



# THE SOLUTION AND ANALYSIS OPTION OF THE CASE STUDIES METHOD IN TEACHING THE SUBJECT OF KEPLER'S LAWS FROM ASTRONOMY

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## Abstract:

*This article is about the use of the Case study method in the process of teaching the subject of "Kepler's Laws" in astronomy to students with hearing disabilities, taking into account their physical, physiological conditions and capabilities.*

**Key words:** Sun, Earth, Kepler's laws, orbit, ellipse, focus, aphelion, perihelion, eccentricity, radius vector, rotation period, semimajor axis.

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"If children do not learn to think, it is inevitable that the effectiveness of education will be low. Of course, knowledge is also necessary. But knowledge goes its own way, and independent thinking is also a great asset." The main task of the education system is to prepare students to be the owners of this wealth. Because, nowadays, only a person who has the ability to think independently and creatively will be useful to himself and to the society - he will have the ability to solve his own problems.

The use of cases, which is effectively used on a large scale in world pedagogy, firstly, develops students' ability to think, and secondly, directly connects the educational process with development. As Herbert Spencer said: "The great purpose of education is not to impart knowledge, but to teach action." Or, in most cases, in the existing education system, the goal of teaching is to give knowledge to students as the final result, but at the world level, it should be recognized that the practical

application of acquired knowledge is considered the final result of education.

1. The main problem in the case study:
2. Finding the semi-major axis of the planet Venus.

Ways to solve the problematic situation:

1. Let's get acquainted with the case study and its information supply.

First of all, let's get acquainted with the case study. We carefully read all the information it contains to determine the problem that needs to be solved. We determine the level of problem solving.

2. Let's get acquainted with the given situation.

The problem of determining the sidereal period of the rotation of the planet Venus around the Sun.

3. Analysis of the problem situation.

We will try to analyze the problematic situation. Let's determine the physical quantities necessary to solve the problem

Determining the semi-major axis of the planet Earth.



3. Determination of the sidereal period of the Earth's rotation around the Sun

4. Determination of the sidereal period of the rotation of the planet Venus around the Sun.

In this case, we find all possible solutions to the problem:

A problematic situation	A problematic situation occurs reasons for leaving	Out of the situation departure actions
Finding the semi-major axis of the planet Venus.	Finding the semi-major axis of the planet Venus using Kepler's 3rd law.	For the teacher to teach students how to use Kepler's law to find the semi-major axis of the planet Venus. For students, determining the semi-major axis of the planet Earth, determining the sidereal period of the Earth's rotation around the Sun, determining the sidereal period of the rotation of the planet Venus around the Sun. Find the semi-major axis of the planet Venus using Kepler's laws.

#### 4. Conducted analyzes and results

Readers know that the ratio of the squares of the sidereal cycles of the planets around the Sun is equal to the ratio of the cubes of the major semi-axes of the orbit ellipses. The main problem is to find the semi-major axis of the planet Venus using the semi-major axis of the planet Earth, the sidereal period of the Earth's revolution around the Sun and the sidereal period of the planet Venus' revolution around the Sun. From the formula of Kepler's 3rd law

$$\frac{T_1^2}{T_2^2} = \frac{a_1^3}{a_2^3}$$

( $T_1$  and  $a_1$ -The sidereal period and the semi-major axis of the Earth's rotation around the Sun.  $T_2$  and  $a_2$ - The sidereal period and the semi-major axis of the rotation of the planet Venus around the Sun.)  $a_2$  problem is solved by finding

#### **Explaining the subject of "Kepler's Laws" to students based on the case-study method**

Topic: "Kepler's Laws".

The main goal of the case is to teach students how to determine the sidereal period and the semi-major axis of the planets' rotation around the Sun with the help of Kepler's laws.

Expected results of educational activities:

- He studies Kepler's laws.

- Will have information about orbit and ellipse.

- Learns to determine the focus of an ellipse.

- Explores the aphelion and perihelion points of the planets.

- Learns the methods of determining the eccentricity, radius vector, rotation period and semimajor axis of the planets using Kepler's laws.

- identify a problem and find a solution to solve it.

In order to successfully implement this case, students must have the following knowledge and skills:

The student should know:

The value of the sidereal period and semimajor axis of the planets around the Sun.

The student should:

- learns the subject independently;
- clarifies the essence of the problem;
- works independently with educational information;
- compares, analyzes and summarizes data.

List of recommended literature for using sources:

1. Rakhmatillayev N. M. General astronomy course. Tashkent, teacher 1995.
2. Rasulmuhamedov et al. General astronomy course, mechanics, Tashkent, teacher 1989.



