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STUDYING THE LAWS OF PLANETARY MOTION IN THE SOLAR SYSTEM USING THE PHET PROGRAM

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Abstract

This article describes the study of Kepler's laws with the help of the PHET program, which is related to the teaching methodology of astronomy.

Key words

PHET program, Kepler's laws, Solar system, Information technologies.

1. Enter

It is impossible to imagine the development of the education system without information on its current state . In fact, the use of modern information technologies creates a basis for improving the quality of education. The content of the pedagogical process will be improved, innovative models of teaching will be introduced, and cooperative activities of students and teachers will be organized. The development of a unified policy and strategy for the introduction of modern information technologies both in management and in the educational process is a prerequisite for informatization of the educational process in any educational institution.

Education is rising to a new level, students' level of thinking is expanding, getting information is becoming easier, in the process of such growth, not using innovative technologies in teaching sharply reduces the effectiveness of the lesson.

Today, the task of Uzbekistan is to ensure the development of the economy based on innovations. Therefore, reforms in the education system in Uzbekistan are closely related to the emergence of new changes in the economy. In the next 20 years, a number of changes were made in the education system of Uzbekistan.

One of the reasons for these problems can be explained by the quality of textbooks and the incomprehensibility of newly published science textbooks for students, as well as the lack of electronic or virtual versions of these textbooks created using modern information technologies. In order to solve these problems, several decisions aimed at the use of information technologies and the development of this field are proving their strength. In this way, in turn, virtual and electronic versions of textbooks for the educational system are being developed. In the creation of such textbooks, the use of several programs is of course important. Today, every teacher must know how to use pedagogic information technology.[1]

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2. Experimental method.

Below we can see the virtual laboratory of the "PhET simulation" program used in the teaching of the optional subject. PhET simulation program provides some convenience in teaching and reality for the student. Even if he does not understand the complex sentences in the textbook , it will be very convenient for the student to see the real reality and learn new terms and laws in the textbook by seeing the virtual laboratory. Through this program, we will get acquainted with the virtual laboratory prepared for conducting physical experiments in the system of general education and higher education.

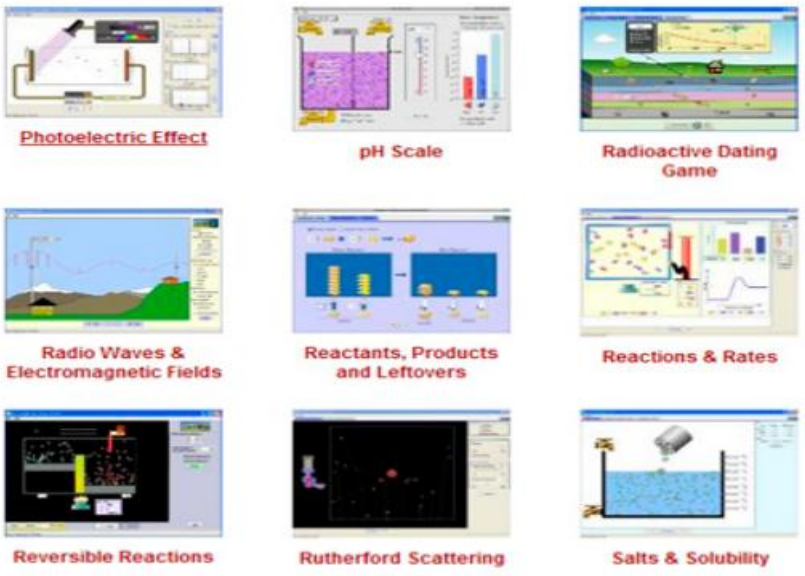


Figure 1. PhET program window. The desired laboratory is selected from this window.

3. The obtained result and their analysis

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Informatization of the educational process requires solving difficult and multifaceted issues related to technological, pedagogical and organizational work. Creating an information learning environment of an educational institution is not only a purely technical matter. For this, it is necessary to use the appropriate scientific-methodical, organizational and pedagogical capabilities of the institution based on a systematic approach. There are many definitions of the concept of "information-learning

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environment". Their analysis allows us to conclude that this concept is a set of information-technical, educational-methodical systems that provide a specific goal-oriented educational process.

