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**ФИЗИКАНЫ ОҚЫТУ ӘДІСТЕМЕСІ**  
**МЕТОДИКА ФИЗИКИ**  
**METHODOLOGY OF PHYSICS**

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**Using of workbook on the subject «Physics and astronomy»  
in English at the secondary school**

The article considers a multilingual education which is a new program of Kazakhstan's education system. This education program carries out not only the teaching of languages (Kazakh, Russian and English languages) but also the teaching of disciplines of natural sciences in the languages mentioned above. Base on the example of physics the article presents some principles and approaches of teaching natural science disciplines in English by using workbook of «Physics and astronomy». It helps to teacher to make a correct procedure of a lesson and organize students' activity for effective mastering both physics material and language skills. The main didactic purpose of the workbook is to speed up process of mastering the teaching material, i.e. to bring the educational process closer to the most effective characteristics. One of the main advantages of the workbook is that it allows teacher to control flow and formation of students' thinking activity. The workbook will help to formulate necessary knowledge, skills and skills for students. Thanks to the workbook on the subject «physics and astronomy», the lesson material is better understood, the lesson time is rationally used. The effectiveness of teaching Physics through a foreign language is opened by numerous advantages, such as formation of intercultural knowledge and understanding; development of intercultural skills; introduction of a broader cultural context; expansion of school and university profile; increase of general and specific language competence; development of communication skills; preparation for future research and / or labour activity; addition of individual learning strategies; increase of students' motivation.

*Keywords:* workbook, physics and astronomy, tasks, multilingual education, school, science direction, language skills.

President's strategic initiative aims at the stable development of country and entering of Kazakhstan into 30 the most developed countries of the world. Within the scope of Plan of nation President charged to carry out some reforms in the sphere of education. The main task is compliance of scientific educational system with requirement of time. According to Plan of nation «100 concrete steps on realization of 5 institutional reforms» it will be planned to switch over step-by-step to English language teaching at Kazakhstan schools and institutes of higher education [1]. The main aim is competitive recovery of the trained personnel, export potential increase of the educational sector and participation of Kazakhstan people in the world association and international processes. This innovation will improve quality of human capital on the basis of economic cooperation and standards of development organization countries. It is accepted to introduce and realize project of three languages at the secondary schools, Republic of Kazakhstan takes the first steps to educational system by entering of English into teaching of natural sciences.

The major tasks for teacher are to ensure a sufficient learning by pupils, to develop their creative and cognitive abilities, to provide connection of teaching with life, labour, moral and aesthetic education. Teacher uses different teaching aids for successful solving of these problems. We decided to develop a teaching aid which enables to solve a whole complex of pedagogical problems. This teaching aid is a printed workbook.

The modern specialist must find unusual decisions of practical tasks, acquire knowledge without assistance, work with information and make interpersonal relations skillfully. In connection with these requirements in the process of teaching:

– to pay much attention to personal- oriented education;  
 – support and development of self-realization, self-development, self-education and other qualities, necessary for making up of personality;  
 – transition from knowledge transmission to purposeful formation of qualities necessary for life. Test ensures not only learning, control and self-control of the definite knowledge, but helps to form skills of their independent gaining. Especially, it is actually for pupils who learn in foreign language.

The feature of workbook on Physics and Astronomy is that all tasks were chosen in order to maximal activate process of teaching. Pupils not only master abilities and skills, acquire new knowledge, but develop their logical thinking and overcome formalism of knowledge. This teaching aid helps in fostering of persistence, purposefulness, aesthetical tastes and attitude to labour in pupils.

The great importance for increasing pupils' interest in Physics and astronomy is the workbook. The workbook favours learning of Physics in English, improvement of vocabulary, searching and conducting of different laboratory works. Using of workbook gives pupils opportunity to do test, to develop their creative abilities and to search [2].

The basic conditions on organization of pupils' workbook:

1. To give a definite task.
2. To fix time of carrying out work.
3. To do test.

Pupils must think actively in the course of doing tasks on workbook. As a result they will learn to control without assistance, to develop sense of responsibility, hardworking and time management [3].

