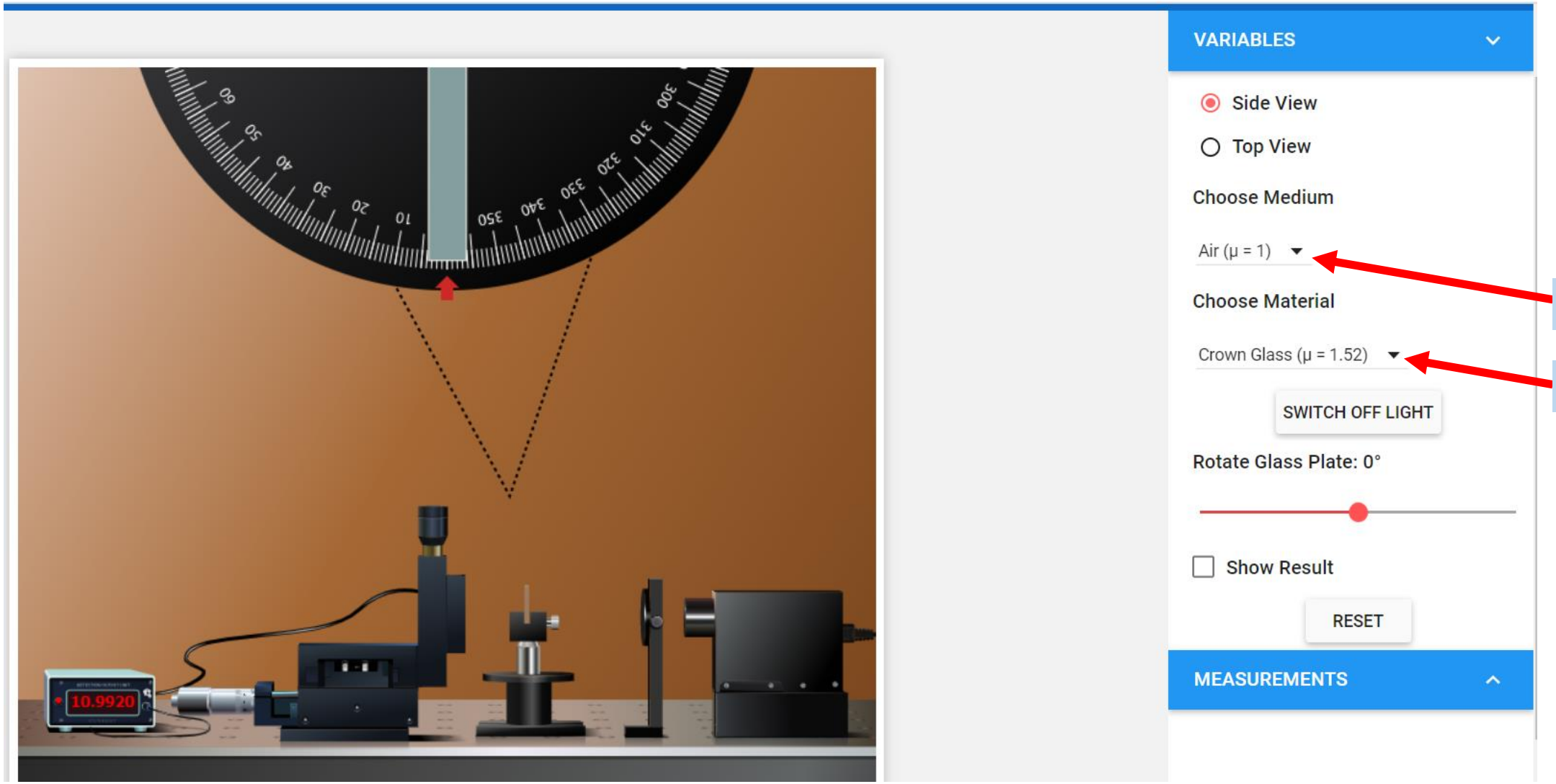
2. Select the medium (air), material (Crown Glass) and click the switch ON light.

3. Rotate the glass plate at an interval of 5 degree, note down the rotation angle (θ) and corresponding current value (I) .

