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ВЕСТНИК

РОО «НАЦИОНАЛЬНОЙ
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В 2016 году для развития и улучшения качества жизни казахстанцев был создан частный Благотворительный фонд «Халык». За годы своей деятельности на реализацию благотворительных проектов в областях образования и науки, социальной защиты, культуры, здравоохранения и спорта, Фонд выделил более 45 миллиардов тенге.

Особое внимание Благотворительный фонд «Халык» уделяет образовательным программам, считая это направление одним из ключевых в своей деятельности. Оказывая поддержку отечественному образованию, Фонд вносит свой посильный вклад в развитие качественного образования в Казахстане. Тем самым способствуя росту числа людей, способных менять жизнь в стране к лучшему – профессионалов в различных сферах, потенциальных лидеров и «великих умов». Одной из значимых инициатив фонда «Халык» в образовательной сфере стал проект Ozgeris powered by Halyk Fund – первый в стране бизнес-инкубатор для учащихся 9-11 классов, который помогает развивать необходимые в современном мире предпринимательские навыки. Так, на содействие малому бизнесу школьников было выделено более 200 грантов. Для поддержки талантливых и мотивированных детей Фонд неоднократно выделял гранты на обучение в Международной школе «Мирас» и в Astana IT University, а также помог казахстанским школьникам принять участие в престижном конкурсе «USTEM Robotics» в США. Авторские работы в рамках проекта «Тәлімгер», которому Фонд оказал поддержку, легли в основу учебной программы, учебников и учебно-методических книг по предмету «Основы предпринимательства и бизнеса», преподаваемого в 10-11 классах казахстанских школ и колледжей.

Помимо помощи школьникам, учащимся колледжей и студентам Фонд считает важным внести свой вклад в повышение квалификации педагогов, совершенствование их знаний и навыков, поскольку именно они являются проводниками знаний будущих поколений казахстанцев. При поддержке Фонда «Халык» в южной столице был организован ежегодный городской конкурс педагогов «Almaty Digital Ustaz.

Важной инициативой стал реализуемый проект по обучению основам финансовой грамотности преподавателей из восьми областей Казахстана, что должно оказать существенное влияние на воспитание финансовой

грамотности и предпринимательского мышления у нового поколения граждан страны.

Необходимую помощь Фонд «Халык» оказывает и тем, кто особенно остро в ней нуждается. В рамках социальной защиты населения активно проводится работа по поддержке детей, оставшихся без родителей, детей и взрослых из социально уязвимых слоев населения, людей с ограниченными возможностями, а также обеспечению нуждающихся социальным жильем, строительству социально важных объектов, таких как детские сады, детские площадки и физкультурно-оздоровительные комплексы.

В копилку добрых дел Фонда «Халык» можно добавить оказание помощи детскому спорту, куда относится поддержка в развитии детского футбола и карате в нашей стране. Жизненно важную помощь Благотворительный фонд «Халык» оказал нашим соотечественникам во время недавней пандемии COVID-19. Тогда, в разгар тяжелой борьбы с коронавирусной инфекцией Фонд выделил свыше 11 миллиардов тенге на приобретение необходимого медицинского оборудования и дорогостоящих медицинских препаратов, автомобилей скорой медицинской помощи и средств защиты, адресную материальную помощь социально уязвимым слоям населения и денежные выплаты медицинским работникам.

В 2023 году наряду с другими проектами, нацеленными на повышение благосостояния казахстанских граждан Фонд решил уделить особое внимание науке, поскольку она является частью общественной культуры, а уровень ее развития определяет уровень развития государства.

Поддержка Фондом выпуска журналов Национальной Академии наук Республики Казахстан, которые входят в международные фонды Scopus и Wos и в которых публикуются статьи отечественных ученых, докторантов и магистрантов, а также научных сотрудников высших учебных заведений и научно-исследовательских институтов нашей страны является не менее значимым вкладом Фонда в развитие казахстанского общества.

С уважением, Благотворительный Фонд «Халык»!

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METHODOLOGY FOR THE DEVELOPMENT OF SCHOOLCHILDREN'S SKILLS IN ANALYZING PHYSICS PROBLEMS

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Abstract. The article deals with the problem of developing students' skills in analyzing physical tasks. In addition, we are talking about ways that lead to the use of physical terms, leading to an understanding of the course of a physical phenomenon, a process in a physical problem. This indicates the relevance of developing student's skills of written and oral presentation in the scientific language of physics in the process of preparing scientific projects in the context of the development of modern science and technology. In this regard, the purpose of the research work was to improve the methodology for developing students' problem solving skills when solving physics problems. Having analyzed the methodology of teaching physics, the authors of the article have developed a system of questions that contribute to an in-depth understanding of the types of physical tasks and physical objects considered in them. Providing students with a sequence of questions in a logical sequence when solving physics problems was considered as a methodological approach that contributes to the development of their skills in analyzing physical problems. The questions asked allow you to analyze the tasks, determine the physical quantity, and higher-level questions allow you to understand the essence of the physical phenomenon. Depending on the types of problems (graphical, experimental, textual) considered in the physics section of the secondary school in mechanics, appropriate samples of questions were presented, and an analysis of possible answers of students was carried out. In addition, the article describes the progress of the conducted research on the development of students' skills in analyzing graphical and experimental tasks. and the correct use of scien-

tific terms in solving problems.

