Organization of Solving Problems in the Module "Linear Optics" of General Physics Based on Modern Pedagogical Technologies

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ABSTRACT
In this article, there is proposed a method for solving the problems of the theme "Light return and fracture" in the general physics module "Linear optics" using new pedagogical technologies.

Keywords: Linear optics, module, pedagogical technology, blits-questionnaire, light fracture, light return.

Introduction

Practical classes are designed to teach students to deepen, expand and apply their knowledge of physics in lectures and independent work. The organization of problem-solving in general physics based on modern pedagogical technologies has a good effect on the assessment of students' knowledge in practical classes in the modular system [1-4]. This is because it has been repeatedly proven that if each type of lesson is organized using modern innovative technologies, the quality of education will rise to a higher level, and student's interest in learning will increase.

In this article, we aim to describe the methods of applying modern pedagogical technologies in solving problems on the topic "Laws of refraction and refraction of light", which belongs to the module "Linear Optics" of General Physics.

The main part

In the process of educating educators, we encounter that students are not ready for educational models built on new educational models. In this regard, we believe that it is necessary to achieve the acquisition of skills in the use of modern pedagogical technologies.

To accelerate the practice of using modern pedagogical technologies in the system of continuing education, we consider it an effective way to divide higher education students into small groups in practical classes and teach them to use these technologies in graphic organizers [5-10

That is why we have chosen simpler issues in this work.

Subject: The law of return of light. We will first consider the application of modern pedagogical technologies as an example of solving the problem of the law of return.

The purpose of the practical training: To acquaint students with the methods of application of modern pedagogical technologies on the example of topics related to the laws of refraction and refraction of light.

Students in the classroom are divided into small groups. Students are already familiar with the use of modern pedagogical technologies and organizers used in the lesson.

To focus and activate the students' attention, the teacher asks the questions "Blitz-questionnaire" and "Brainstorming":

"Blitz-survey" questions:

1. What is meant by light?
2. From what surfaces do light return flat?
3. From what surfaces does light return diffuse?
4. What is the angle of incidence of the light?
5. What is the angle of rotation of the light?

The B / BX / B spreadsheet is distributed to students (divided into groups, the questions are shown on a slide) to get students 'feedback.

Table 1. B / BX / B table.

№	*Subject question*	*I know (+)*	*To know I*	*I know I got*
1	What do you know			
2	Do you know the			
3	Do you know what			

Questions to reinforce:

1. What surface is called a mirror surface?
2. Where is the flat return of light used?
3. Where is the diffuse return of light used?

"Blitz-survey" questions:

1. What is the absolute refractive index of the environment?
2. What is the refractive index of the environment?
3. Explain the law of refraction when light passes from a medium with low optical density to a medium with high optical density.
4. Explain the law of refraction when light passes from a medium with high optical density to a medium with low optical density.
5. Explain the law of refraction of light.
6. How does the law of refraction depend on the optical density of the medium?
7. Give examples of the application of the law of refraction of light.

2. Example. The light falls on a flat parallel glass plate at an angle of 300 and exits from it parallel to the original light. The refractive index of glass is 1.5. If the distance between the beams is 1.94 cm, what is the thickness d of the plate?

Given: $i_1 = 30°$ $n_h = 1$;

$n_{sh} = 1.5$;

$L = 1.94$ cm.

Need to find: d =?

S-light source, SO-incident light, OB-refracted light, L-beam displacement distance, d-glass plate thickness, i_1-fall angle, i_2-refraction angle;

"Brainstorming" questions

1. Why do the objects on the other side of the campfire seem to vibrate when we sit by the campfire?
2. What quantities does the value of the light refractive index of the medium depend on?

Students will be given an Insert spreadsheet to complete throughout the lesson. Students fill in separately. They systematize the information obtained in the process of solving the problem - enter it in the columns of the table, according to the following symbols defined in the text:

"V" - corresponds to the information I know;

"-" - Contrary to the information I know;

"+" - new information for me;

"?" "You don't understand me."

Information identification, and completion is required.

Table 2. Insert table

V	+	-	

Solution: We use the law of refraction to solve the problem. The light beam refracts at the adjacent boundary of the two environments. The ratio of the angle of incidence sine to the angle of refraction sine is a constant of magnitude for both media, and the ratio of the absolute refractive index of the second medium to the absolute refractive index of the first medium. Just like the law of rotation, at the point of incidence of the incident light, the normal refraction and the rays transferred to the surface lie in the same plane. n_{21} is said to be the relative refractive index of the second medium relative to the first medium. The refractive index of any medium relative to a vacuum is called the absolute refractive index.

$sin^{i} n_2 / n; Fn_{21}$ (1) The relation represents the law of refraction of light. $n_2 / n_1 = n_{21}$ referred to as the relative refractive index of light. The law of refraction of light applies not only at the boundary of the approach of two environments but also at the adjacent boundary of several environments. The law of refraction of light is very widely used in practice. They can be used to determine the optical densities and thicknesses of transparent substances.

We write the main condition of the matter:

Then the law of refraction for the point of incidence of light:

$\frac{\sin i}{\sin r} = n(2) n$- light refractive index of glass;

The law of refraction when light is refracted from glass and released into the air

$\frac{\sin i}{\sin r} = \frac{1}{n}$ (3)determined by

As can be seen from the drawing, two triangles and formed. We derive a working formula by performing several mathematical operations according to the drawing and according to the law of refraction $\Delta AOB \Delta O$CB.

ΔAOB and $cos i_2 = \frac{OA}{OB}$we can see that we write the expressions from (4) to (5). If we take (1) the expression and (2) the ratio to the expression, $OA = dcos i_2 = \frac{d}{OB} \Delta AOB sin(i_1 - i_2) = \frac{BC}{OB} BC = Lsin(i_1 - i_2) = \frac{L}{OB}$ $\frac{cos_2}{sin(i_1 - i_2)} = \frac{d}{L}$(6) is formed. (3) follows from expression (7). $d = L \frac{cos_2}{sin(i_1 - i_2)}$

The fracture angle is not given in the case condition. From the law of refraction, we calculate the angle of refraction from expression (8). $i_2 n = \frac{\sin i_1}{\sin i_2} \sin i_2 = \frac{\sin i_1}{n}$

$\sin i_2 = \frac{\sin i\, 30^{\circ}}{1.5} = \frac{0.5}{1.5} \approx 0.33$ so, equals $i_2 = 19°30'$

(7) is the formula for finding the thickness of the glass we need to calculate.

Calculation: $d = l \frac{\cos i_2}{\sin(i_1 - i_2)} = \frac{1.94 \cdot 10^{-2} m * cos 19°30}{\sin(30° - 19°30)} = \frac{1.94 \cdot 10^{-2} \cdot 0.9426}{0.1822} 10.036 \cdot 10^{-2} m \approx 0.1 m$

Answer: d = 0.1m.

Conclusion. The speed of light scattering varies. Because the angle of refraction is smaller than the angle of incidence, the light refractive index of air is smaller than the light refractive index of glass. The light moves inside the glass and refracts at the glass-air boundary and exits by sliding a distance of 1.94 cm parallel to the first incident light.

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