BIRZEIT UNIVERSITY

Faculty of Science كلية العلوم

Department of Physics دائرة الفيزياء

Phys111 Report

Experiment #6: Index of Refraction

Name:	Bayan Saleem Alkamel	**ID #:**	1231030
Partner:		**ID #:**	
Section:	12		
Date:			

(1) Abstract:

- **Aim of the experiment:**

To find the index of refraction when light passes from on medium to another.

Glass (μ =1.52)

- **The main result is:**
  - The index of refraction of the block $\mu = 1.47 \pm 0.04$

(2) Data:

	i		$\bar{\imath}$	$sin(\bar{\imath})$	r		$\bar{r}$	$sin(\bar{r})$
	i_1	i_2			r_1	r_2		
1	10	9	9.5	0.165	6	5	5.5	0.096
2	20	20	20	0.342	14	14	14	0.242
3	30	31	30.5	0.508	21	19	20	0.342
4	40	40	40	0.643	26	24	25	0.423
5	50	50	50	0.766	31	30	30.5	0.508
6	60	61	60.5	0.870	36	36	36	0.588

(3)Calculations:

Let $x = sin(\bar{r}),\ \ y = sin(\bar{i})$

x_i	y_i	$x_i y_i$	x_i^2
0.096	0.165	0.01584	0.009216
0.242	0.342	0.082764	0.058564
0.342	0.508	0.173736	0.116964
0.423	0.643	0.271989	0.178929
0.508	0.766	0.389128	0.258064
0.588	0.870	0.51156	0.345744
$\sum x_i = 2.199$	$\sum y_i = 3.294$	$\sum x_i y_i = 1.445017$	$\sum x_i^2 = 0.967481$

$$D = 6\left(\sum_{i=1}^{6} x_i^2\right) - \left(\sum_{i=1}^{6} x_i\right)^2 = 6(0.967481) - (2.199)^2 = 0.969285$$

$$\mu = m = \frac{6\left(\sum_{i=1}^{6} x_i y_i\right) - \left(\sum_{i=1}^{6} x_i\right)\left(\sum_{i=1}^{6} y_i\right)}{D} = \frac{6(1.445017) - (2.199)(3.294)}{0.969285} = 1.471802411$$

$$b = \frac{\left(\sum_{i=1}^{6} x_i^2\right)\left(\sum_{i=1}^{6} y_i\right) - \left(\sum_{i=1}^{6} x_i\right)\left(\sum_{i=1}^{6} x_i y_i\right)}{D} = \frac{(0.967481)(3.294) - (2.199)(1.445017)}{0.969285} = 0.0095844163$$

$(y_i - mx_i - b)$	$(y_i - mx_i - b)^2$
(0.165 – (1.4718×0.096) - 0.0095844163)= 0.0141222783	1.994530194×10^{-4}
(0.342 – (1.4718×0.242) - 0.0095844163)= -0.023760016	5.645383746×10^{-4}
(0.508– (1.4718×0.342) - 0.0095844163)= -0.004940016	2.440376104×10^{-4}
(0.643– (1.4718×0.423) - 0.0095844163)=0.010844183	1.175963201×10^{-4}
(0.766– (1.4718×0.508) - 0.0095844163)=0.008741183	$0.7640829248\times10^{-4}$
(0.870– (1.4718×0.588) - 0.0095844163)= -0.0005002816	$0.2502817093\times10^{-4}$
	$\sum(y_i - mx_i - b)^2 = 12.27061788 \times 10^{-4}$

$$\sigma_y^2 = \frac{1}{4}\sum_{i=1}^{N}(y - mx_i - b)^2 = \frac{1}{4} \times 12.27061788 \times 10^{-4} = 3.06765447 \times 10^{-4}$$

$$\Delta\mu = \Delta m = \sqrt{\frac{6\sigma_y^2}{D}} = \sqrt{\frac{6\times(3.06765447\times10^{-4})}{0.969285}} = 0.043576575 \approx 0.04$$

(4) Results:

- The index of refraction of the block is $\mu = 1.47 \pm 0.04$

(5) Conclusions:

$\mu = 1.47 \pm 0.04$

Discrepancy test→ $|$ True value - Exp.value $|$ ≤ 2ΔR

→ $|$ 1.52 – 1.47 $|$ ≤ 2×0.04→ 0.05 ≤ 0.08 → **so, the result is accepted.**

Through the test, we see that the result we obtained is acceptable and close to the true density of the glass (μ =1.52). Its due to many possible reasons:

- **The way that the measurements was took is accurate.**
- **I focused on taking measurements perfectly.**

There are many mistakes that I could have made if I had not measured properly, However, the result is different from the real one due to many systematic errors including:

The glass piece used in the experiment was not of uniform thickness from all sides, and this affected its density. We also assumed that the speed of light in a vacuum is equal to the speed of light in air. In addition, there are certainly random errors that we were unable to avoid. For example, it is possible that errors were made in shining the light onto the glass piece perfectly, and this therefore affects the angle.

The result can be improved by increasing the accuracy of the experiment, the tools used, and the measurements, and by improving the lighting during the experiment so that the light is dim.

Note: that the piece used in the experiment is made of glass.