Keywords: physics, problem analysis skill, problem solving, teaching methods

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МЕКТЕП ОҚУШЫЛАРЫНЫҢ ФИЗИКА ЕСЕПТЕРІН ТАЛДАУ ДАҒДЫЛАРЫН ДАМЫТУ ӘДІСТЕМЕСІ

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Аннотация. Мақалада орта мектеп оқушыларының физикалық есептерді талдау дағдысын дамыту мәселесі қарастырылды. Сонымен қатар, физикалық есеп мазұнындағы физикалық құбылыстың, процестің барысын түсінуге әкелетін физикалық терминдерді қолдануға әкелетін жолдар сөз болады. Бұл қазіргі ғылым мен техниканың даму жағдайында оқушылардың ғылыми жобалар дайындау барысында физиканың ғылыми тілінде жазбаша және ауызша баяндау дағдыларын дамытудың өзектілігін көрсетеді. Соған байланысты зерттеу жұмысының мақсатына физикадан есептер шығару кезінде мектеп оқушыларының есепті талдау дағдысын дамыту әдістемесін жетілдіру алынды. Мақала авторлары физиканың оқыту әдістемесіне талдау жасай отырып, физикалық есептердің түрлеріне, оларда қарастырылатын физикалық нысандарды терең түсінуге ықпал ететін сұрақтар жүйесін әзірледі. Оқушылардың физикадан есептер шығару барысында оқушыларға логикалық бірізділіктегі сұрақтар ретін ұсыну олардың есеп мазмұнын талдау дағдысын дамытуға ықпал ететін әдістемелік тәсіл ретінде қарастырды. Берілген сұрақтар есептерге талдау жасауға мүмкіндік береді, оқушы ізделініп отырған физикалық шаманы анықтайды, ал жоғары деңгейлі сұрақтар физикалық құбылыстың мәнін түсінуге мүмкіндік береді. Орта мектеп физикасының механика бөлімінде қарастырылатын есептің түрлеріне (графиктік, эксперименттік, мәтіндік) қарай сәйкесінше сұрақтар үлгілері ұсынылып, оқушылардың мүмкін жауаптарына талдау жасалды. Сонымен қатар, мақалада оқушылардың графикалық және эксперименттік есептерді талдау дағдыларын дамыту және есептерді шығаруда ғылыми терминдерді дұрыс қолдану бойынша жүргізілген зерттеу барысы сипатталған.

Түйін сөздер: физика, есепті талдау дағдысы, есептер шығару оқыту әдістемесі

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МЕТОДИКА РАЗВИТИЯ У ШКОЛЬНИКОВ НАВЫКОВ АНАЛИЗА ЗАДАЧ ПО ФИЗИКЕ

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Аннотация. В статье рассматривается проблема развития у школьников навыков анализа физических задач. Кроме того, речь идет о путях, приводящих к использованию физических терминов, приводящих к пониманию хода физического явления, процесса в физической задаче. Это свидетельствует об актуальности развития у учащихся навыков письменного и устного изложения на научном языке физики в процессе подготовки научных проектов в условиях развития современной науки и техники. В связи с этим целью исследовательской работы являлось совершенствование методики развития у школьников навыков анализа задач при решении задач по физике. Проанализировав методику преподавания физики, авторы статьи разработали систему вопросов, которые способствуют углубленному пониманию типов физических задач, физических объектов, рассматриваемых в них. Предоставление учащимися вопросов в логической последовательности при решении задач по физике рассматривалось как методический подход, способствующий развитию их навыков анализа физических задач. Заданные вопросы позволяют проанализировать задачи, определить физическую величину, а вопросы более высокого уровня позволяют понять сущность физические явления. В зависимости от типов задач (графических, экспериментальных, текстовых), рассматриваемых в разделе физики средней школы по механике, были представлены соответствующие образцы вопросов и проведен анализ возможных ответов учащихся. Кроме того, в статье описывается ход проведенных исследований по развитию у учащихся навыков анализа графических и экспериментальных задач и правильного использования научных терминов при решении задач.

Ключевые слова: физика, навык анализа задачи, решение задач, методика обучения

Introduction

One of the qualitative indicators of a student's knowledge is the ability to work with information, solve problems following changes, and make decisions responsibly.

However, in pedagogical practice, it is often reflected that students memorize the answers to test tasks to get a "good" grade. In addition to demonstrating what they have learned, students are required to solve professional problems in new situations by investigating and explaining a phenomenon in progress, considering various contributing factors, identifying and explaining relationships between factors, scientifically substantiating their findings, and so on. Therefore, understanding the meaning of the considered physical terms and the use of scientific language is of great importance in learning. This, in turn, increases students ' ability to explain scientific theory orally and in writing in physical terms. Therefore, improving the methods of developing students' skills in analyzing problems in the process of solving them becomes one of the most pressing problems.

Materials and methods

When teaching physics in high school, problem solving is very important. Solving and analyzing the problem allows you to understand and remember the basic laws and formulas of physics, gives an idea of their characteristics and limits of application. Physical tasks develop skills in applying the general laws of the material world to solve specific tasks of practical and cognitive importance. The ability to solve problems is the best criterion for assessing the depth of study of program material and its assimilation. Each physical task is based on a specific specific representation of one or more fundamental laws of nature and their consequences. Therefore, in order to deduce the problems of any branch of physics, it is necessary to carefully study the theory of this issue and carefully analyze its examples. Without mastering the theoretical material in physics, it will be impossible to analyze relatively simple tasks. Thus, solving physical problems helps students to master the subject of physics. Teaching students to solve problems allows them to form specific actions, analytical skills related to the application of knowledge in certain situations. This analytical activity should be formed both on an algorithmic and creative level. Therefore, we believe that the development of students' analytical skills in solving physics problems in the process of solving them should be carried out consciously.

The purpose of general secondary education is to create an educational space suitable for ensuring the academic training of students for continuing education and professional self-determination in higher education based on the development of a wide range of skills, including the use of various communication methods (State mandatory standards of preschool education and training, primary, basic secondary, general secondary, technical and professional, post-secondary education, 2022).

The analysis of the task content directly depends on the proper use of physical terms and concepts by students, that is, the linguistic style of the subject - the academic language. Academic language is a means of mastering the content of the discipline and improving the ability to think and work with physical concepts. Therefore, physics teachers must pay constant attention to the development of students' academic language. Therefore, the problem of the formation of academic language in the study of the discipline is considered in the regulatory and methodological documents of the educational sphere of the country.

