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Making a Simple Prism as an Alternative Physics Practicum Tools

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Abstract: Refraction of light occurs due to the difference in the speed of light in the two mediums where the speed of light in a dense medium is smaller than the speed of light in a less dense medium. One of the refraction phenomena also occurs in prism glass. Prisms help scatter incoming light from monochromatic light sources. To prove this, refraction experiments can be carried out using a prism. Where the prism used is made manually using used glass made of acrylic. The prism that is made is then filled with water on the inside and a test is carried out to determine the refraction and the value of the angle of deviation. Based on the results obtained, the refraction of the prism glass made in where a beam of light that passes through the prism is deflected from its original direction, while the angle of deviation of the rays is proportional to the angle of incidence.

Keywords: Glass Prism; Practicum; Refraction

Introduction

Physics is a branch of Natural Sciences (IPA), where science explains events that exist in nature, where problems related to science are often encountered in everyday life (Sholikah, et.al., 2020). Various phenomena related to science can sometimes bring kinds of questions in our minds. One of the phenomena that are often encountered is an object that is dipped in a clear container filled with water which then appears broken when observed from the side of the container (Yulianingsih, 2018). This is one of the natural science phenomena known as refraction events or also known as deflections. Refraction usually occurs when objects are in a medium that has a different density, for example, air and water (Hadiningrum, et.al., 2016). Refraction of light can occur because the two mediums have different values for the speed of light which for a dense medium, the speed of light will be smaller when compared to a less dense medium. (Winingsih, 2015).

Refraction is a term related to the angle of incidence, refraction, and the normal line, where the angle of incidence is defined as incident light that forms a normal angle in a medium, while the angle of refraction is the formation of an angle based on the occurrence of incident light (reflected light) to the normal line (Hadiningrum, et.al., 2016). Furthermore, for the minimum deviation angle obtained based on the angle of incidence and the angle of refraction, it can be seen that it is necessary to conduct experiments on the minimum deviation angle on the prism. Prism is an optical instrument used to determine the refraction and dispersion of incoming light by measuring the angle of deviation of the light. (Dewi, et.al., 2021). Furthermore Dewi, et.al. (2021) states that the function of a prism is to spread light that comes from a monochromatic light source. To prove this, refraction experiments can be carried out using a prism.

An experimental activity generally helps students to be actively involved in doing something, and learning activities can encourage communication and learning together and individually (Anggraini & Suyadi, 2019). However, the lack of equipment in the laboratory is an obstacle that makes physics learning not in context and mathematical in nature (Ain, 2013). Therefore, simple tools were made from used materials and several other materials that are easily found in the surrounding environment. The refraction experiment was carried out using a prism. Where prism glass is made used glass

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made of acrylic. There are two prisms made of glass with different angle sizes. The prism that is made is expected to contain water in it. The water used as a test tool made because water is more affordable and does not require additional costs. In retaining high enough heat, water has this capacity while other liquids do not and this makes the temperature of the water can be reduced in temperature variations (Nurcahyo, et.al., 2014). Meanwhile, to find the angle of refraction of the prism, two different objects will be used, namely a laser and a pin. A laser is an event that is stimulated by light by emitting radiation (Winingsih, 2015). While the use of pins is also because pins have advantages when looking for the angle of refraction of light, one of which is because the prices issued are quite affordable (Saputra & Sucahyo, 2015). For this reason, it is necessary to manufacture and test prismatic glass made of acrylic that has been made.

Method

Tools and Materials

The tools and materials used in the manufacture of this tool are as: Used Glass, Glass Cutter, Glass Glue, Water, Laser, Wooden Board, Straight Pin, Protractor, Ruler, and Block Millimeter

How to Assemble Tools

The method of making or assembling tools is as follows:

a. Prepare the tools and materials needed.
b. Cut the used glass with a width of 3 cm and a length of 5 cm using a glass cutter.
c. Do the steps until you get three pieces of glass with the same size.
d. Then shape it like a prism by gluing it using glass glue and then dry it.
e. Cut the glass in the shape of an equilateral triangle that has a side length of 3 cm.
f. Glue the pieces of glass that have been glued together on the triangular-shaped glass and then glue them back together and dry.
g. Cut the glass in the shape of an equilateral triangle that has a side length of 3 cm.
h. Glue the pieces of glass that have been glued together on the triangular-shaped glass and then glue them back together and dry.
i. Fill the prism with water and cover it with triangular glass.
j. Glue the prism that has been filled with water and glue it with glass glue then dry.
k. Check again whether the prism that has been filled with water has a leak or not, if there is a leak then fix it with glass glue.
l. Glue the prism to the wooden board and then glue it.
m. The tool can already be used to carry out experiments.

How to Use the Tool

The steps of the refraction experiment using a prism carried out are:

a. Put the millimeter block paper on the wooden board.
b. Put the prism on the millimeter block of paper.
c. Draw a prism on millimeter block paper.
d. Make a normal line (N1) on the side of the first plane.
e. Make the angle of incidence as desired.
f. Stick the pin in the line of incident light.
g. Create a second normal line (N2).
h. Observe the refraction that occurs.
i. Knowing the refraction and then sticking the pin in accordance with the known refraction.
j. Calculates the deviation of the prism and the angle of refraction of light.
k. Repeat the experiment 5 times and record the observations in the observation table.