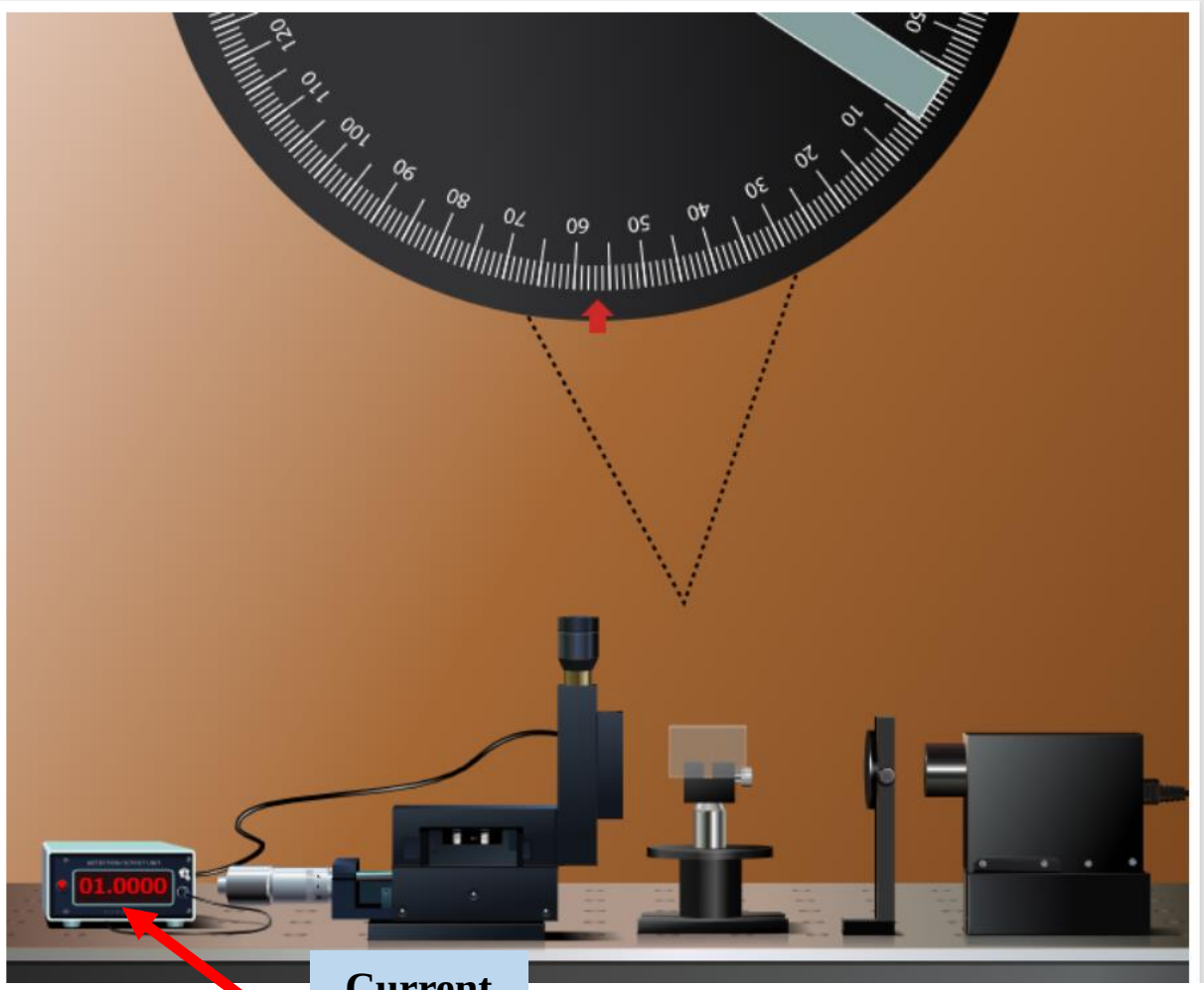
4. Plot a graph of reflected power (current I) vs angle θ.
5. From the graph find Brewster's angle as well as refractive index of the material.