The letter of methodological guidance «on the peculiarities of the organization of the educational process in secondary education organizations of the Republic of Kazakhstan in the 2022–2023 academic year» emphasizes the need to pay special attention to the development of the academic language of students in the discipline (Letter of methodological guidance, 2022).

In physics teaching methodology, the emphasis is on conversation organized in the classroom, and student-student, student-teacher dialogue. The studies of physics methodologists emphasize systematic conversation as a means of improving the quality of students' knowledge (Zorina, 1978: 128).

It is important to form in students a system of knowledge about the physical theory and its structure, as well as individual elements of the theory. Each element of the theory (concept, law, phenomenon, etc.) is closely related to each other. For students to know these connections, it is important to teach them to build a systematic story, and to practice it. According to L.Y.Zorina, systematic storytelling is «a holistic, sufficient description of the physical object by answering interconnected questions» (Zorina, 1978: 128).

L. Rubinstein emphasized the importance of the interconnectedness of the student's speech and thinking activity (Rubinstein, 2020: 960). The connection of the word in the narrative is carried out through the content of the educational material.

In his research, V.Chandra Sekhar Rao emphasizes the importance of academic language for the development and implementation of curricula, understanding and communication of students with the subject in an educational environment (Dr. Chandra Sekhar Rao, 2022).

Academic language is «a language used by teachers and students to acquire new knowledge and skills, which includes the transmission of new information, the description of abstract ideas and the development of conceptual understanding by students» (Chamot & O'Malley, 1994). It also requires students to learn words that allow them to work with scientific texts considered at school, compose a new text and discuss them.

And its presentation will directly depend on the regularity of thinking. Therefore, by teaching students to speak on a given topic, they contribute to the systematic formation of the content of the educational material in their cognition.

Today, experience has shown that students in the 9th grade face several difficulties in the conversation during the lesson in physics. Now let's look at the nature of these difficulties. First of all, students do not know how to start answering if the given question does not correspond to the name of the paragraph. As a result, information is given that does not correspond to the content at all. For example, when asked about the description of Newton's first law, a student starts his sentence by stating that kinematics, dynamics, and statics are the principles of mechanics instead of directly answering the question. In this case, the student cannot explain why he started his narrative in this way.

Secondly, in the speech of students, a lot of superfluous information is given that does not relate to the given question. In the course of the narrative, the student presents a mixture of a description of the mechanism of the phenomenon and the experience of observing the phenomenon, that is, a systematic description of the phenomenon does not occur.

Thirdly, it is difficult for students to compose a story about a scientific fact. Since the sequential presentation of the material, argumentation does not go beyond the system, the student's narrative is expressed as a set of incomprehensible, long, and unrelated words.

To form in students the skill of building a systematic conversation, it is necessary to clarify the generalized structure aimed at the implementation of his thinking activity. According to S. L. Rubinstein, the student's speech will depend, firstly, on whether he understood the content and meaning of the educational material, and secondly, on the conversational environment (Rubinstein, 2020: 960).

We consider methodological research related to the development of the academic language of students in recent years.

Academic language is clearly expressed through the content of any subject. For example, if we look at some arithmetic numbers, we remember algebra. Or when we look at formulas, we remember physics. To study the main content of such subjects, it is necessary to develop the academic language of students. That is, the result of the formation of an academic language leads to the study of the main content of a particular discipline and also contributes to the improvement of skills in working with the main content of the discipline.

To develop the academic language of students in physics lessons, teachers must:

- provide students with the necessary work tools to work with the basic physical concept (for example, to propose terms necessary for discussion or group work, to give a sequence of questions);

- discuss with students what educational achievements they have achieved at the end of the lesson;

- use of reading methods that contribute to the formation of reading-pronunciation, and listening-writing skills in students;

- it is crucial that the student gives various exercises or tasks to develop his vocabulary.

Therefore, there is a defined necessity of considering the development of skills for analyzing physical tasks by students along with the formation of their academic language. In this regard, by asking questions in the development of students' task analysis skills, we will consider the tasks of the classical mechanics section and ways to solve them.

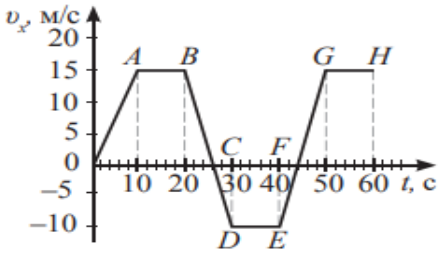
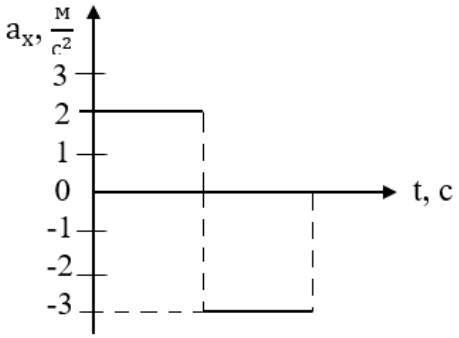
Results

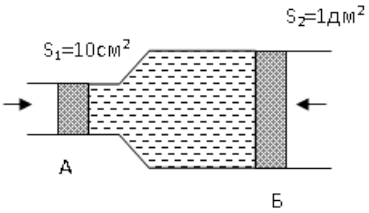
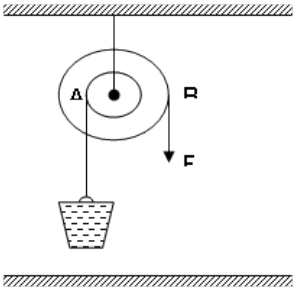
In the course of the research work, the section «Mechanics» was taken as a basis. In order to develop students' academic language, the application of analytical questions by types of tasks was considered. Sample analytical questions related to problem types are presented in Table 1.