The main aim of workbook is to form pupils' cognitive duties, to develop creative abilities, interest and to arouse a keenness for knowledge. Using different methods is necessary to give opportunity for expressing children's opinions. Every lesson, given by different methods develops child's profound thinking and learns to express their opinion. There is opportunity to work with children of different levels and to control pupils' creative level with the help of the methodical approaches. Example of task from the workbook Table 1.

Table 1

**To fill the table, indicating the comparative conceptions**

Phenomenon	External signs of the phenomenon	Conditions of passage	Definition
Drying	a) liquid volume contraction; b) drying of wet substances.	a) presence of the open side of liquid; b) evaporation of liquid; c) drying in any temperature.	Drying is a phenomenon of evaporation in liquid
Boiling	a) appearance of steam bubbles in the liquid, increase, cleaving at the bottom of liquid; b) fast turning of liquid into steam.	a) to warm up nearly crisis temperature for liquid; b) in the temperature when steam pressure in bubbles is equal to liquid pressure; c) to warm up liquid continuously.	Boiling is a process of evaporation in steam bubbles and liquid.

We may compare phenomenon, concepts, laws, physical quantities and all you want. Especially, it is important, when pupils confuse them. By virtue of some similarity of words bears relation to body speed, pupils confuse or don't distinguish phenomenon of inertia and inertness quality Table 2.

Table 2

**Phenomenon of inertia and inertness quality**

Inertia	Inertness
1	2
Difference	
Phenomenon	Quality of bodies
Body speed doesn't change	Body speed changes
There is no physical quantity which defines phenomenon	Mass defines inertness of body

Continuation of Table 2

1	2
Similarity	
It is connected with movement of bodies	
In writing similarly	

The independent making of comparative tables enables pupils to understand sense deeply. Operation of comparison allows pupil to do personal discoveries. Let's compare two laws: law of universal gravitation and Coulomb law Table 3.

Table 3

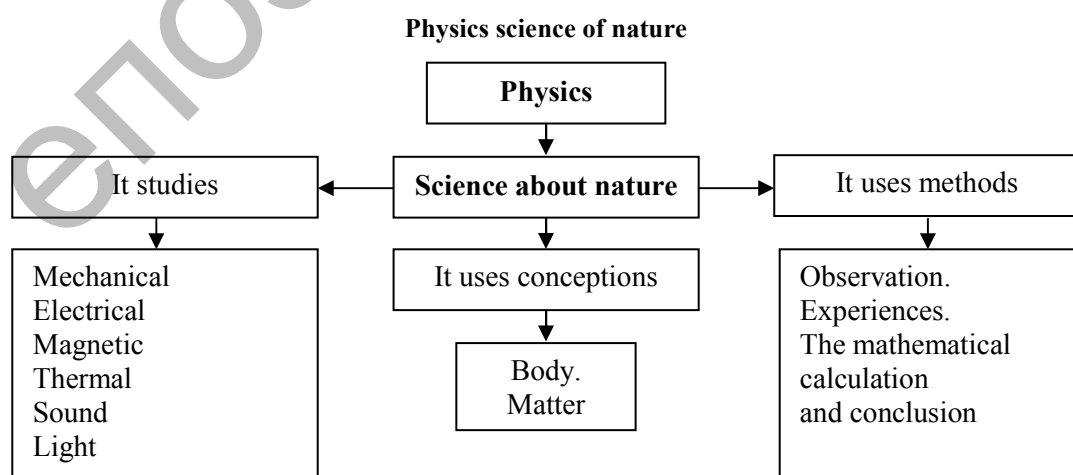
## Law of universal gravitation and Coulomb law

Law of universal gravitation	Coulomb law
Difference	
It describes gravitational interaction	It describes electromagnetic interaction
$F = GMm/R^2$	$F = KQq/R^2$
$G = 6.67 \cdot 10^{-11} \text{Nm}^2/\text{kg}^2$	$K = 9 \cdot 10^9 \text{Nm}^2/\text{C}^2$
Bodies always draw up	Bodies may draw up and push away
There is no (-) particle which bears the smallest indivisible gravitational charge (-)	There are particles which bear the smallest indivisible electric charges (+,-)
Similarity	
The mathematical notation	
Bodies are material points	
Radius of action is endlessness	
The torsion balance was used	

How amazing and suspicious, laws are like. Pupils ask question about principle difference between these two interactions. And why wasn't graviton opened up to now? May be, these questions urge somebody to work at unified field theory and somebody else look for graviton.

