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Refraction of Light on Prisma Applications

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Abstract
A prism is a clear object made of glass. Its uses include directing light beams, changing and inverting shadows, and breaking white light into the colors of the spectrum (rainbow colors). The difference in the color of the spectrum is caused by the difference in the wavelength and frequency of the constituent rays, so that in the medium these rays have different refractive indices. Assume that the medium around the prism is air. This is called the angle of deviation. The angle of deviation is the angle formed by the intersection of the extended incident light and the extended refracted light leaving the prism. The light beam that comes to the prism in the direction of ED will be refracted along the line DF and so on out of the prism in the direction of FG. It is difficult for us to see or mark the red spectrum and the purple spectrum due to the influence of light from outside the laboratory, so we need a dark enough room to see the spectrum. Difficulty in determining the direction of the light source so that it coincides with a predetermined normal line, the light is out of focus (a bit wide).
***Keyword**: Refraction; deviation; frecuency.*

1. Introduction

A prism is a clear object made of glass. Its uses include directing beams of light, changing and reversing the location of shadows, and breaking white light into spectrum colors (rainbow colors[1, 2, 3]. The difference in the color of the spectrum is due to the difference in the wavelength and frequency of the constituent rays, so in the medium, these rays have different refractive indexes [4, 5].

prism is a clear substance bounded by two planes. If a ray of light falls on one of the prism planes, which is then referred to as the refracting plane I, it will be refracted closer to the normal line. Arriving at the refracting plane II, the ray will be refracted away from the normal line. In the refracting plane I, the refracted rays approach the normal line, because the rays coming from the optical substance are less dense to the optical substance denser, namely from the air to the glass. On the other hand, in the refracting plane II, the rays are refracted away from the normal line, because the rays coming from an optically dense substance to an optically less dense substance are from glass to air. So that a ray of light that passes through a prism will be deflected from its original direction. Let us study the phenomena that occur when a ray of light passes through a prism as well as the angle of deviation and dispersion of light.

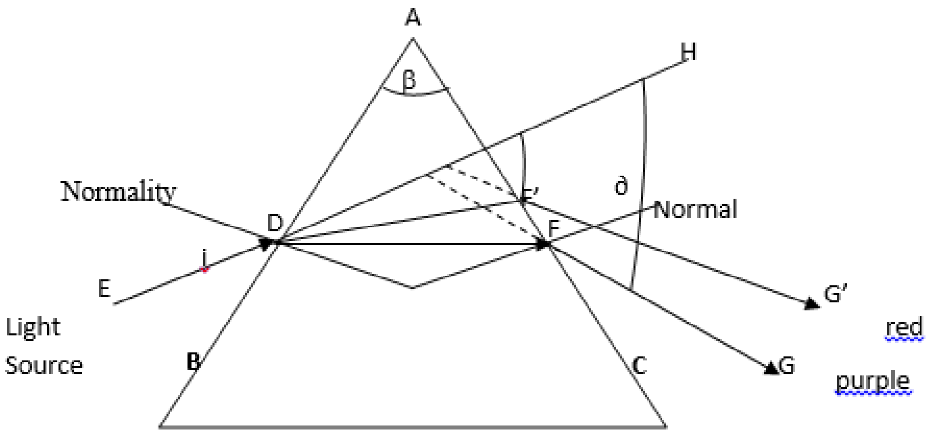
Assume that the medium around the prism is air. A ray of light entering a prism with a certain angle of incidence will be refracted twice[6. 7, 8, 9]. The first is when it enters the prism from the air, the second when it comes out of the prism. In the first refraction[10,11], the incident ray is refracted towards the normal, while in the second refraction, the incident ray is refracted away from the normal[12, 13]. This happens because the refractive index of the prism is greater than the refractive index of air or $n2 > n1$. So that the prism forms the angle of deviation[14, 15].

The definition of light refraction or refraction is an event when a visible light bends when passing through a medium to a medium that has a different optical density due to acceleration. Optical density is a property of a translucent medium. The refraction of light is divided into two, namely the first is refraction that approaches the normal line. This means the condition when light coming from a less dense or less dense medium goes to a denser medium and then the light will be refracted closer to the normal line. An example is light from air to water. Then the second is refraction away from the normal line. This means that when the light comes from a denser medium to a less dense medium, the light will be refracted away from the normal line. An example is a light from water into the air.

Refraction of light is explained in detail through Snell's Law or also known as Descartes' Law or Law of Refraction. Snell's law was first discovered by a Dutch mathematician named Willebrord Snellius. Snell's law describes the relationship between the angle of incidence and the angle of refraction that occurs when light passes through two media with different optical densities. Snell's law is also called Descartes' law because, in 1937, the French scientist Rene Descartes also explained this phenomenon through his writings Discourse on Method. The paper explained that light has a high speed when passing through a denser medium because basically light is a wave that arises because the plenum is disturbed, the continuous substance that eventually forms the world, which is called the angle of deviation. The angle of deviation is the angle formed by the intersection of the extended incident light and the extended refracted light leaving the prism[16, 17]. From Figure 1 it can be seen that the incident light beam on the prism in the ED direction will be refracted along the DF line and so on out of the prism in the FG direction. The direction of the rays coming out of the prism (direction FG) is the direction of the deviated light beam[18, 19]. The angle formed by the incident ray i1 and the refracted ray i2 is called the angle of deviation (∂). In the image, the angle of deviation is formed from the extension of the original direction of the incident ray (DH) with the deviated direction of the ray (FG). The angle of deviation is expressed by the formula [20].