Table 1. Analysis questions depending on the types of tasks

Types of tasks	Analysis questions	Examples
Analysis of textual problem	- Determining what the problem is about; - To reveal the physical meaning of the problem condition, that is, to determine which physical phenomenon is described in the problem; - Interpretation and construction of a diagram or picture related to the task; - Outline how to solve a problem: what physical laws and equations are in the problem; - What equations or systems of equations were obtained in the process of solving the problem, etc.	Task №1. What is the speed of the river flow if a motor ship carrying cargo along the Irtysh River moves with the flow at a speed of 600 km/day, and against the flow at a speed of 344 km/day? Task №2. Approaching a post, the driver of an electric train turned off the engine, after which the train went into motion, the acceleration of which gradually decreased by 0.1 m/s2. What distance will he cover before stopping, if the train speed at the brake start is 54 km/h.

continuation of the table 1.

Types of tasks	Analysis questions	Examples
Analysis of graph problems:	- What kind of physical dependence is given in graph? - What physical quantities are indicated in coordinate axis and what are their units of measurement? - What does the dependence graph mean? - Are there any special points on the graph? What is their physical meaning? - What problems does the graph allow you to solve?	Task №1. In Figure 1, show the intervals at which the body moves constantly, accelerating, and decelerating uniformly.  **26-сурет.** *4 (2)-тапсырмаға* *Figure 1.* Graph of velocity Task №2. The body moves along the ox axis. Figure 2 depicts a graph of the time dependence of the projection of body acceleration. At the initial moment of time (t = 0), the projection of the body velocity was equal to = 3 m/s. Determine the projection of the body velocity when t = 1s, and t = 2s.  *Figure 2*. Dependence of the acceleration projection on time.

Analysis of diagrams	- What is shown in the picture? (physical bodies, parts, tools, mechanisms, graph elements, etc.) - What are the functions of these objects? - What is the relationship between objects? - What properties of objects change and why? - How do their changes affect other objects? What phenomenon, law does a picture (diagram) describe?	Task №1. The cross-sectional area of the wide part of the pipe filled with water and placed horizontally (Figure 3) is 1 dm^2, , and the thin part is 10 cm^2. To balance the force of 10 kN acting on the piston B, What force should be acting on the piston A?  *Figure 3.* Pipe cross section Task №2. Figure 4 shows blocks with different radii attached to each other. If the radius of the large block is equal to the radius of the small block what is the mass of the weight you are carrying if it is three times the radius and has F=200 N?  *Figure 4.* Blocks attached to each other

continuation of the table 1.

Types of tasks	Analysis questions	Examples
Analysis of physical experiment problems	- What physical phenomenon, process does experience reflect? - What are the main elements of the device? - What are explanatory drawings for? - What characterizes the course and results of the experiment? - What can be changed on the device and how will it affect the result? - How do you make conclusions?	Task №1. A lever holds a weight of 50 g and 100 g. Find the curves of the body that are in equilibrium, using a ruler to move the weight. Prove the formula = with the data obtained. Task №2 Prove patterns by placing a 100 g and 200 g weight on a lever using a dynamometer 1) by measuring the forces applied to the moving block, and 2) by measuring the forces applied to the stationary block.

In addition to the type of problem, the use of questions of analysis of a physical phenomenon, analysis of a physical quantity, analysis of a physical law, and formula concerning general problems, along with academic language, makes the meaning and purpose of the problem clearer.

The list of questions for the analysis of a physical phenomenon, a physical quantity, a physical law, and a formula considered in all types of physics problems (analysis algorithm) is shown in Table 2.

Table 2. Analysis questions depending on the types of physical object

Type of physical object	Samples of analysis questions
Physical phenomenon	- Properties of a phenomenon; - The conditions for observing a phenomenon; - The essence of the phenomenon, its explanation in the modern context; - Relation of the phenomenon to other physical phenomena; - Application of the phenomenon in practice.
Physical quantity analysis	- What properties of a body or phenomenon does a given quantity characterize? - Determining the value; - The formula that determines the relationship of a given quantity with other quantities; - Units of measurement; - Methods of measuring quantities.
Physical law analysis	- What quantities or phenomena does the law indicate the relationship? - Formulation of the law; - Mathematical expression of the law; - Practices that prove the law; - Interpretation of the law in a modern context; - Examples of the application of law in practice.
Formula analysis:	- What is the name of the formula? - What physical quantities does the formula relate? - What is the type of mathematical dependence? - What is the physical meaning of a given pattern? - What is the physical meaning of constant coefficients? - What formula can be summarized? - Does the resulting formula make physical sense? - Where can the formula be used?

Let's consider the application in practice of the analysis questions (analysis algorithm) presented in the second table.

Discussion

Analysis of the phenomenon in a text problem

Task №1. What is the speed of the river flow if a motor ship carrying cargo along the Irtysh River moves with the flow at a speed of 600 km/day, and against the flow at a speed of 344 km/day?

Given: $v_1 = 600\ \frac{km}{day}$ = 6,90 m/s, $\vartheta_2 = 344\ \frac{km}{day}$ = 3,98 m/s

Need to find: $v_{river} = ?$

Solution:

$$v_1 = v_{river} + v_{ship}$$

$$v_2 = v_{ship} - v_{river}$$

$$\left.\begin{array}{l} 6{,}91 = \vartheta_r + \vartheta_s \\ 3{,}93 = \vartheta_s - \vartheta_r \end{array}\right\} => \left.\begin{array}{l} \vartheta_s = 6{,}90 - \vartheta_r \\ \vartheta_s = 3{,}98 + \vartheta_r \end{array}\right\}$$

$$6{,}90 - \vartheta_r = 3{,}98 + \vartheta_r$$

$$6{,}90 - 3{,}98 = 2\vartheta_r$$

$$\vartheta_r = 2{,}92 \div 2$$

$$\vartheta_r = 1{,}46\ m/s$$

Answer: $\vartheta_r = 1{,}46$ m/s

An excerpt from the transcript of the students' answers according to the proposed algorithm during solving the given problem is presented below.

