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Research Article

METHODOLOGY OF SELECTING AND SOLVING DIFFERENT TYPES OF NON-STANDARD PROBLEMS RELATED TO "KINEMATICS" OF PHYSICS

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ABSTRACT

The method of choosing and solving various types of non-standard problems related to the "Kinematics" department of physics in general education schools is described.

KEYWORDS

Non-standard, issue, didactic, principle, phenomenon, process, situation, experience, thinking, knowledge, skill, competence, competence, assignment, thought, thinking.

INTRODUCTION

In our scientific-research work, the method of choosing, creating and solving non-standard graphic, drawing, picture-type problems related to the "Kinematics" department of physics is based on the principle of demonstration of didactics, that is, according to the words of the Czech pedagogue Ya.A. Komensky, the golden rule of didactics .

The standard issue is understood as the minimum knowledge, skills, competence and competence to be given to the student. But by non-standard issue, knowledge, skills, skills and competences above the minimum are understood. Therefore, non-standard problems are recommended for gifted students. Therefore, it is appropriate to refer non-standard issues to higher education institutions and students participating in the Olympiad [14].

It is worth noting that in the process of teaching mechanics, non-standard problems are considered special forms of educational creative problems, while solving such non-standard problems, previously acquired knowledge is deepened and activated, the experience of applying knowledge in a new situation expands, the formed qualities of thinking and thinking skills are improved.

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In the process of teaching mechanics, a system of psychological, pedagogical and methodical approaches is formed, which will be necessary in the process of solving non-standard problems in order to clarify the specific features of the development of the creative outlook of students [15].

In the process of teaching mechanics, it is necessary to determine and implement the educational goal, determine the content of education, describe a new topic, repeat the previous topic and determine the level of mastery, formation, development, generalization and strengthening of the necessary knowledge, skills, skills and competencies in students, independent creative thinking activities in students. and used to determine the levels and extent of acquired knowledge, skills, skills and competences, and development of abilities [16].

The most important thing is that the purposeful use of non-standard, practical-applied, natural-scientific non-standard problems is the most important tool in forming logical thinking, scientific worldview and developing personal qualities in students [17].

Nonstandard problems in mechanics are usually more complicated and can be done with any mechanics formula. It is useful to assign a non-standard problem solving task in extracurricular activities after a practical lesson on non-standard problems in the classroom. This is of great importance in developing students' ability to imagine non-standard problems [14, 15, 16, 17].

Below, we will consider solving different types of non-standard problems related to mechanics.

Issue 1. The graph of *y (t)* given in Figure 1 consists of a semicircle. In this case y $_{max}$ = *y* $_o$. Find the average speed of this motion.

The path traveled by the object in the time interval O t is numerically equal to the surface of the semicircle in Fig. 8. It is known that y $_{max}$ = *y* $_o$ the radius of the semicircle, then the surface of the semicircle

$$s = \frac{\pi R^2}{2} = \frac{\pi v_o^2}{2}$$

and this is the path taken, ie $s = \frac{\pi v_o^2}{2}$.

is equal to the ratio of the time taken to cover the distance traveled, i.e. In this case, time t $\upsilon_{\text{ўрт.}} = \frac{s}{t}$ is equal to the diameter of the semicircle or two radii in the graph, i.e. t $_1$ =2 *R*. But t = 2 *v* $_o$.

Now if we put the values of s distance and t times into the average speed formula, $\upsilon_{\text{ўрт.}} = \frac{s}{t} = \frac{s}{t} = \frac{\pi v_o^2}{2 * 2v_o} = \frac{\pi v_o}{4}$ it will be equal.

So, the average speed is equal to y $_{average}$ = .$\frac{\pi v_0}{4}$

Answer: $\upsilon_{ave} = \frac{\pi v_o}{4}$.