The workbook is of great importance in the course of teaching Physics in English. Doing tasks of workbook, pupils have opportunity to master Physics, English; to develop ability to remember scientific terms and rules Table 4.

Table 4



Also there is task of interaction with other objects Table 5.

## Interaction with other objects

<b>Geography</b>	studies climate	<b>P H Y S I C S</b>	explains cause of beginnings such climatic conditions, origin of cyclones and etc.
<b>Biology</b>	studies plant and animal world		explains, for example, how water comes from soil to branches, why perch and sand dab have different structure of skeleton
<b>Astronomy</b>	studies stars, planets		explains why planets move round Sun and why don't they fly away and etc.

The multilevel types of tasks give pupils opportunity to study Physics under supervision of teacher and without assistance.

Such requirements were fulfilled when preparing of workbook:

- 1) the work content must meet requirements of program;
- 2) the workbook must develop pupils' ability for thinking;
- 3) variety of type and work content.

Workbook on Physics have such tasks: to mark out key words which have the main sense load, to argue it, to try to add definition, to analyze success of attempt, to use their knowledge in other situations (in daily life, in every day life and in future speciality); comparison of phenomenon with the studied one before; making of schemes, tables and graphs; to draw conclusion with the help of analysis where pupil must use thought and creative abilities; table of arithmetical approaches for remembering and calculation; to compare similarity with comparison for analysis; to distinguish law; the didactic games and interesting tasks. You may see below examples from workbook [4].

1. A force that resists the movement of one surface against another.

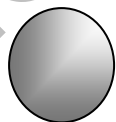
- A. Centripetal
- B. Inertia
- C. Friction
- D. Kinetic

2. The force of attraction that exists between two objects.

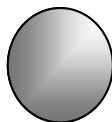
- A. Gravity
- B. Inertia
- C. Mass
- D. Momentum

3. A student is eating french fries and needs ketchup. He shakes the ketchup bottle as it is turned upside down but the ketchup won't move. He then smacks the bottle and the ketchup moves. However, the ketchup won't stop moving until he turns the bottle upright. This is an example of \_\_\_\_.

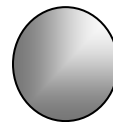
4. Which ball will hit the ground first?



Wood ball



Plastic ball



Metal ball

- A. Metal first, then plastic, then wood last
  - B. Wood first, then plastic, then metal last
  - C. They will all hit at the same time.
  - D. There is no way to tell.
5. A change to an objects motion is caused by...
    - A. Balanced forces
    - B. Unbalanced forces
    - C. Acceleration
    - D. Velocity

## 6. Fill in the blank

A. The group of internationally accepted stand and units is called the .....or 'the international system', abbreviated as SI

B. Both sides of an equation must have the same units, that; the equation must be.....  
Using this fact, a technique called ..... can be applied when we need to check a specific formula or an equation.

C. Volume is defined by .....

D. The number used to describe the physical quantity also implies how precisely it has been measured via the number of .....

All requirements on workbook «Physics and Astronomy» were taken into account. Type of workbook is combined; there are different tasks, exercises, tables, tests and game tasks in it. This workbook is an important didactic approach for assessing pupils and providing pupils with tests. The main aim of learning subject is to develop pupils' mental, cognitive and creative abilities, to open role of Physics for this social life, development of general human culture, to use knowledge on Physics with creation and to form pupils' scientific opinions. The only source which leads to this aim is pupil's workbook.

Our developed workbook on Physics was created for Physics teachers and pupils with the aim to improve efficiency of the independent work while of practical lessons and home work. Paying attention to those or other aspects of process teaching of Physics in English, teacher may correct or change tasks, to pay a special attention to formulation of conclusions or pictures aesthetics.