- What phenomenon is considered in the task? (velocity relativity)
- How to study this phenomenon? *(by comparing the counting body with stationary bodies).*
- Modern explanation of this phenomenon? *(We can observe this phenomenon when we are on the bus. If we go from the back of the bus to the front, our speed relative to the ground will be equal to the sum of the speed of the bus and our own)*
- The relationship of this phenomenon with other physical phenomena? *(the phenomenon of relative velocity is closely related to uniform straight-line motion)*
- How do we use this phenomenon in practice? *(if we move in the direction of a moving escalator, our speed increases, if we move in the opposite direction, we can move slowly or stand still).*

Example of value analysis in a text problem

Task №2. Approaching a post, the driver of an electric train turned off the engine, after which the train went into motion, the acceleration of which gradually decreased by 0.1 m/s2. What distance will he cover before stopping, if the train speed at the brake start is 54 km/h.

Given: $a = 0{,}1\ m/s^2$, $\vartheta_0 = 54\ km/h$ = 15 m/s

Need to find: S = ?

Solution:

$$\left.\begin{array}{l} s = \vartheta_0 - \dfrac{at^2}{2} \\ a = \dfrac{\vartheta - \vartheta_0}{t} \end{array}\right\} \qquad s = \frac{\vartheta_0^2 - \vartheta^2}{2a}$$

$$s = \frac{225 - 0}{2 \cdot 0{,}1} = 1125 \text{ m}$$

Answer: S = 1125 m

Below are the student responses to the problem-solving.

- What properties of a body or phenomenon does a given quantity characterize? *(describes the uniform variable movement of the body)*
- What values are given? *(physical quantities: acceleration of the body, initial speed of the body)*
- What are the formulas that determine the relationship of a given quantity with other quantities? *(a formula that shows how the displacement of a body in uniformly variable motion correlates with its initial velocity, acceleration, and time traveled:* $s = \vartheta_0 - \frac{at^2}{2}$; $a = \frac{\vartheta - \vartheta_0}{t}$
- What are the units of measurement? *(the unit of measurement of the speed of the body according to the SI is m/s, additional multiples are cm/s, km/h etc., the main unit of measurement of displacement is - m, additional – cm, dm, km, the main unit of measurement of acceleration is - m/s^2, km/s^2, etc.)*
- What are the ways to measure a quantity? *(there are two ways to measure physical quantities: direct and indirect, for example, speed can be measured with a speedometer, or speed can be measured using a formula using the results of road and time measurements)*

Physical law analysis in a graph problem

Task №1. In Figure 1, show the intervals at which the body moves constantly, accelerating, and decelerating uniformly.

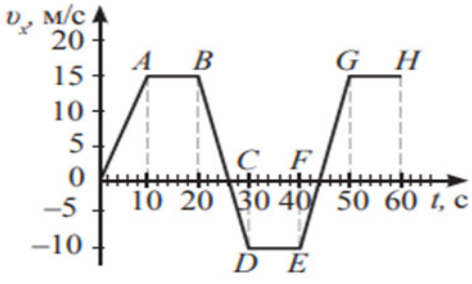


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Figure 1. Graph of velocity

Given:
Figure 1
Need to find:
1) Accelerating uniformly - ?
2) Decelerating uniformly - ?
3) Moving constantly - ?

Solution:
1. The body increases its speed with a smooth progressive movement.
Accelerating uniformly: OA; EG
2. The body smoothly reduces its speed during uniform deceleration.
Decelerating uniformly: BD
3. With uniform movement, the speed of the body is constant.
Moving constantly: AB; DE; GH
Answer: Accelerating uniformly: OA; EG, Decelerating uniformly: BD, Moving constantly: AB; DE; GH

The answers of students obtained during monitoring the progress of the analysis of the graph are presented below.

- What quantities does the law indicate the relationship? *(the path traveled in constant motion shows the relationship between time and speed, while in uniform acceleration and deceleration the relationship is between the initial speed, acceleration, and time)*
- Formulation of the law; *(In uniform acceleration, its speed increases by the same magnitude, and in uniform deceletaion, its speed decreases with each unit of time, in constant motion, the acceleration is zero, since the velocities are constant)*
- Mathematical expression of the law *(*$S = \vartheta t;\ S = \vartheta_0 t \pm \frac{at^2}{2}$; *)*
- A modern interpretation of the law *(for example, we can see that electric vehicles start to move evenly when they accelerate, or we can see that the car decelerates uniformly when we apply the brakes)*

Examples of the application of law in practice. *(can be observed when driving a vehicle. Accordingly, we notice that when increasing the speed, we begin to move evenly, or in the same way, we can notice that the car decelerates uniformly when applying the brake, or moves smoothly in constant motion)*

Task № 2. The body moves along the ox axis. Figure 2 depicts a graph of the time dependence of the projection of body acceleration. At the initial moment of time (t = 0), the projection of the body velocity was equal to = 3 m/s. Determine the projection of the body velocity when t = 1s, and t = 2s.

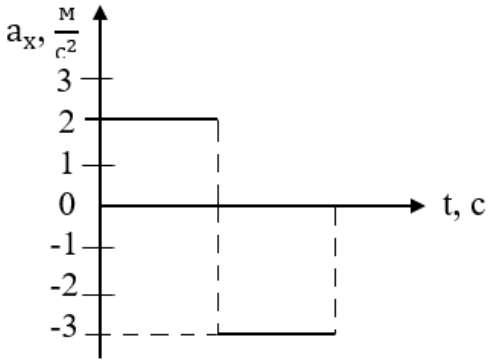


Figure 2. Dependence of the acceleration projection on time.