2. Materials and Methods

The method used in writing this scientific paper is by studying literature and conducting direct experiments on the topic. The materials used in this research are HVS Paper, Water, and Flashlight as light materials. The equipment used includes HPLC, Kjeldahl flask, measuring cup, pavodest, Erlenmeyer, and other glassware.



Experimental stages:

1. Set up the experiment as above

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2. Place the prism on HVS paper, then draw the prism according to the shape of the prism with a sharp pencil
3. At point D draw a normal line that is perpendicular to the plane
4. Install the light source, and adjust the beam coming out of the light source so that the ED beam forms an angle of incidence i1 to the normal.
5. Mark points with a sharp pencil at points E, D, F, and G
6. Lift the light source with a prism then draw lines ED, DF, FG, (and F'G" if it is a spectrum)
7. Draw the DH line by extending the ED line and draw the extension of the FG and (F'G' lines if a spectrum occurs) until it intersects the DH line. The intersection is the angle of deviation.
8. Measure the angle i1 and its deviation using a protractor.
9. Record the measurement results in an observation journal
10. Repeat steps from the beginning so that it is repeated 10 times with different deviations.

3. Results and Discussion

Based on the results of experiments and data analysis carried out, it was obtained

NO	B	i_1	r_1	i_2	r_2	δ	$(i_1 + r_2) - \beta$
1	60°	45°	24°	35°	57°	42°	= (45+57) - 60 = 42°
2	60°	55°	25°	35°	49°	43°	= (55+49) - 60 = 44°
3	60°	50°	30°	27°	50°	43°	= (50+50) - 60 = 40°
4	60°	40°	23°	39°	58°	38°	= (40+58) - 60 = 38°

$$n_m = \frac{\sin\left(\frac{\delta+\beta}{2}\right)}{\sin\left(\frac{\beta}{2}\right)} = \frac{\sin\left(\frac{38+60}{2}\right)}{\sin\left(\frac{60}{2}\right)} = \frac{\sin 49}{\sin 30} = \frac{0.75}{0.5} = 1{,}50$$

$$\Delta n_m = \frac{1/2.\cos\left(\frac{\delta+\beta}{2}\right)}{\sin\left(\frac{\beta}{2}\right)} \Delta\delta_m = \frac{1/2.\cos\left(\frac{38+60}{2}\right)}{\sin\left(\frac{60}{2}\right)} 0{,}5$$

$$= 0.5\text{x} \frac{0{,}66}{0{,}5} \times 0{,}5$$

$$= 0{,}33$$

$$n_1 = n_m \pm \Delta n_m$$

$$n_1 = 1{,}50 \pm 0{,}33$$

Purple Light Spectrum

$$n_u = \frac{\sin\left(\frac{\delta+\beta}{2}\right)}{\sin\left(\frac{\beta}{2}\right)} = \frac{\sin\left(\frac{39+60}{2}\right)}{\sin\left(\frac{60}{2}\right)} = \frac{0{,}76}{0{,}5} = 1{,}52$$

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$$\Delta n_u = \frac{1/2.\cos\left(\frac{\delta+\beta}{2}\right)}{\sin\left(\frac{\beta}{2}\right)}\Delta\delta_u = \frac{1/2.\cos\left(\frac{39+60}{2}\right)}{\sin\left(\frac{60}{2}\right)}0{,}5$$

$$= 0{,}5x\frac{0{,}65}{0{,}5}\times 0{,}5$$

$$=0{,}32$$

$$n_2 = n_u \pm \Delta n_u = 1{,}52 \pm 0{,}32$$

Refractive index of the red light spectrum

$N_1 = 1{,}50 \pm 0{,}33$

Refractive index of the red light spectrum

$N_2 = 1{,}30 \pm 0{,}33$

Light beams into one of the refracting planes of the prism and the light that comes out of the prism will break down into its color components: red, orange, yellow, green, blue, indigo, and violet. The errors we made and affected the experimental data that were obtained the first time were due to common mistakes, i.e. errors that occurred due to human error. A common error that occurs is in the reading of the scale, namely the measurement of the angle that occurs. Errors in determining the normal angle that does not match 90 degrees and lack of accuracy in describing the light beam that is formed. Inaccuracy in adjusting the collimator (light source) so that the light beam obtained does not match the predetermined angle of incidence. The second error is systematic error caused by measuring instruments or instruments and by environmental influences when conducting experiments. The systematic error that occurred in this practicum was that the gap of the light source used was too wide so that the meeting point of the light with the normal line did not match. While the third error is a random error that occurs beyond the view of the practitioner.

4. Conclusion

The light emitted into one of the refracting planes of the prism and the light coming out of the prism will break down into its color components: red, orange, yellow, green, blue, indigo, and violet. But we can't see the description of the color components clearly, what is clearly visible is the red and purple spectrum.

Acknowledgments

It is difficult for us to see or mark the red spectrum and the purple spectrum because of the influence of light from outside the laboratory, so we need a dark enough room to see the spectrum. Difficulty in determining the direction of the light source so that it coincides with a predetermined normal line, the light is out of focus (a bit wide).

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