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SOLVING EXPERIMENTAL PROBLEMS IN PHYSICS TEACHING IN A SECONDARY SCHOOL

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Abstract:

This article examines the problem of improving the methodology of teaching physics in secondary schools by solving experimental problems in optics. By solving a number of experimental problems, some methods of studying optics were identified. An empirical solution to the experimental problems is shown.

Keyword: Experiment, task, optics, quantity, quality, experience, light, beam.

Introduction

UMUMTA'LIM MAKTAB FIZIKA TA'LIMIDA EKSPERIMENTAL MASALALARNI YECHISH

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Annotatsiya

Ushbu maqolada umumta'lim maktablarda fizikani o'qitish metodini optika bo'limidan eksperimental masalalarni hal qilish orqali takomillashtirish muammosi qaralgan. Biq qator eksperimental masalalarni yechish orqali optika bo'limini o'rganishni ba'zi usullari ochib berilgan. Eksperimental masalalarning empirik tarzda yechimi ko'rsatilgan.

Kalit so'zlar: Eksperiment, masala, optika, miqdor, sifat, tajriba, yorug'lik, nur.

Introduction

Currently, various methods are used to increase the level of knowledge of students in physics in secondary schools. In this case, it is possible to increase the number of experimental and test works in the process of teaching physics and comprehensively organize the independent work of students. Experimental problems are the main assistant in this matter. The solution to experimental problems is found empirically. Experimental problems are problems of physics

that cannot be solved without conducting experiments. Experimental physics problems require more time from students to prepare for their solution, but at the same time they have a positive effect on the quality of teaching such a complex subject as "Physics". By solving experimental problems, students' activity in the lesson increases, children acquire the ability to analyze various phenomena, as well as to use their skills and knowledge in solving everyday problems.

ANALYSIS OF RELATED LITERATURE

There is no clear definition of experimental problems in the methodological literature. P.A. In Znamensky's "Methodology of Teaching Physics", experimental problems include computational problems and problem questions, in the solution of which it is said that experience is of great importance. His work does not provide a methodology for solving such problems, but there are examples of them [1]. S.S. Moshkov in his work "Experimental Problems in Physics" gives a classification of experimental problems, methods for their solution and examples [1]. V.P. Orekhova and S.E. Kamenetsky define experimental problems as follows: "Experimental problems are tasks in which an experiment is used for one purpose or another" [2]. Based on the above, it is possible to formulate a holistic definition of experimental problems. I.G. Antipin divides the solution of experimental problems into several groups depending on the degree of participation of experience [2].

RESEARCH METHODOLOGY

Experimental problems can be qualitative and quantitative. Qualitative experimental problems include problems that do not require mathematical calculations and quantitative data for their solution. In this type of problem, the student must independently reproduce some physical phenomenon using the provided tools or predict this phenomenon as a result of an experiment. Quantitative experimental problems are problems whose solution is carried out by mathematical processing of experimentally obtained data. Solving such problems begins with an experiment. To solve a quantitative problem, mathematical formulas are used to perform measurements, and then calculate the answer to the problem.

There are two main problems in considering light phenomena: how light propagates from a source in a homogeneous medium and how it behaves at the boundary of two media. At the same time, three main parts can be distinguished: the propagation of light along a straight line, the law of reflection of light, and the law of refraction of light. The remaining materials contain the consequences of these laws[2].

Graphical visualization is of great importance in the study of light phenomena - the use of a blackboard, tables, and a graphic projector. However, before constructing an image on the blackboard and in a notebook, one should strive to show the true shape of light rays and the images of objects obtained as a result, and to create a visual image of light phenomena using instruments.

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ANALYSIS AND RESULTS

The following is a description and solution of an optical experimental problem.

Experimental problem: Measurement of the refractive index of the medium.

Task. Measurement of the refractive index of vegetable oil. To do this, the following steps are performed.

Instruments and equipment. Laser source, Petri dish, glass with vegetable oil to be studied, graph paper.

Setting up the experiment

1) The Petri dish is filled with oil. It is placed on a sheet of graph paper. A circle is drawn around it on the sheet.

2) The laser beam is directed to a certain point on the side wall of the oil dish. The direction of the beam is determined. Points corresponding to the points of entry and exit of the beam into the glass are marked on the circle (or next to it).

3) The experiment is repeated 7-10 times, each time a new entry point and angle of incidence of the beam are selected. The results of all measurements are recorded on graph paper.

4) A graph is drawn of the dependence of the sine of the angle of incidence of the beam from the glass on the sine of the angle of incidence of the beam on the glass (Figure 1).

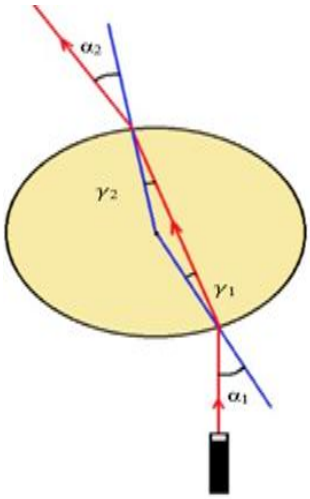

Figure 1. Schematic of the path of light rays passing through a Petri dish filled with oil (top view).

Solution. According to the law of refraction, the refractive indices of two media are related as follows:

$$\frac{n_2}{n_1} = \frac{\sin\alpha}{\sin\gamma} \quad (1)$$

in this α - The angle of incidence of a light ray at the boundary of the medium, γ- is the angle of refraction. Note that both rays lie in the same plane. The refractive index of air is assumed to be unity. If a light ray falls into any medium other than air, equation (1) is simplified to:

$$n = \frac{\sin\alpha}{\sin\gamma} (2)$$

n - refractive index of the medium.

Explanations

The diagram shows the incident laser beam in red, and the normals at the points of incidence and exit of the beam on the cup in blue. The refractive index n of the medium is found from the relationship:

$$\frac{\sin\alpha_1}{\sin\alpha_2} = n = \frac{\sin\alpha}{\sin\gamma} (3)$$

Instructions. During the experiment, use only the side surface of the Petri dish - it is impossible to shine a laser on the dish from above or below with oil; the refraction of light on a curved glass surface can be neglected.

CONCLUSIONS AND SUGGESTIONS

In the conditions of experimental problems, not all the information necessary for their solution is available, therefore, the student must first understand the physical phenomenon indicated in the problem, determine the data he needs and substitute them into the formula, which the student can do very rationally, think over and find ways to determine them.

In the process of independently solving experimental problems in physics lessons, students acquire the following skills:

- study, observe the phenomena and properties of objects and substances;
- describe the results of their observations and experiments;
- put forward hypotheses;
- select the devices necessary for conducting the experiment;
- make measurements;
- calculate indirect and direct measurement errors;
- display measurement results in the form of graphs and tables;
- explain the results of experiments;
- draw appropriate conclusions;
- participate in the discussion of the results of the experiment.

Solving experimental physics problems educates students in a critical approach to measurement results. Students understand that the results of measurements obtained during the experiment are approximate. When conducting an experiment, it is necessary to take into account that various reasons affect the accuracy of the data. Therefore, when conducting an experiment, all adverse effects should be eliminated.

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