3. Mamadazimov Mamadmusa. Astronomy textbook for grade 11. Davr publishing house Tashkent-2018.

Description of the case based on technological features:

The main source of this case is a cabinet, a record, and it is described on the basis of life situations. The main object of the case is person- and experience-oriented. This is an organizational institutional case, and the data is structured based on situations and questions. The volume is short, systematic, and aimed at creating knowledge and skills on the educational subject intended for training. According to didactic purposes, cases are aimed at presenting problems, solving them, analyzing and evaluating them.

This case can be used in teaching Astronomy.

Enter. The science of astronomy is part of the set of specific sciences closely connected with nature, and all the sections and topics covered by it are based on life events. Laws and concepts of science are mostly based on experience. Also, choosing the topics of this experiment in a vital and interesting way will quickly lead to the result of the goal. The topic chosen for the case is also very interesting for students, and based on the topic, they have concepts about the relationship between the

sidereal period of the planets and the semi-major axis of their rotation around the Sun, and they can apply them in solving the problem. they will have skills.

Solving the recommended case allows you to achieve the following results:

- strengthening knowledge on the mastered topic;
- transfer of knowledge and skills in individual and group analysis of the problem and the adopted solution;
- development of logical thinking;
- acquiring independent decision-making skills;
- check the level of assimilation of educational information.

Determination of the sidereal period of the rotation of the planet Venus around the Sun. (Difficult situation).

Readers know that the ratio of the squares of the sidereal cycles of the planets around the Sun is equal to the ratio of the cubes of the major semi-axes of the orbit ellipses. The main problem is to find the semi-major axis of the planet Venus using the semi-major axis of the planet Earth, the sidereal period of the Earth's revolution around the Sun and the sidereal period of the planet Venus' revolution around the Sun.

Methodical instructions for students on step-by-step analysis and solution of the practical situation (Instructions for students)

Work steps	Tips and recommendations.
1. Getting to know the case study and its information support	First of all, familiarize yourself with the case. In order to understand Kepler's laws, it is necessary to carefully read all the available information. Do not rush to analyze the situation while studying
2. Acquaintance with the given situation	Read the information carefully again. Finding the semi-major axis of the planet Venus find out what the main problem is.
3. Analysis of the problematic situation	Focus on the main problem and small problems. Main problem: Finding the semi-major axis of the planet Venus using the semi-major axis of the planet Earth, the sidereal period of the Earth around the Sun, and the sidereal period of the planet Venus around the Sun



4. Selection and justification of methods and means of solving a problematic situation	In order to find ways to get out of this situation, start filling out the table "Problem situation" presented below. To solve the problem, consider all situations, create an alternative situation. Choose a solution to the problem from specific options, find a specific solution to the problem. Fill in the table. Attach the results of working with the case study in written form
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Fill in the "Problem situation" table

With the problem in the situationType	Causes of the problematic situation	Out of the situation departure actions

The results of working with the case study are attached in written form

**Case-study written requirements**

1. The work should be written in the form of a thesis on one side of an A4 standard sheet (no more than 2 sheets).
2. Procedure for preparing a written work:
  - on the first page, on the right side, the student must write his name, surname and group;
  - the topic of the case is written in the center of the sheet;
  - and then the results of working with the case are written in the form of a thesis

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Students list	The main problem has been identified and the object of research has been determined max. 6 p	The causes of the problematic situation are clearly indicated max. 4 p	Actions to get out of the situation It is clearly indicated max. 10 p	Total max. 20 p

Assessment criteria and indicators for the work performed in the auditorium

Groups list	The group is active max. 1 p	The information was presented visually max. 4 p	Answers were given completely and clearly max. 5 p	Total max. 10 p
1				
2				
3				

8-10 points - excellent, 6-8 points - good, 4-6 points - satisfactory, 0-4 points - unsatisfactory.

1. Students must have the necessary knowledge and issues to complete their work.
2. The groups should be given specific tasks.
3. Sufficient time will be allocated to complete the task set before the small group.
4. It is necessary to warn that opinions in groups are not limited and not subject to pressure.

If the value of the semi-major axis of the planet Venus as a result of calculations corresponds to the value in the table, Kepler's 3rd law, that is, the relationship between the sidereal periods of the planets' rotation around the Sun and the semi-major axes of the orbit ellipses, will be appropriate.

#### Used literature

1. G. I. Sayfullaeva, N.T. Namozova, S.Kh. Mirzaqandova //Creation of a new generation of textbooks on astronomy// Luchshaya nauchnaya statya 2021 year
2. G. I. Sayfullaeva, Sh. G'. Khaitova, N.N. Rashidova //Spot on the sun and its effect on the earth// Science and education 2021 year
3. G. I. Sayfullaeva, N.T. Namozova, N.N. Rashidova //Edinitsa izmereniya astronomicheskikh rasstoyaniy v astronomii// Advanced science 2021 year
4. G. I. Sayfullaeva, A. R. Sattorov //Methodology of application of innovative educational technologies from astronomy to laboratory activities// European Journal of life safety and stability 2021
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