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METHODOLOGY OF SELECTION, CONSTRUCTION AND SOLUTION OF NON-STANDARD GRAPHICS, DRAWINGS, PICTURES OF THE DEPARTMENT OF PHYSICS "MECHANICS"

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Abstract:

This article describes the methodology of selection, construction and solution of non-standard graphic, drawing, picture-type problems in the "Mechanics" section of physics according to the demonstrative principle of didactics.

Keywords: Nonstandard, type, knowledge, skill, competence, competence, creativity, technology, drawing, graphics, drawing, matter, mass, speed, acceleration, power.

The article describes the methodology of selection, construction and solution of non-standard graphic, graphic, drawing problems in the "Mechanics" section of physics, according to the principle of demonstration of didactics, in the words of Czech pedagogue Jan Amos Comenius, the golden rule of didactics. A non-standard issue is defined as the minimum knowledge, skills and competencies given to a student. But non-standard matter is understood as knowledge, skills and competencies above the minimum. Hence, non-standard subjects are therefore recommended for more gifted students. Therefore, it is expedient to refer non-standard issues to higher education institutions, students participating in the Olympiad.

Analysis of the relevant literature. The article focuses on VA Krutetsky's well-founded scientific hypothesis about the main approaches to the formation of students 'creative abilities and the possibilities of non-standard issues in the development of students' worldview.

It should be noted that in the process of teaching physics, non-standard problems are a special manifestation of educational and creative problems.

In the process of teaching physics, a system of psychological, pedagogical and methodological approaches is formed, which is necessary in the process of solving non-standard problems to determine the specifics of the development of students' creative worldview [1].

Problem solving in the process of teaching physics is the main form and means of organizing students' physical activity. Figuratively speaking, problem-solving is at the heart of teaching physics. In the process of teaching physics, the definition and implementation of educational goals, defining the content of education, stating a new topic, determining the level of repetition and mastery of the previous topic, the formation, development, generalization and consolidation of necessary knowledge, skills and abilities, independent creative thinking and worldview development and is used to determine the level and scope of knowledge, skills and competencies acquired. Most importantly, the purposeful use of non-standard, practical, natural-scientific issues is the main tool for students to develop logical thinking, scientific outlook and skills, competencies and competencies of their personal qualities [2].

ANALYSIS AND RESULTS.

Defining and implementing educational goals, defining the content of education, stating a new topic, determining the level of repetition and mastery of the previous topic, forming, developing, generalizing and strengthening the necessary knowledge, skills and abilities in students, independent creative thinking activities and abilities development and is used to determine the level and scope of knowledge, skills and competencies acquired. Most importantly, the purposeful use of non-standard, practical, natural-scientific issues is the main tool for students to think logically, to form a scientific worldview and develop their personal qualities. [5]

In the process of teaching physics, students have the opportunity to get acquainted with the use of physics in industry, agriculture, medicine and transport, communications, ...; an understanding of automation is given, solving non-standard problems that are widely used in life. This is of great importance in preparing students for a commonly useful cocktail.

Non-standard problems in mechanics are usually simple and can be solved by any physical formula. It is helpful to give assignments to solve problems in an extracurricular setting rather than a practical lesson in the classroom. This is of great importance in developing the ability of students to visualize non-standard issues. [3]

Below we discuss how to solve different types of problems.

Issue 1. The vertical wall is moving with acceleration relative to the horizon. In it lies a pallet (Fig. 1). The coefficient of friction between the wall and the pallet is k = 0.4. Draw a graph of the relationship between the friction force between the pallet and the wall and the acceleration of the wall. a); b) Find the acceleration and velocity modulus () of the pallet when. [4]

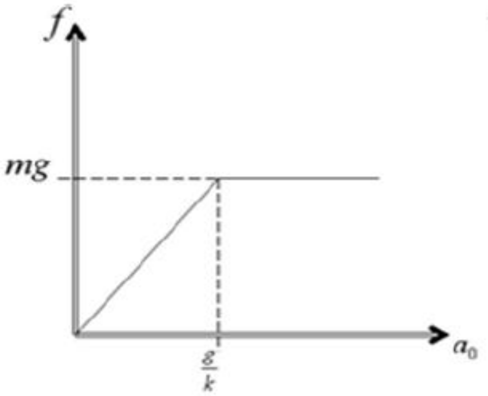

Figure-1

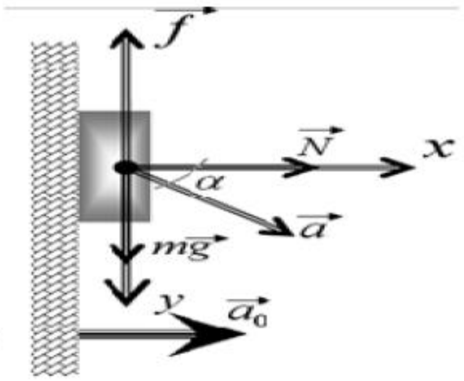

Figure -2

Given:

