# USE OF COMPUTER PROGRAMS IN SOLVING PHYSICS PROBLEMS

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**ABSTRACT**

*The article shows the method of using computer programs to solve physical problems graphically. By solving problems using the graphical method, students can easily absorb large amounts of information related to the topic. Implementation of the lesson with the use of digital technologies not only helps teachers to save time, but also makes it easier for students to master the subject.*

**KEYWORDS:** *Graphical Method, Physical Problem, Digital Technologies, Connection Graphs, Computer Programs.*

## INTRODUCTION

Acquiring knowledge in a general physics course means not only understanding physical phenomena and laws, but also putting them into practice learning to use is also. Any application of the general rules of physics to solve a specific, specific question is solving a physical problem. A physical problem is a problem that can be solved by thinking logically, based on physical laws, and using mathematical operations. Solving problems in physics belongs to practical educational methods and fulfills educational, educational and developmental tasks based on the active thinking activity of the student. The physical meaning of various definitions, rules, and laws becomes clear to students only after they have used them many times in solving concrete example problems [1-4]. The educational task of a physical problem leads to the formation of a scientific outlook in students, educates independent thinking, interest in learning, perseverance in achieving the goal. During problem solving, students develop logical and creative thinking. Being able to solve problems leads to effective application of knowledge in practice [3-6].

Computers can be called the great invention of the 20th century. Their appearance makes a great contribution to the development of science and technology. Now it is difficult to point to any sector of the national economy that has not been penetrated by computers. Especially, the scope of their application in physics is incredibly wide of the President of the Republic of Uzbekistan Sh. Mirziyoyev to the Oliy Majlis, it was emphasized that the acquisition of digital knowledge and modern information technologies is necessary and necessary to achieve development, which gives the opportunity to take the shortest path to progress. Development of Information Technologies and Communications in Decree No. PF-6108 of the President of the Republic of Uzbekistan of November 6, 2020 "On measures to develop the fields of education and science in the new development period of Uzbekistan" The task of introducing modern forms of teaching, new pedagogical and information technologies in the preschool education system by January 1, 2022, together with the Ministry of Education, the State Inspection of Education Quality Control and other interested ministries and agencies is envisaged [7-11].

**Relevance of the Topic**

In addition to improving the quality of education, digital technologies serve to demonstrate the educational process and facilitate easy mastery of topics.

Nowadays, it is impossible to imagine without computers the processing of information sent from spaceships, the control of the movement of particles in accelerators, the conducting of very sensitive physics experiments, and the solving of complex problems of theoretical physics. This is very important for the initial study of physical concepts and laws. But it happens in life almost all physical problems cannot be solved analytically and require the use of computers to solve them. That is why it is useful for every physicist to know how to solve problems on a computer independently. Today, scientists and pedagogues of the world have carried out certain works in this field, and computers and similar digital information technologies are effectively used to solve problems in physics graphically and use them in the educational process. But the almost absence of literature published in Uzbek in this field indicates how much work needs to be done in this field. Based on the above, in this work, it was aimed to solve problems that can be solved graphically using computer programs [11-14].

Must first master the methods of solving problems. There are several methods of solving problems in physics, and solving problems graphically is one of them. is of great importance. In the process of solving graphic problems, students learn the fundamentals of physics. In the process of solving graphic problems in the lesson and in the process of independent homework, students see in practice the interrelationships of physics and mathematics.

This method is used in solving problems where it is possible to draw graphical connections of two physical quantities and their product gives the value of the sought physical quantity. In this case, the numerical value of the sought quantity is equal to the surface of the figure lying under the graph. Therefore, we can see the distance traveled from the speed-time graph, gas pressure P and the volume V occupied by the connections - the work done by the gas when it expands, and the current I from the time-t graph - the length of the conductor It is possible to determine the charge passing through the cross-sectional surface, the graph of the connection of the capacitor charge to the voltage on its covers - the work done by the current source in the process of charging the capacitor.

As a proof of our point, let's look at some problems that can be solved graphically, as an example.

Issue 1. When an ideal gas expands, its pressure changes according to the law P = P o + aV, where a- is a constant quantity. Find the molar heat capacity of the gas for this process.

Figure 1. The ideal gas pressure to gas volume graph The molar heat capacity of a gas is determined by the following formula – p

$$C = Q / \left( vAT \right), \qquad (1)$$

Here, Q is equal to the amount of heat given to v mole gas to raise its temperature to AT. So, the molar heat capacity is equal to the amount of heat used to raise the temperature of one mole of gas by one unit. The SI unit of heat capacity is J/(mol K). We determine the amount of heat by the first law of thermodynamics

$$Q = AU + A, \tag{2}$$

Here AU is the change in internal energy of the gas, A is the work done by the gas in this process.