BREWSTER'S LAW SETUP (VIRTUAL)

Link : http://lo-au.vlabs.ac.in/laser-optics/Brewsters_Angle_Determination/experiment.html



BREWSTER'S LAW SETUP (VIRTUAL)



VARIABLES

Side View

Top View

Choose Medium

Air (μ = 1)

Choose Material

Crown Glass (μ = 1.52)

SWITCH OFF LIGHT

Rotate Glass Plate: 56.7°

56.7

Show Result

RESET

MEASUREMENTS

Current becomes minimum

Rotate the angle, till current value becomes minimum

BREWSTER'S LAW VERIFICATION

Theoretical Calculation $\theta_P = \tan^{-1}(1.52)$

$\theta_P = 56.66^{\circ}$

OBSERVATION TABLE

Rotation Angle θ (in degree)									
Current (I)									

RESULT

Plot a graph of reflected power (current I) vs angle θ.

1. Brewster's angle for the material is ……
2. The refractive index of material of glass is ……

TO STUDY MALUS' LAW USING LASER LIGHT

AIM

To determine the relationship between the intensity of the transmitted light through analyzer and the angle between the axes of polarizer and analyzer.

APPARATUS USED

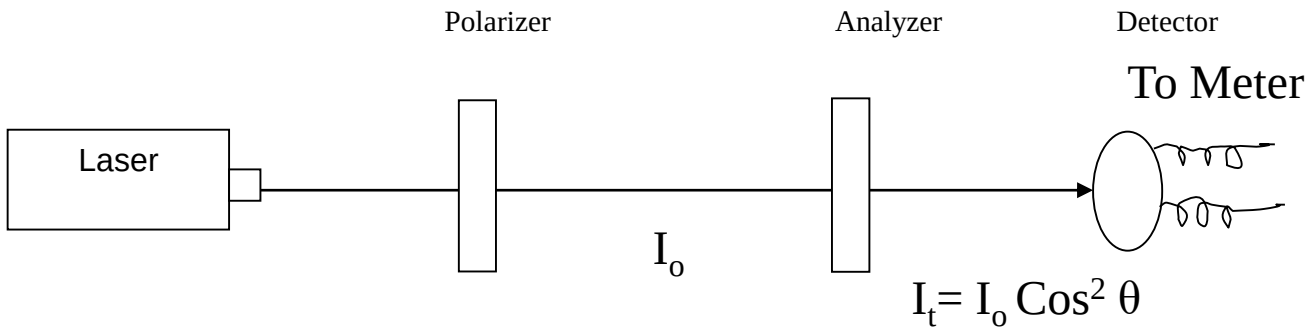
Laser, Polarizer, Analyzer, Photo Detector, Detector output measuring unit, optical bench.

THEORY & FORMULA USED

When light falls on a polarizer, the transmitted light gets polarized. The polarized light falling on another Polaroid, called analyzer, transmits light depending on the orientation of its axis with the polarizer. The intensity of light transmitted through the analyzer is given by Malus' law. This law describes how the intensity of light transmitted by the analyzer varies with the angle that its plane of transmission makes with that of the polarizer. The law can be mathematically written as:

$$I_t = I_o \, Cos^2 \, \theta$$

where I_t is the intensity of the light transmitted through the analyzer; and I_o is the intensity of the incident plane polarized light.