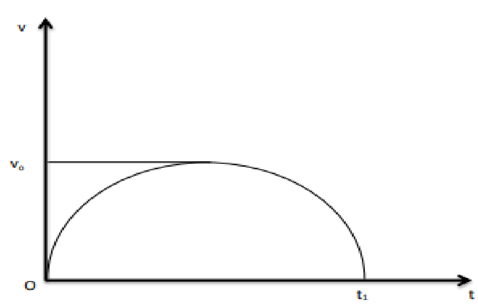

Figure 1.

Issue 2. A pump with power N should transfer water Q m ^{3} /h to a height H in a pipe with cross-sectional surface **S.** What should be the smallest (minimum) value of power N? If the pump power is not enough for this, if the pump cannot be replaced, then what to do?

Suppose the pump pumps water Q m ^{3} /h. The volume of water flowing through the S-section surface pipe in the time interval Δt is v=qΔt. The height of the water column in the pipe $h = 1 = \frac{V}{S} = \frac{Q\Delta t}{S}$ is equal to

Flow rate of water in the pipe $\upsilon = \frac{l}{\Delta t} = \frac{Q\Delta t}{s\Delta t} = \frac{Q}{S}$ will be

The work done by the pump consists of the kinetic energy of moving the water up to y and the potential energy of the water at the height H. It is known that the density of water ρ, then the mass m = rV =r Q Δ t will be equal to Potential energy E $_{pot.}$ = mgH = r QΔtgH. The work done by the pump in the time interval Δt is A= E $_{pot.}$ + E consists of $_{kin.}$

If we put the values of potential and kinetic energies to this,

$A = \rho Q \Delta t g H + \frac{\rho \Delta t Q^3}{2S^2}$ will be equal to

Minimum pump capacity (for FIK 100%) $N = \frac{A}{\Delta t} = \rho q g H + \frac{\rho Q^3}{2S^2}$.

If we increase the cross-sectional area S of the pipe, then the value of the second adder decreases in squares and the minimum power of the pump decreases, that is, if the power of the pump N is not enough, then this can be done by increasing the cross-sectional area S of the pipe.

Issue 3. The body is α at an angle to the horizon y_o - the origin shoots quickly. At what height does the kinetic energy of an object equal its potential energy?

The full energy of the body during movement is stored, therefore $\frac{mv_o^2}{2} = \frac{mv^2}{2} + mgh$; where $\frac{mv_0^2}{2}$ the kinetic energy of the object at the time of the launch $\frac{mv^2}{2}$ and mgh are the kinetic and potential energies of the object to the height h. What we need to find is the kinetic and potential energy at the height

$\frac{mv^2}{2} = mgh$ will be equal to

$\left(\begin{array}{l} \frac{mv_0^2}{2} = \frac{mv^2}{2} + mgh \\ \frac{mv^2}{2} = mgh \end{array} \right) : m$ if we reduce the system of equations to m, $\frac{v_0^2}{2} = \frac{v^2}{2} + gh$; $\frac{v^2}{2} = gh$; it follows that if we determine the height h- . $h = \frac{v_0^2}{4g}$

Problem 4: A body falls from a height H with no initial velocity. It hits a fixed plane at an angle of 30 ° to the horizon at a height h (Fig. 2). The time the object falls Determine t and flight distance λ .

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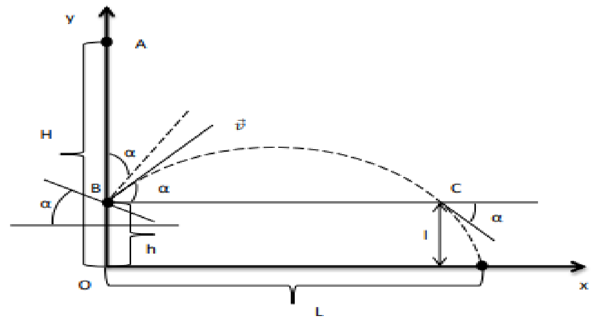

Figure 2.

the object to fall $H-h=\frac{gt_1^2}{2}$ from point A to *point B is found from the following formula:* from this $2(H-h)=gt_1^2$ ёки $t_1^2=\frac{2(H-h)}{g}$, $t_1=\sqrt{\frac{2(H-h)}{g}}$.