The change in internal energy is determined by the following formula, regardless of the process by which the work done by the gas is performed

$$AU = CvvAT \tag{3}$$

Let's determine the work done by the gas in this process graphically. Based on the condition of the problem, we draw a graph of gas pressure and its volume (Fig. 1). The work done by the gas is determined by the plane of the area bounded by the coordinates P and V, that is, the surface of the hatched trapezoid in the graph:

$$A = \left(Po\ +\ P\right)V / 2 = \left(2Po + aV\right)V / 2 \tag{4}$$

Putting expressions (3) and (4) into (2), we get the expression for Q:

$$Q = CvvAT + \left(2Po + aV\right)V / 2 \tag{5}$$

(1) we determine the vAT multiplier needed to determine C according to the formula from the following system of equations: P = Po + aV;

$$PAV = vRAT \tag{6}$$

Here AV = V - 0 = V. Solving this system of equations, we get the following

$$vAT = \left(Po + aV\right)V / R \tag{7}$$

expressions (5) and (7) into (1), we find the expression for calculating the molar heat capacity of gas for the given process:

$$C = Cv + R\left[\left(2Po + aV\right) / \left(2Po + 2aV\right)\right] \tag{8}$$

Issue 1. A passenger who is late for a train notices that the penultimate car has passed in front of him at ti = io s, and the last one at t2 = 8 s. Assuming the motion of the train to be uniformly accelerated, determine the delay time of the passenger.

The train's speed versus time during its uniformly accelerated motion. In the graph, the time intervals of the penultimate and last carriages of the rail train passing in front of the observer through t2 are defined. According to the condition of the problem, it is necessary to find the delay time of the passenger to . It should be noted that according to the velocity graph, the path traveled by the object is determined by the surface of the area bounded by the v and t axes on the graph. Since the length of the wagons is the same, the distances covered by the train in the time t1 and t2 are also the same, so the surfaces of the trapezoids with heights equal to t1 and t2 must also be equal to each other, i.e. S1 = S2.

The surface of the first trapezoid is equal to S1 = (Vo +V 1)t 1 / 2, and that of the second is equal to S2 = (V1 + V2)t2 / 2.

Equating the right sides of these equations, we get the following equation:

$$(Vo+V1)t\ 1=(V1+V2)t2 \tag{9}$$

to, (to + t1) h (to + t1 + t2) corresponding to the moments of time, expressed by the speed formula of the train speed included in equation (1) in flat acceleration, we get the following:

$$\begin{aligned} &Vo = a\ to; \\ &V2 = a(to+t1+t2); \\ &V1 = a(to+t1); \end{aligned} \tag{10}$$

Putting these expressions into (1) and making some simple substitutions, we get the following expression:

$$to=(t22+2t1t2-t12)/2(t1-t2), \tag{11}$$

Putting the numerical values in the problem condition into the expression (3), we find that the passenger's delay time is equal to = 31 s.

Most of the physical problems recommended for solving on the computer are designed to work without approximate methods, in which it is required to determine the relationship between two or more physical quantities, or to draw a graph of the connection between these quantities. Studying the relationships between physical quantities with the help of graphs creates a clearer picture of them and helps students gain deeper knowledge. Special functions and operators have been developed for drawing graphs and shapes in BASIC. To draw a graph of a function using these operators, the following program can be used: REM q/d - Graphing SCREEN 2

H=(BA)/N

FOR X=A TO B STEP H GOSUB 300 PSET (x,y ) NEXT X RETURN

Issue 2. Draw a time graph of the relative amount of remaining atoms in a radioactive substance with a half-life T. Solving. According to the law of radioactive decay

N=No.2-t/T

From here N/No=2-t/T we enter notation: N/NoY, tX Problem program: 10 REM

20 INPUT "Half-life"; T 30 INPUT "Number of time intervals and points"; A, B, N 40 GOSUB 200 50 END

300 Y=2A(-x/ T)* l00 310 RETURN

Our goal is to improve problem solving with graphic methods in specialized schools on the basis of digital technologies. Currently, digital technologies are widely and effectively used in the educational process at the international level. I hope that an electronic program that can be an assistant for physics teachers can be the only program that covers all parts of physics that can be solved graphically.

The following will be possible with the help of the program:

- Draws the graphs presented in the condition of the problem;
- Allows to calculate problems based on formulas in a short time.

**CONCLUSIONS**

1. Solving problems in various ways, including digital technologies, increases students' ability to think creatively;

2. The use of computer programs to solve physical problems graphically helps students to easily absorb large amounts of information related to the subject. Implementation of the lesson using digital technologies not only saves time for teachers, but also makes it easier for students to master the subject.

3. Solving problems on the basis of computer programs, checking whether problems solved in the traditional way are correct or incorrect, allows students to self-evaluate.

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