Result and Discussion

The manufacture of a prism as an experiment on refraction was carried out with two different types of experimental objects, where a laser and a pin were used. Prisma glass made using acrylic glass is cut to the length of 5 cm. There are two prisms made of glass, both of which have different angles. The prism glass angles are 45° and 60°. The results of the prism glass that has been previously glued with glass glue, then after the glass glue dries, the prism is filled with water. Furthermore, the prism is checked for leaks, is still a leak then gluing is done again. After that, data was collected from the prism glass that was made.

In the experiment using a pin, the prism glass was first placed on a millimeter block of paper and then the shape of the prism base was drawn on the millimeter block. After that, draw a normal line and then determine the value of the angle of incidence for the experiment. Where in this experiment, three different angles of incidence were used, namely 35°, 50°, and 60°.

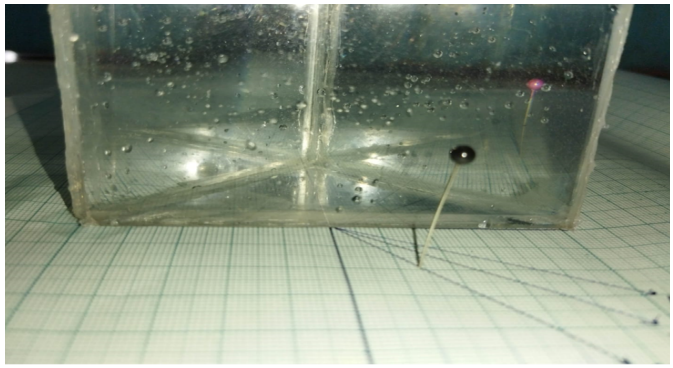

Figure 1, Experiment with Pins

Next, the pin is placed at a predetermined angle of incidence, then viewed on each other side of the prism to see where the image or refraction is formed. The data

from the prism glass experiment using a pin can be seen in Table 1.

Table 1. Results of Observing the Minimum Deviation of Prisms with Pins

Prism Angle	Come Corner (i)	Refractive Angle (r)	Deviation Angle (d)
45°	35°	33°	23°
	50°	55°	60°
	60°	35°	50°
60°	35°	60°	35°
	50°	40°	30°
	60°	35°	35°

Based on Table 1, it can be said that when the initial angle of the beam is reduced, the value of the angle of deviation obtained will also be smaller. Then it can also be said that the angle of deviation will reach a minimum if the angle of incidence of light is equal to the angle of refraction. As for the theory, the initial angle value will be proportional to the value of the refractive angle on the prism where the incident is a process in determining the minimum refractive index value of the prism. In the experiments that have been carried out, the values between the angle of refraction and the angle of incidence are not the same, which can be due to the lack of skill of the observer in conducting experiments and in observing the refractive line. Then the data is retrieved again using a different object, where the second object used is a laser. Similar to the previous experiment, where the prism glass was first placed on top of the millimeter block.

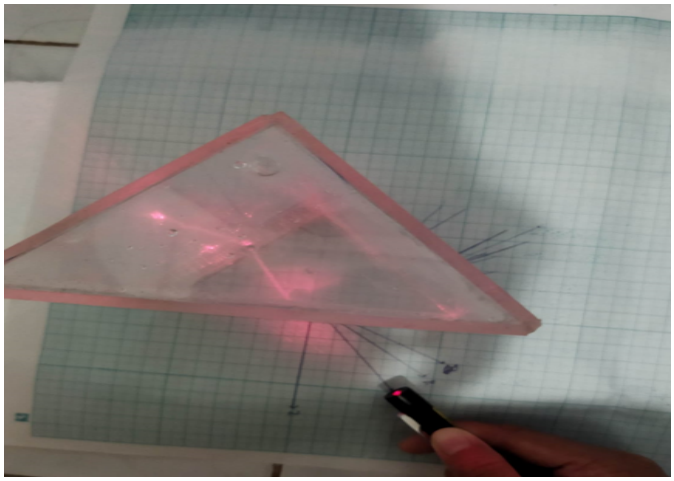

Figure 2. Experiment with Laser

Followed by drawing a line for the normal line, and determining the angle of incidence, then observations are made and the observations obtained are then recorded. The data from the laser refraction experiment on the prism obtained can be seen in Table 2.

Table 2. Results of Observing the Minimum Deviation of Prisms with Laser

Prism Angle	Come Corner (i)	Refractive Angle (r)	Deviation Angle (d)
45°	35°	32°	22°
	50°	22°	27°
	60°	35°	50°
60°	35°	61°	36°
	50°	46°	36°
	60°	40°	40°

The experimental results in Table 2 show that the data obtained are not much different from the data in the experiment using a pin. Where the value of the angle of incidence of the small rays will be proportional to the value of the angle of deviation. It is the same with experiments using pins that the angle of refraction and angle of incidence are not the same. Factors that cause this to happen can be caused by observer errors in conducting experiments and can also be caused by making glass with less standard materials.

Conclusion

A ray of light that passes through a prism will be deflected from its original direction, while the angle of deviation of the rays is proportional to the angle of incidence. The existence of unequal data acquisition between the angle of incidence and the angle of refraction can be caused by observer errors in conducting experiments and making prismatic glass that does not match the size of one angle to another. The advice given is that data collection can be done in groups to anticipate data collection errors, and in making prismatic glass use the type of glass that supports it.

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