

Solving Physics Problems Using Modeling Methods

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Abstract:

This article discusses the effective use of the modeling method in solving physical problems, at the same time, it is thought about creating a model for understanding the essence of the problems and gaining advanced ideas through this model.

Keywords: innovation, model, qualification requirements, physics, education of non-standard issues.

Introduction

Modeling - the study of objects of knowledge (physical phenomena and processes) with the help of their models is the creation and study of models of existing objects and phenomena. The modeling method is widely used in modern science. It facilitates the process of scientific research, and in some cases becomes the only means of studying complex objects. Modeling is of great importance in the study of abstract objects, distant objects, very small objects. The use of physical and logical modeling is of great importance for the theoretical and practical development of physics.

Physical modeling is successfully used to solve various practical problems in exact sciences. The modeling method provides an opportunity to quantitatively express one or another quantity that characterizes the problem, and then to study the relationship. The effectiveness of modeling is confirmed by the execution of huge calculations related to complex systems, the trajectory of space ships, the creation of complex engineering structures, the design of transport highways, etc. Usually, conducting computational experiments on a model is carried out in cases where it is not possible to study the real object experimentally or it is not economically feasible.

Literature analysis

Working on physics problems is one of the necessary elements of educational work. Problem solving helps students to learn the connection between physical phenomena, laws, to further develop their logical thinking and ability to search, and to form the skills to achieve goals. It teaches how to use the acquired theoretical knowledge in different situations and establish a connection between theory and practice.

Knowing the laws of physics is not defined only by describing them, but also requires solving the problems related to them. Therefore, in the study of physics, problem solving not only occupies an important place, but also creates a certain difficulty.

When analyzing a problem and creating a system of equations representing a phenomenon, the main attention should be paid to what are the frequently encountered physical quantities. In particular, if the quantity is of vector nature, it is necessary to take into account not only their numerical values, but also their directions. It should be remembered that the numerical value and direction of vector quantities is their integral description. When talking about the constancy or change of the vector magnitude, it is necessary to consider its direction along with its numerical value. It is worth noting that as soon as you read the condition of the problem, you should immediately focus on the amount you are looking for and not try to find it quickly. First, it is necessary to thoroughly understand the physical phenomenon mentioned in the question, remember the physical laws underlying this phenomenon, and try to clearly imagine the mechanism of its occurrence.

We would like to quote the following comments of Professor D.SH.Shodiev about problem solving skills: "Creating physical formulas will never give learners the opportunity to get acquainted with natural phenomena. Generating and memorizing formulas is secondary, the main thing is that the learner should understand the essence and meaning of the physical phenomenon during the educational process. The main purpose of exemplifying this point is that the general secondary education system and academic lyceums are now more mathematized than necessary physics textbooks. In teaching the content of physics education, often focusing on simple mathematical structures and calculations also limits the possibility of understanding the physical essence of the studied phenomenon, because mathematics is not the content of physics, but a tool. This weapon should be used only in necessary situations.

It is known that in order to work on problems, superficial knowledge of physical laws is not enough. In some cases, knowledge of specific methods and techniques that are common is also required, and in other cases, such methods and techniques may not be available. In this case, in addition to knowing the theory, the formation of logical thinking is important.

Working on problems from the physics course of higher educational institutions requires the following:

- ✓ explaining the reason, essence and content of the methods used;
- ✓ deeper knowledge and wider understanding of physical laws;
- ✓ development of thinking ability of students

Research methodology

Types of problems and ways of working differ according to their content and didactic purpose. They can be divided into classes according to the following characteristics:

- ✓ on providing information on the matter;
- ✓ on the way of processing the issue;

Qualitative issues are those that do not require calculation, but require the explanation of one or another phenomenon, the selection of the conditions for the occurrence of the phenomenon, and the

opening of qualitative classifications of different views. In these, numerical expressions are not given directly.

Calculation problems are problems in which the answer to the given question is found through calculations. To solve such issues, they are first analyzed qualitatively. As a result, calculation methods and solutions that can be applied are determined, and arithmetic, algebraic, geometric and graphic methods are used for calculation.

Arithmetic operations are used to solve the problem arithmetically, and formulas and equations are used when using the algebraic method. When solving a problem in a geometrical way, the theorems of geometry are used, and in the graphical method, the methods of drawing a graph or analyzing a given graph are used.

Analysis based on the modeling of the studied phenomenon in problem solving provides an opportunity to systematically master the process. Studying with the help of modeling phenomena and processes in solving physical problems is carried out in four stages.

The first step is to express the laws defining the main objects of the model.

The second stage is the analysis of the physical problem, verification and model selection.

The third stage is to determine whether the selected model satisfies the accepted practice criteria. In other words, to determine whether the obtained results match the theoretical data.

The fourth stage is to conduct a further analysis of the model by gathering information about the phenomenon being studied, and to develop and refine it.