The angle of descent is equal to the angle of return. Therefore, after hitting the plane and returning to the point S, the body moves at an angle of 30 ^{o} relative to the horizon. We determine the speed of the body when it hits the point V of the plane: $\upsilon=\sqrt{2(H-h)g}$.

The speed of the body during the return is quantitatively equal to the speed during the descent, therefore:

$$t_1=\frac{2v\sin a}{g}=\frac{2\sqrt{2(H-h)g}\cdot 0{,}5}{g}=\sqrt{\frac{2(H-h)}{g}}.$$

The velocity of the object at point C is equal to the velocity at point V, but is directed in the other direction according to the attempted trajectory. Its vertical organizer $v_0=v\sin a=\sqrt{2(H-h)g}\cdot 0{,}5.$

Here t_2 is the time of movement of the body from V to S.

The vertical movement of the body from the point S is an accelerated movement, therefore

$$h=\frac{t_2\sqrt{2(H-h)g}}{2}+\frac{gt_3^2}{2}$$

t_3 this equation we solve with respect to:

$$(t)_{3,1,2}=\frac{2(H-h)g\pm\sqrt{2Hg-2hg+8hg}}{2g}-\frac{2(H-h)g\pm\sqrt{2I}}{2g}$$

Then $(t)_{3,1,2}=\sqrt{\frac{(H+3h)}{2g}}-\sqrt{\frac{H-h}{2g}}$. we determine the time of All movement: $t_1+t_2+t_3=t$, i.e

$$t=\sqrt{\frac{2(H-h)}{2g}}+\sqrt{\frac{2(H-h)}{2g}}+\sqrt{\frac{H+2h}{2g}}-\sqrt{\frac{H-h}{2g}}=\frac{3}{2}\sqrt{\frac{2(H}{2}}$$

will be

In the XOY coordinate system we have chosen, the flight distance is $OA_1=OC_1+C_1A_1$, that is, $OS_1=VC$ – to the horizon corresponds to the flight distance of the selected object at an angle of 30 ^{o}, then

$$OC_1=\frac{v^2\sin 2a}{g}=\frac{2(H-h)g\sqrt{3}}{2g}=\sqrt{3(H-h)}.$$

The horizontal component of the velocity after the body passes the point C $v_1=v\cos a=\sqrt{2(H-h)g\cdot\frac{\sqrt{3}}{2}}$ is equal to .

Since the vertical and horizontal movements of the body are independent movements

$$A_1C_1=vt_3=\frac{\sqrt{3}*\sqrt{2(H-h)g}}{2}*\left(\sqrt{\frac{H+3h}{2g}}-\sqrt{\frac{H-h}{2g}}\right.$$

In that case

$$L_1 = OC_1 + A_1C_1 = \sqrt{3}(H-h) + \frac{\sqrt{3}*\sqrt{2(H-h)g}}{2} * \left(\sqrt{\frac{H+3h}{2g}} - \sqrt{\frac{H-h}{2g}}\right) =$$

$$= \frac{\sqrt{3}}{2}(H-h) + \sqrt{H+2hH-3h^2} \text{ бўлади.}$$

Answers: $t = \frac{3}{2}\sqrt{\frac{2(H-h)}{g}} + \sqrt{\frac{H+3h}{2g}};$

$$h = \frac{\sqrt{3}}{2}(H-h) + \sqrt{H^2+2hH-3h^2}.$$

It should be noted that choosing, composing and solving non-standard problems, first of all, forms the imagination of students or applicants; secondly, develops independent thinking; thirdly, it activates creative activities; improves skills, qualifications and competencies.

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