The use of models in the educational process is not a new method. Models have been used in education since ancient times. Nowadays, simulators are widely used in the educational process. Computer simulators can be used mainly in two directions: modeling of real objects and development of these models. In modeling life objects, it is possible to create virtual prototypes from the simplest chips to complex computer systems. In the process of studying virtual models, students will be able to further improve their working principles and methods [2].

We know that the movement of the planets in the solar system is carried out according to Kepler's laws. So we study Kepler's laws using the PHET program . According to Kepler's first law, all the planets in our system move along a closed curve called an ellipse. Our Sun is located at one of the foci of the ellipse.

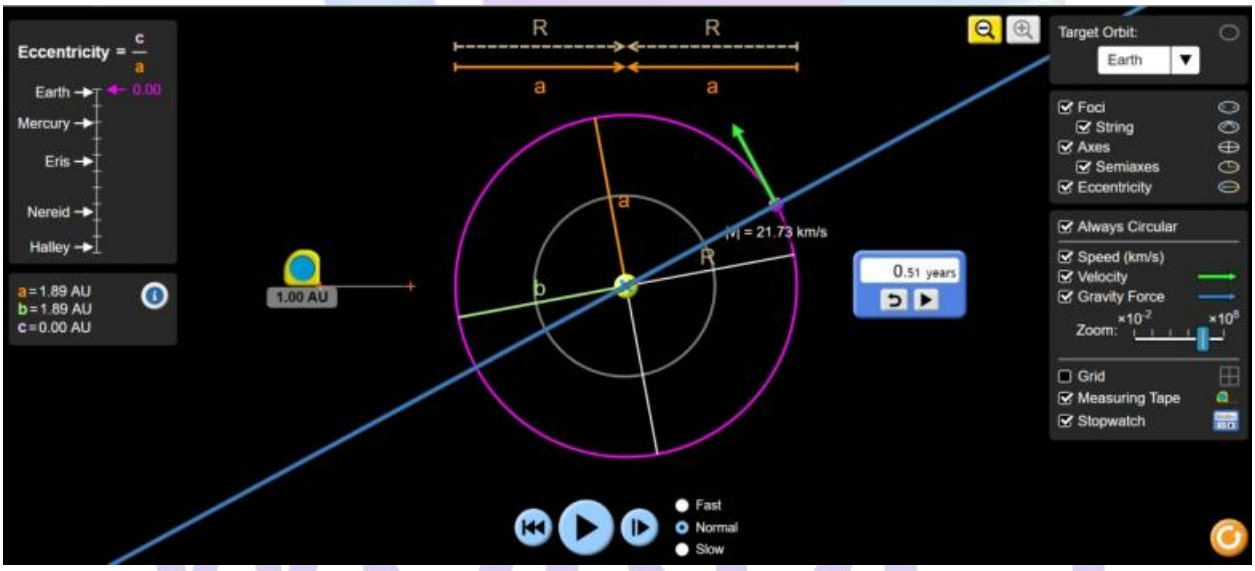


Figure 1. Learning Kepler 's 1st law using the PHE T program.

Kepler's two- inch law . An imaginary straight line connecting the sun and the planet divides the ellipse into equal areas at equal intervals.

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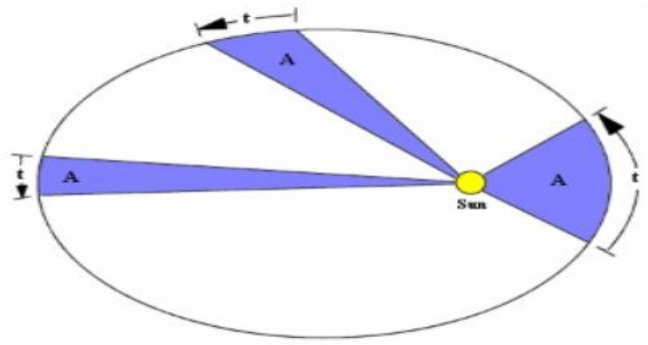


Figure 2. Planetary motion as stated in Kepler's 2nd law

According to Kepler's Law, the planets should draw equal surfaces at arbitrary equal times. This means that as the radius vector transferred from the point where the planet is moving to the Sun increases, its speed decreases, and on the contrary, the speed increases. We can also see this using PHET software.