Given: $t_1 = 0\ s,\ \vartheta_{x1} = 3\ m/s,\ t_2 = 1\ s,\ t_3 = 2\ s$

Need to find: $\vartheta_{x2} = ?\ \ \vartheta_{x3} = ?$

Solution:

$\vartheta = at$

$\vartheta = \vartheta_0 \pm at$

$\vartheta_0 = 3\ m/s$

$\vartheta_{x2} = 3 + 2 \cdot 1 = 5\ m/s$

$\vartheta_{x3} = 5 - 3 \cdot 1 = 2\ m/s$

Answer: $\vartheta_{x2} = 5\ m/s\ \ \vartheta_{x3} = 2\ m/s$

The students' responses regarding the analysis of the problem are presented below.

- What quantities does the law indicate the relationship? *(the variable motion equation shows the relationship between speed, acceleration, and time)*
- Formulation of the law *(to determine the speed of a body in uniform acceleration or uniform deceleration, add or subtract the product of acceleration and time in its initial year, respectively)*
- Mathematical expression of the law *(*$\vartheta = \vartheta_0 \pm at$ *)*
- Examples of application of the law in practice *(applied to describe the mechanical motion of uniformly moved body; ex, determine the values of physical quantities when car is accelerating or decelerating uniformly)*

Analysis of the formula in the process of solving the problem given by the figure

Task №1. The cross-sectional area of the wide part of the pipe filled with water and placed horizontally (Figure 3) is 1 dm^2, , and the thin part is 10 cm^2. To balance the force of 10 kN acting on the piston B, What force should be acting on the piston A?

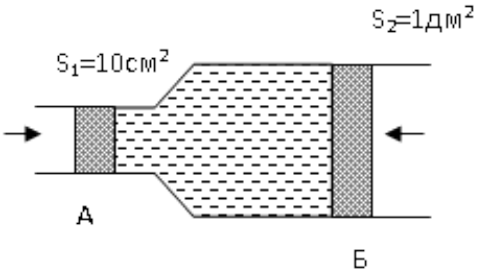


Figure 3. Pipe cross section

Given:

$s_1 = 10\,cm^2 = 10 \cdot 10^{-2}\mathrm{m}^2, \quad s_2 = 1\,cm^2 = 10 \cdot 10^{-2}\,\mathrm{m}^2, F_B = 10\,\mathrm{kN} = 10 \cdot 10^{-2}\mathrm{m}^2$

Need to find: $F_A = ?$

Solution:

$$\frac{F_1}{S_1} = \frac{F_2}{S_2}$$

$$F = \frac{S_1 \cdot F_2}{S_2}$$

$$F = \frac{10 \cdot 10^{-4} \cdot 10 \cdot 10^3}{10 \cdot 10^{-2}} = 100\ \mathrm{N}$$

Answer: $F_A = 100\ \mathrm{N}$

The answers of students on the analysis of the formula in the problem are presented below.

- What is the name of the formula? *(formula for hydraulic machine operation)*
- What physical quantities does the formula relate? *(correlates the areas of cross-sections of the Pistons of the hydraulic machine and the forces acting on them)*
- What is the type of mathematical dependence? *(*$\frac{F_1}{S_1} = \frac{F_2}{S_2}$*)*
- What is the physical meaning of a given pattern? *(the greater the cross-sectional area of the large piston of the hydraulic machine, the greater the force acting on the large piston)*

What formula can be summarized? *(from the given formula, you can summarize the formulas for determining the cross-sectional areas of the Pistons of the hydraulic machine, the forces acting on the piston)*

Task №2. Figure 4 shows blocks with different radii attached to each other. If the radius of the large block is equal to the radius of the small block what is the mass of the weight you are carrying if it is three times the radius and has F=200 N?

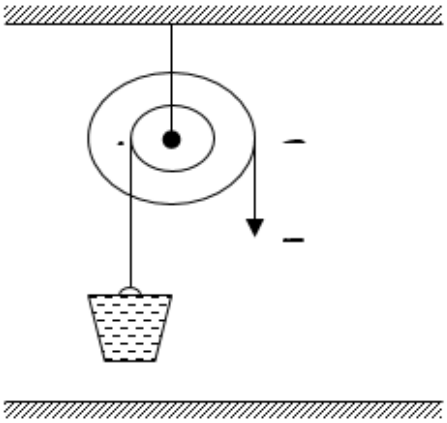


Figure 4. Blocks attached to each other

Given:
$R_B = 3R_A$
$F_1 = 200$ N

Need to find: m-?

Solution:
$F_1 d_1 = F_2 d_2$
$F_2 = mg$
$d_1 = R_3$
$d_2 = R_A$
$F_1 R_B = mgR_A$
$F_1 3R_A = mgR_A$

$$m = \frac{3F_1}{g} = \frac{3 \cdot 200}{10} = 60 \text{ kg}$$

Answer: m = 60 kg

The answers of students on the analysis of the formula in the problem are presented below.

- What is the name of the formula? *(equilibrium condition of the moment of force in simple mechanisms)*
- What physical quantities does the formula relate? *(relates the moment of force, the length of the arm, the force acting on the arm).*
- What is the type of mathematical dependence? *(*$F_1 d_1 = F_2 d_2$ $F_1 d_1 = F_2 d_2$, *inverse proportional)*
- What formula can be summarized? *(by converting the formula, you can simply determine the working and gravity forces in mechanisms, the lengths of their cranks)*

Analysis of physical experiment problem

Task №1. A lever holds a weight of 50 g and 100 g. Find the curves of the body that are in equilibrium, using a ruler to move the weight. Prove the formula $F_1 d_1 = F_2 d_2$ with the data obtained.

Given: $m_1 = 50$ g $= 5 \cdot 10^{-2}$kg, $m_2 = 100$ g $= 10 \cdot 10^{-2}$kg

Need to find:
$d_1 - ?$ $d_2 - ?$

Solution:

In order to solve the problem, students conduct an experiment with the help of the given equipment (which they choose) and perform calculations with the help of the data obtained as a result of it (Figure 5).