PROCEDURE

1. Open the given link in a window

   http://lo-au.vlabs.ac.in/laser-optics/Malus_law/experiment.html

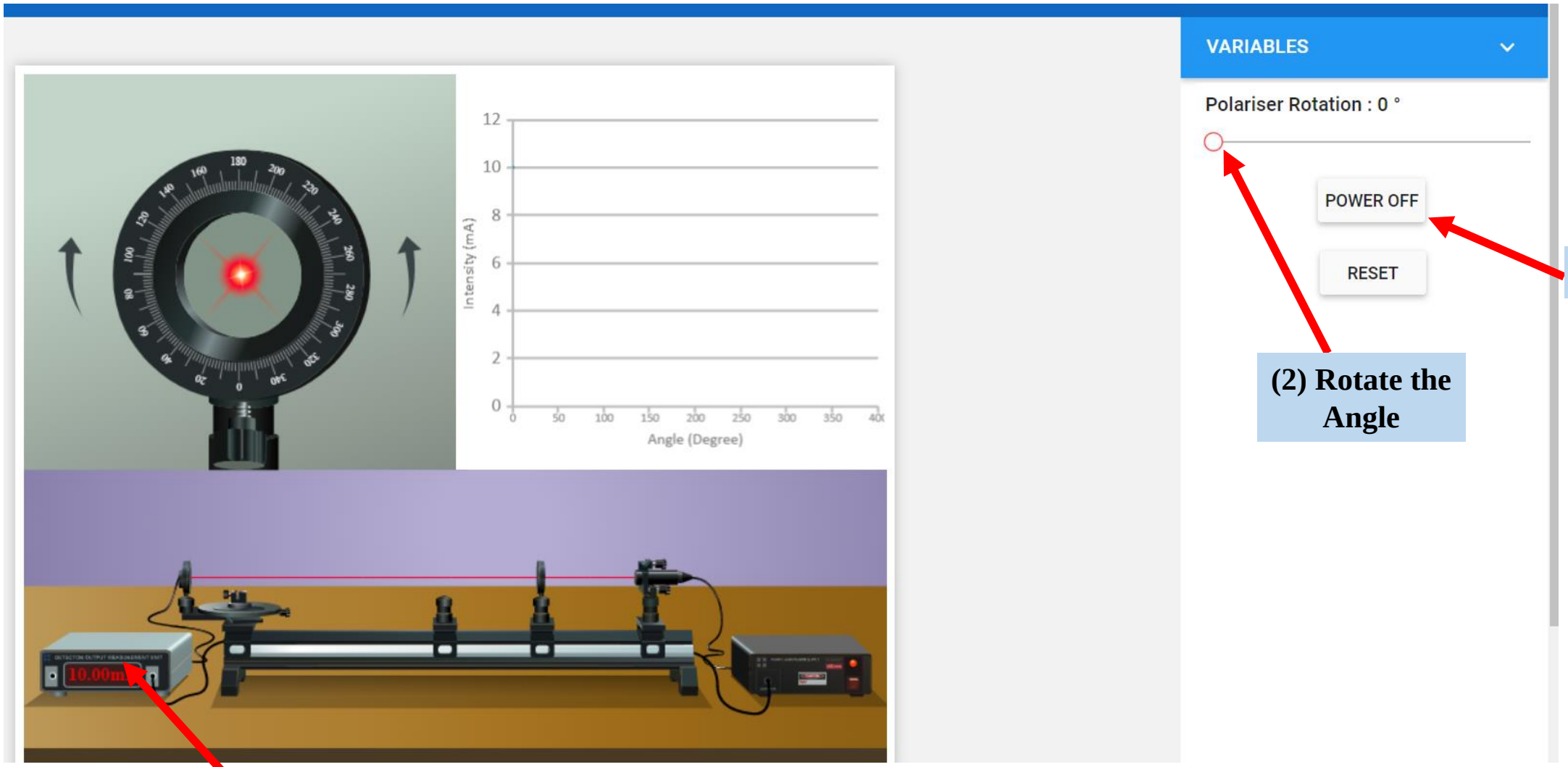
2. Click on the Power ON knob.

3. Rotate the Polarizer angle at an interval of 10 degree, note down the rotation angle (θ) and the corresponding current value (I_{expt}).