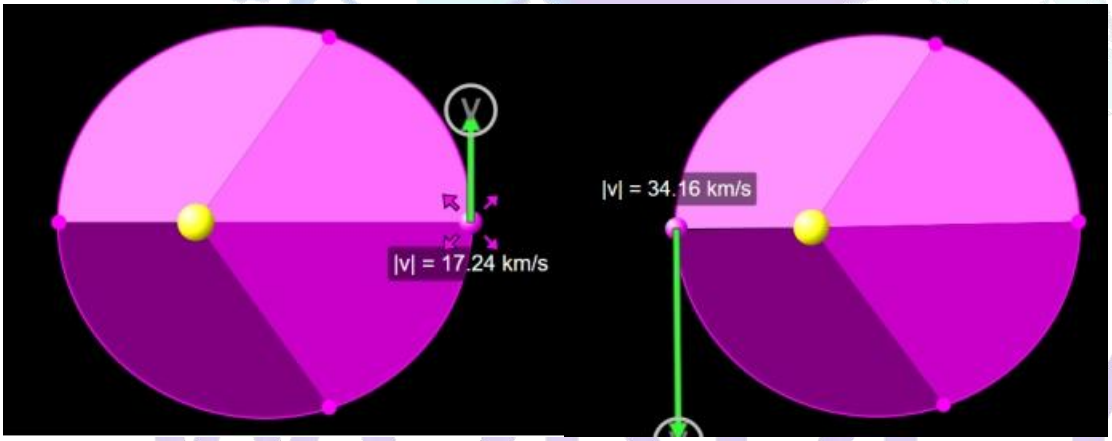


Figure 3. Studying Keepler's 2nd Law using PHET software

Figure 3 shows that the speed of the planet when approaching the sun is 34.16 km/s, and at the furthest point it is 17.24 km/s. Therefore, the experience seen in this program creates imagination in the child in learning Kepler's law.

Kepler's 3rd law: The ratio of the squares of the period of the planets orbiting the Sun is equal to the ratio of the semi-major axes of the orbit of this planet. That is

$$\left(\frac{T_1}{T_2}\right)^2 = \left(\frac{R_1}{R_2}\right)^3 \qquad (1).$$

We can see this law also with the help of PHET software.

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Figure 4. Exploring Kepler's 3rd Law in PHET.

Figure 4 illustrates the study of Kepler's 3rd law in the PHET program. In the mirror we can get and study the movement of the Voluntary Planet with the results we want.

Features of the program: The optimal program that demonstrates physical phenomena, more than 50 step-by-step teaching lessons, ready-made models of more than 150 departments of physics, the possibility of modeling physical processes on a computer, a simple interface that allows independent modeling, Earth to carry out and observe experiments that are difficult to conduct under the conditions, the powerful instrumentation of the program allows to calculate the value of the physical quantities participating in the experiment with very good accuracy, to create a graphical connection between the physical quantity participating in the physical event and other physical quantities, created models can be saved and printed on paper.

Summary.

The use of virtual laboratories is important for students to apply their theoretical and practical knowledge in the course of the lesson. In the process of these studies, they will directly contribute to the development of theory and life studies, as well as strengthening their knowledge. In addition, they can contribute to the further development of those simulators, bringing them closer to real-life research. This, in turn, makes students not only "listeners", but also direct participants in scientific research. This in turn increases students' interest in studying and research.

Nowadays, new types of teaching students based on the use of modern information technologies are being formed. Among them, visual explanation of physical processes that are difficult for students to observe with the help of special computer programs through animations and video clips is of great importance. Therefore, it is desirable to study the processes in the physics course, as well as to create

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a virtual analog of the devices used in the lessons, to strengthen the training with the help of various virtual experiments that involve the students' work.

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