к=0,4

a) $a_0 = 30м/c^2$; b) $a_0 = 10м/c^2$

F(a_0)=?

$\vec{a}$ =?

Solution:

The pallet is affected by three forces. They are: gravity $m\vec{g}$, normal reaction force $\vec{N}$, friction force $\vec{f}$. According to Newton's second law: $m\vec{a} = m\vec{g} + \vec{N} + \vec{f}$

Based on Figure 1, we obtain a projection with respect to the selected x and y axes:;

$ma_x = N$; $ma_y = mg - f$

Hence, the acceleration of the pallet along the x-axis is equal to the acceleration of the wall:;

$a_x = a_0$; $N = ma_0$

At insignificant values of wall acceleration, the pallet slides along the wall. Then the friction force is equal to:

$$f = kN = kma_0 .$$

From this we obtain the following expression: $a_y = g - \frac{f}{m} = a - ka_0$

If so $ka_0 \geq 0$, $a_y \leq 0$ yes. This happens when the pallet is "stuck" $a_y = 0$ to the $f = mg$ wall.

Based on the above, we can draw a graph of the relationship between f the friction force between the pallet and the wall and a_0 the acceleration of the wall. (Figure 2)

Depending on the condition : a) $ka_0 > g$ Because:

$$a_x = a_0 = 30m/s^2;$$
$$a_y = 0$$
$$a = a_0$$

Depending on the condition б) $ka_0 < g$ as is

$$a_x = a_0 = 10 m/s^2;$$

$$a_y = g - ka_0 = 6 m/s^2$$

we find the acceleration:

$$a = \sqrt{a_x^2 + a_y^2} \approx 11{,}66 m/s^2$$

$$tg\alpha = \frac{a_y}{a_x} = 0{,}6 => \alpha = 31^o$$

Answer: 11,66 m/s^2

Issue 2. There is a ball on the flat non-smooth bottom of the container. The bottom of the vessel is tilted at an angle to the horizon (Fig. 3). The ball is held in place by a string parallel to the bottom of the bowl. How can the bottom of the container be tilted to the largest angle α so that the ball is in balance? Is equal to the coefficient μ of friction. [5]

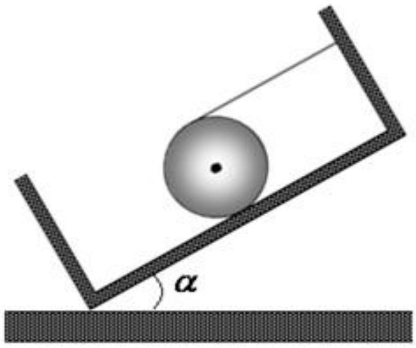

Figure-3

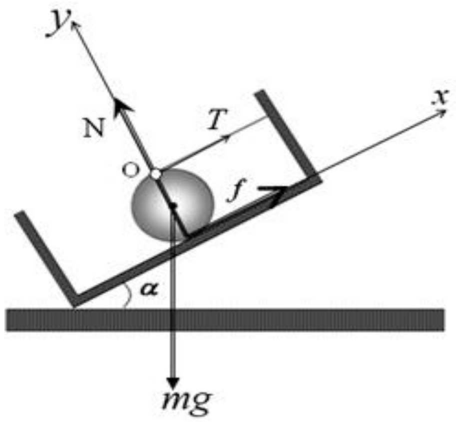

Figure -4

Given:

μ

α =?

Solution: The ball is affected by the force of gravity mg, the normal reaction force N, the tensile force of the rope $\vec{T}$, and the friction force (Fig. 4). The ball is still. Therefore, according to Newton's second law, the vector sum of these forces must be zero:

$$m\vec{g} + \vec{N} + \vec{T} + \vec{f} = 0$$

We get a projection on the selected y-axis:

$$-mg\cos\alpha + N = 0; \; N = mg\cos\alpha \quad (1)$$

To keep the ball in equilibrium,. $f \le \mu N$, $f \le \mu mg\cos\alpha$ (2) there will be.