We noticed that when placing and balancing loads weighing $m_1 = 50$ g and $m_2 = 100$ g on the lever, the length of the cranks was equal to $d_1 = 20$ cm and $d_2 = 10$ cm (Figure 5).

$$F_1 = m_1 g$$
$$F_2 = m_2 g$$
$$m_1 g\, d_1 = m_2 g\, d_2$$
$$m_1\, d_1 = m_2\, d_2$$
$$5 \cdot 10^{-2} kg \cdot 0{,}2 \text{ m} = 10 \cdot 10^{-2} kg \cdot 0{,}1 \text{ m}$$
$$0{,}01 = 0{,}01$$

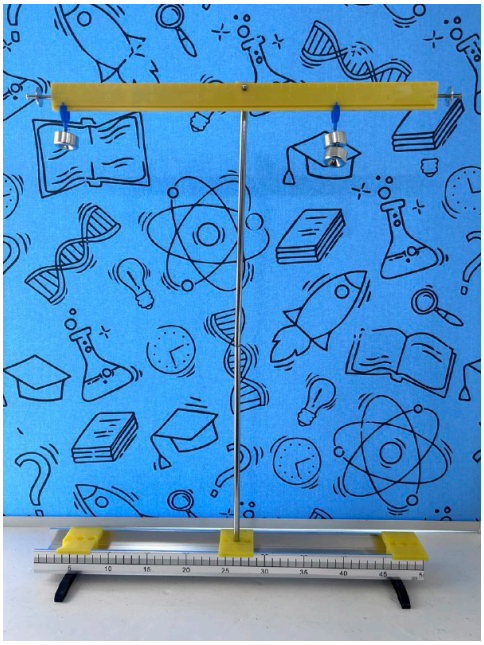


Figure 5. The lever on which the loads are hung

The answers of students on the analysis of the experimental problem are presented below.

- What physical phenomenon, process does experience reflect? *(the work with the lever in the statics section is shown)*
- What device was used in the experiment? *(lever, loads)*
- Why are bodies with different weights in balance? *(this is because, according to the equilibrium condition of the moment of force of the body, the sum of the moments of force acting on the body must be equal to 0 for the body to remain in an equilibrium position)*
- What forces act on the body during the experiment? *(the body is affected by gravity and there is a tension force where the body is suspended)*
- What can be changed on the device and how will it affect the result? *(The result of changing the position of the body in the device leads to a change in the moment of force)*

How do you draw conclusions? *(a change in the position of the body in the lever leads to a change in the moments of force and affects the load that is in the opposite direction)*

Task №2 Prove patterns by placing a 100 g and 200 g weight on a lever using a dynamometer 1) by measuring the forces applied to the moving block, and 2) by measuring the forces applied to the stationary block (Tulchinsky, 2021: 336).

1) *Given:* $m_1 = 100\,g = 1 \cdot 10^{-1}$kg, $m_2 = 200\,g = 2 \cdot 10^{-1}$kg

Need to prove: $F_1 d_1 = F_2 d_2$

Solution:

F = mg

1) $F_1 = \frac{F_2}{2}$ 2)$F_1 = F_2$

1) $F_1 = m_1 g = 1 \cdot 10^{-1} kg \cdot 9{,}8\,m/s = 0{,}98\,N$

$F_2 = m_2 g = 2 \cdot 10^{-1} kg \cdot 9{,}8\,m/s = 1{,}96\,N$

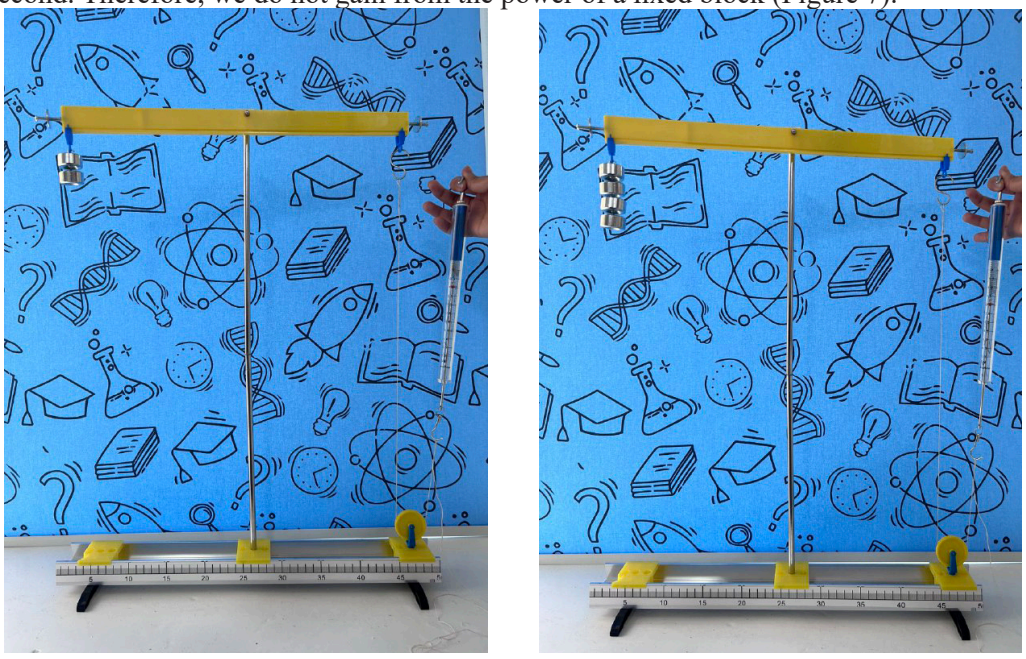
In order to solve the problem, students conduct an experiment with the help of the given equipment (which they choose to determine) and perform calculations with the help of the data obtained as a result of it.