Thus, the main content of modeling consists of theoretical analysis of the model based on the preliminary study of the object, obtaining results through practical calculations and comparing the results with theoretical data about the object, correction (improvement) and so on. In the process of solving physical problems, the problem is first formalized in order to create a model. Necessary characters are entered according to the content of the issue. Then, a functional relationship written in the form of a formula or algorithm is created between the quantities.

We will consider what has been said in concrete examples.

In problem solving, experiment is used in two different senses. First, in order to find the answer to the given questions, it is necessary to conduct an experiment. Second, an experiment is conducted to determine the relationships given in the problem or to find the numerical value of a given quantity. In order to get the desired result, the necessary mathematical calculation is used.

Task: Using a dynamometer, determine the FIK during the movement of a block placed on an inclined plane along an inclined plane.

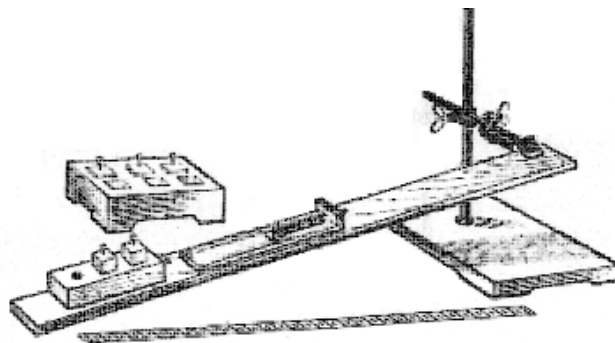


Figure 1.

ORDER OF WORK

1. Install the device as shown in Figure 1.

2. Measure the weight P of the load together with the beam using a dynamometer.
3. Use a dynamometer to move the brush straight as shown in the picture. In this case, record the reading of the dynamometer.

$$4. \eta = \frac{A_f}{A_t} 100$$

determine FIK using the formula.

Nº	$h, \text{ sm}$	$L, \text{ sm}$	$P, \text{ N}$	$F, \text{ N}$	η
1					
2					
3					

The problems presented in the graphic method are also divided into two types. In the first type, the problem is given in graphic form. The answer will be found by analyzing it and performing the necessary actions. In the second type, a problem with the usual condition is given, and the answer is found by constructing a functional graph representing the relationship of two quantities.

Analysis and results

Computer modeling.

There is also a computer modeling technology for solving physical problems, the purpose of which is to speed up the process of understanding and understanding the nature that surrounds us, the phenomena that occur in it, events and changes in society by means of modern methods. Various motion problems can be solved by computer models. This leads to a deeper and wider feeling of the nature of the processes taking place, a real evaluation of the obtained results, and an expansion of imagination about the possibilities of computer modeling.

The theoretical foundations of modeling are divided into five stages.

At the first stage, the process is qualitatively analyzed, the purpose of the issue is studied, and relevant information is collected. By studying the essence of the process on a theoretical basis, its necessary indicators are determined, which forms the basis of this modeling.

The second stage is the optimality criterion of the process, in which all work is brought to the same measurement unit, and the criterion is expressed in the form of a mathematical function, certain values have a unique solution.

At the third stage, the model is described in the form of mathematical expressions (system of equations and inequalities), which can be written in linear, quadratic, non-linear, hyperbolic and other mathematical expressions.

At the fourth stage, the method that determines the quantitative solution of the formed model is selected. Modeling methods are used to solve a problem represented by a model using a mathematical expression. It is possible to use programming or other methods to determine the optimal solution to the problem.

At the fifth stage of modeling, the only (acceptable) solution to the problem is analyzed quantitatively and qualitatively, and the relative situation between them is obtained.

Modeling of events and processes in physics problem-solving classes increases the visibility of the studied educational material and the level of the scientific-theoretical essence of the statement, expands the worldview of students, develops their thinking.

Studies and analyzes have shown that it is difficult to calculate complex integrals or sums that arise in the work of physical problems analytically. It is known that these integrals can be calculated

numerically using various programs. Such an approach to working with problems develops students' creative thinking and leads to the formation of programming and modeling skills. In higher education, a lot of physical quantities are calculated with the help of integrals, including parameters such as center of gravity, moment of inertia and gravitational field strength of massive bodies, field strength and potential of charged bodies, and magnetic field strength are determined for central symmetry.

The department dealing with the most problems in the university physics course on electricity and magnetism is the department on finding the electric field strength and potential of charged bodies. In order to find these quantities in this type of problems, depending on the shape of the charged body, one goes up to the three-dimensional integral. If the considered object does not have central symmetry, or if it does not have symmetry with respect to the point, it is difficult to integrate the analytical expression created to find the required parameter, in some cases it is more difficult to create the expression under the integral.

Conclusion

In conclusion, it should be said that it is important to teach students to create models of original objects and to solve physics problems using the modeling method, and to form the skills of modeling various objects.

It was shown that teaching students to solve theoretical problems related to physics using the modeling method can be carried out in direct connection with teaching them to solve problems of another field in harmony.

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