If a balloon were to move, it would seem to revolve around point O. In order for the sphere not to move, the vector sum of the moments of the forces relative to that point must be zero.

$$-mg \cdot R\sin a + f \cdot 2R + T \cdot 0 = 0$$

$$f = \frac{1}{2} mg\sin\alpha \quad (3)$$

(1) Substituting the result into condition (2), we find:

$$\frac{1}{2} mg\sin\alpha \le \mu mg\cos\alpha \;=>\; tg\alpha \le 2\mu \;=>\; \alpha \le artg 2\mu$$

So α will be the largest $\alpha = artg 2\mu$ value of.

Answer: $\alpha = artg 2\mu$ т

Issue 3. Two pallets of the same mass m slide together in a sloping plane with a slope angle (Fig. 5). The coefficients of sliding friction between the pallets and the inclined plane are k1 and k2 (k1> k2). Find the force of interaction between the pallets. [6]

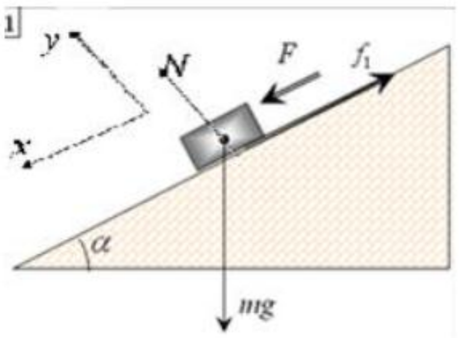

Figure 5

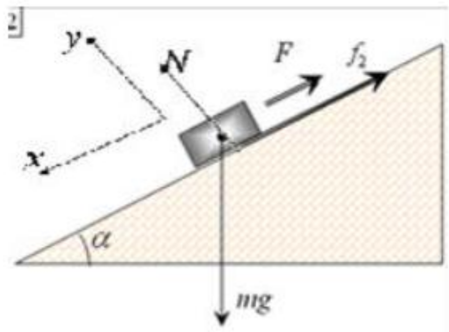

Figure 6

Given:	Solution:
m, α , k_1, k_2	If we assume that the second body does not exist, the force of interaction will be as if the first body is being pushed by the force F. That is, the downward force F along the inclined plane is affected. If we assume that the second body itself is falling, then this force on the second body will be directed upwards along the inclined plane.
F=?	

Based on the above, we obtain the projections on the axis selected according to Newton's law II for each body.

Forces acting on the body: gravity mg, base reaction force N, friction force f , interaction force between pallets F; According to Newton's second law, these forces react as follows:

$$m\vec{g} + \vec{N} + \vec{f} + \vec{F} = m\vec{a}$$

For item 1: We get a projection on the selected y-axis:

$-mg\cos\alpha + N = 0$ => $N = mg\cos\alpha$

We get a projection on the selected y-axis: $mg\sin\alpha - f_1 + F = ma$

$f_1 = k_1 N = k_1 mg\cos\alpha$ considering:

$mg\sin\alpha - k_1 mg\cos\alpha + F = ma$ (4)

For item 2: We get a projection on the selected y-axis:

$-mg\cos\alpha + N = 0$ => $N = mg\cos\alpha$

We get a projection on the selected y-axis: $mg\sin\alpha - f_2 - F = ma$

$f_2 = k_2 N = k_2 mg\cos\alpha$ considering:

$mg\sin\alpha - k_2 mg\cos\alpha - F = ma$ (5)

By comparing (4) and (5), we find F:

$$\begin{cases} mg\sin\alpha - k_1 mg\cos\alpha + F = ma \\ mg\sin\alpha - k_2 mg\cos\alpha - F = ma \end{cases}$$

$$mg\sin\alpha - k_1 mg\cos\alpha + F = mg\sin\alpha - k_2 mg\cos\alpha - F$$

$$F = \frac{1}{2}(k_1 - k_2)mg\cos\alpha$$

Answer: $F = \frac{1}{2}(k_1 - k_2)mg\cos\alpha$

In conclusion, it can be said that the selection, formulation, and solution of non-standard problems form, first, the imaginary imagination of the student or entrant; second, it develops independent thinking; third, activates creative activity; improves skills, competencies and competencies.

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