When hanging a load on the movable block, the force of the load =100 g was 0.98 N, the force of the load = 200 g was 1.96 N. The dynamometer showed us a force of 0.49 N in the first case and 0.98 N in the second. Therefore, the moving block gave a win of two times the force (Figure 6).

a) b)

Figure 6. Sliding block. a) 200 g of cargo is hung, B) 100 g of cargo is hung

2) When the load on the fixed block was the load force was 0.98 N, when the load force was 1.96 N. The dynamometer showed forces of 0.98 N in the first and 1.96 N in the second. Therefore, we do not gain from the power of a fixed block (Figure 7).



a) b)

Figure 7. Fixed block. a) 100 g of weight is suspended, b) 200 g of weight is suspended

The answers of students on the analysis of the experimental problem are presented below.

- What physical phenomenon, process does experience reflect? *(In the course of this practice, work with movable and immovable blocks is shown)*
- What device was used in the experiment? *(lever, blocks, dynamometer were used during the experiment)*
- Why does a moving block gain twice as much power? *(because when working with a mobile block, we lose twice as much work)*
- What is the difference between a movable block and a fixed block? *(an immovable block does not move and does not gain, while a moving block gains twice the strength)*
- What can be changed in the device and how will it affect the result? *(in this experiment we saw the change in force by replacing the moving block with the stationary block)*
- How do you draw conclusions? *(the immovable block is used only for the convenience of performing work. It allows you to change the direction of action of the force, although it does not benefit from the force. And the moving block will win 2 times the strength)*

Conclusion

To develop the skills of analyzing physical problems among high school students, we considered the effectiveness of teaching methods based on asking questions. In this method, the type of problem is taken into account, because depending on what the problem is given, it becomes clear in which direction we should conduct the analysis.

When presenting a problem to a student using such analysis, the student can immediately identify what the problem is and the value to be found. By deepening the questions, they can find a way to solve the problem and determine its value. The result is that the student achieves academic language development through answering the questions.

When solving text problems, students are engaged in searching for answers to questions by the given information. Analysis of the text will not be difficult for the student. Students know what to work with.

We have noticed that analyzing graphical problems presents some difficulty for students. They often assume that the necessary information is provided in the text rather than in the graphs. It is important for subject teachers to anticipate this difficulty in advance. During the pedagogical practice period, with support in solving graphical problems using a graph analysis algorithm, students were able to independently complete exams, gaining practice in solving this type of problem.

It became easier for students to analyze pictorial problems. The images provided in these problems help convey the context, which increases students' interest in solving them. During the analysis, students are able to answer the questions clearly and effectively.

Another type of task that engages students is experimental problems. During the preparation of this type of task, students actively compete and demonstrate a high level of interest. After conducting the experiments, students exhibited the development of their academic language by accurately describing the real phenomena observed during the analysis.

So, for the development of students ' report analysis skills:

1. Distinguishing between types of problems within the «Mechanics» sec-

tion.

2. Providing a clear formulation of analytical questions (solution algorithms) specific to each type of task.

3. Implementing methodological recommendations regarding the requirement for oral or written presentations by students, based on the analytical questions posed before solving the problem and during the analysis of the problem solution.

REFERENCES

Akitai B.E. (2017). Theory and methodological foundations of teaching physics: a manual. — Almaty. ISBN: Almanach. — 236 P.

Basharuly R., Shuynshina Sh., Seifollina K. (2019). Physics 9th grade. — Almaty: Atamura, 2019. — 272 p.

Chamot A.U. & O'Malley J.M. (1994). The CALLA handbook: Implementing the cognitive academic language learning approach. White Plains, MA: Addison Wesley Longman

Didactic foundations of the formation of systematic knowledge of high school students. — M.: Pedagogy, 1978. — 128 p.

Dr. V. Chandra Sekhar Rao (2022). The Academic Language Used in Scientific Research. Journal for Research Scholars and Professionals of English Language Teaching. January 2022. — DOI:10.54850/jr-spelt.6.29.03

Kudaikulov M., Zhanabergenov K. (1998). Methods of teaching physics in secondary school. — Almaty. — ISBN 5–625–83880–5

Kazakhbaeva D.M., Nasokhova Sh., Bekbasar N. (2018). Physics 9th grade. — Almaty: School, 2018. — 265 p.

Letter of methodological guidance «On the peculiarities of the organization of the educational process in secondary education organizations of the Republic of Kazakhstan in the 2022–2023 academic year» [electronic resource] https://uba.edu.kz/qaz/metodology/2

Rubinstein L.S. (2020). Fundamentals of general psychology. — Moscow. — ISBN 5–314–00016–4

State mandatory standards of preschool education and training, primary, basic secondary, general secondary, technical and professional, post-secondary education. Order of the Minister of Education of the Republic of Kazakhstan dated. — August 3, 2022. —No. 348 [electronic resource]. — https://adilet.zan.kz/kaz/docs/V2200029031

Standard curricula of general education disciplines, elective courses and electives for general education organizations. *Order of the minister of Education and Science of the Republic of Kazakhstan dated*. — April 03. 2013. — No. 115. — Appendix 38 [electronic resource] https://adilet.zan.kz/kaz/docs/V1300008424

Tulchinsky M.E. (2021). Qualitative problems in physics in secondary school. A manual for teachers. — Moscow. — ISBN 978–5–17–123557–4

Zakirova N.A., Ashirov R. (2019). Physics 9th grade. — Almaty: Arman-PV, 2019. — 272 p.

Bakynov J.O. (2008). Physics level tasks for grades. — 7–8. — Almaty, 2008.

Kirik L.A. (2010). Independent and control work. — Moscow: Ilexa, 2010. — 192 p.

Volkenstein V.S. (2017). Collection of problems for the general physics course. — Almaty: Nur-Print, 2017. — 450 p.

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