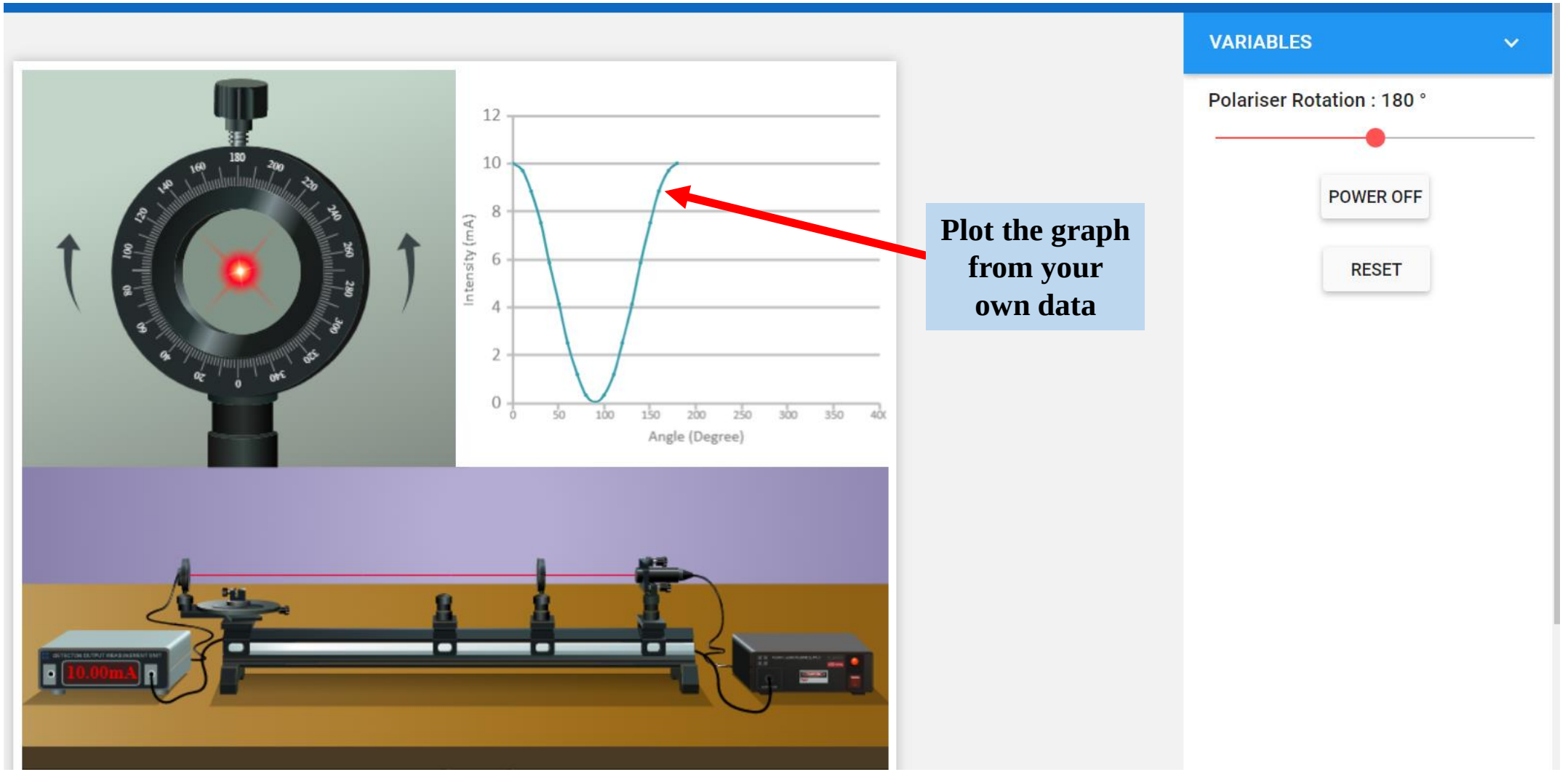
4. Plot a graph between I_{expt} vs θ.

MALUS' LAW SETUP (VIRTUAL)

Link : *http://lo-au.vlabs.ac.in/laser-optics/Malus_law/experiment.html*



MALUS' LAW SETUP (VIRTUAL)



OBSERVATIONS

Maximum Current I_{max} = ….. mA

Sl. No.	Angle of Analyzer θ (Here it is Polarizer) Degrees	Cos θ	Cos^2 θ	Current I_{expt}	Current $I_{theo} = I_{max} * Cos^2$ θ
1.					
2.					
3.					
4.					

RESULT

Plot a graph between I_{expt} vs θ.

Discussion

The experimentally measured current (I_{expt}) and (I_{theo}) that calculated using equation $I_{theo} = I_{max}\ Cos^2\theta$ agree within the limits of the experimental error.

References

http://lo-au.vlabs.ac.in/laser-optics/Brewsters_Angle_Determination/experiment.html
http://lo-au.vlabs.ac.in/laser-optics/Malus_law/experiment.html
https://www.iitr.ac.in/departments/PH/uploads/Teaching%20Laboratory/12%20Brewsters%20angle.pdf
https://www.iitr.ac.in/departments/PH/uploads/Teaching%20Laboratory/9%20Malus%20law.pdf