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### Орта мектепте оқытуда ағылшын тілінде «Физика және астрономия» пәні бойынша жұмыс дәптерін қолдану

Мақалада Қазақстанның білім беру жүйесінде көптілді білім берудің жаңа бағдарламасы мазмұны қарастырылды. Берілген бағытта қазақ, орыс және ағылшын тілдері ғана емес, сонымен қатар нақты ғылыми пәндерін оқыту (жоғарыда берілген тілдерде) жолдары берілді. Мақалада физика сабағын ағылшын тілінде оқытудың мәнері, кейбір қағидалары және оқытуда «Физика және астрономия» пәнінен жұмыс дәптерін қолданып, сабақ барысын дұрыс ұйымдастырып, оқушылардың қызметін, тілді игерудің дұрыс жолдарын ұйымдастыруға септігін тигізеді. Жұмыс дәптерінің басты дидактикалық мақсаты – оқу материалдарын игеру үдерісін жеделдету, яғни, оқу үрдісін ең тиімді сипаттамаларға жақындату. Жұмыс дәптерінің басты артықшылықтарының бірі мұғалімге оқушылардың ойлау әрекеттерінің ағымын және қалыптасуын бақылауға мүмкіндік береді. Жұмыс кітабы оқушыларға қажетті білім, дағдылар мен біліктілігін қалыптастыруға көмектеседі. «Физика және астрономия» пәні бойынша жұмыс дәптері арқасында сабақ материалын жақсы түсінеді, сабақ уақыты ұтымды түрде қолданылады. «Физика» пәнін шет тілі арқылы оқытудың тиімділігі көптеген мәдениетаралық білім қалыптастыру, сонымен қатар көптеген артықшылықтармен айқындалды, мысалы, мәдениетаралық дағдыларды дамыту, кеңірек мәдени контексті енгізу, мектеп және университет бейінін кеңейту, жалпы және нақты тілді біліктілігін арттыру, коммуникативтік дағдыларды дамыту, болашақ зерттеулерге және/немесе жұмысқа дайындалу, жеке оқу стратегияларын толықтыру, студенттердің ынталылығын арттыру.

*Кілт сөздер:* жұмыс дәптері, физика және астрономия, көптілді білім, мектеп, ғылыми бағыт, тілдік дағдылар.

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## Использование рабочей тетради по предмету «Физика и астрономия» на английском языке в средней школе

В статье рассматривается новая программа казахстанской системы образования — многоязычное образование. Эта программа осуществляет не только преподавание языков (казахского, русского и английского), но и преподавание дисциплин естественных наук на упомянутых выше языках. На примере физики в статье представлены некоторые принципы и подходы преподавания естественных дисциплин на английском языке, с использованием рабочей тетради по «Физике и астрономии», которые помогают преподавателю составить правильную процедуру урока и организовать деятельность учащихся с целью эффективного овладения как физическим материалом, так и языковыми навыками. Главное дидактическое назначение рабочей тетради — ускорить процесс усвоения учебного материала, т.е. приблизить учебный процесс к наиболее эффективным характеристикам. Одним из главных достоинств рабочей тетради является то, что она позволяет преподавателю управлять течением и формированием мыслительной деятельности учащихся. Рабочая тетрадь поможет сформулировать у учащихся необходимые знания, умения и навыки. Благодаря рабочей тетради по предмету «Физика и астрономия» лучше воспринимается материал урока, рациональнее используется его время. Эффективность преподавания физики через иностранный язык раскрывается многочисленными преимуществами, такими как: формирование межкультурных знаний и понимания, развитие межкультурных навыков, введение более широкого культурного контекста, расширение школьного и университетского профиля, повышение общей и специфической языковой компетентности, развитие навыков общения, подготовка к будущим исследованиям и/или к трудовой деятельности, дополнение индивидуальных стратегий обучения, повышение мотивации учащихся.

*Ключевые слова:* рабочая тетрадь, физика и астрономия, задачи, многоязычное образование, школа, направление науки, языковые навыки.

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