ORGANIZING TEACHING DEMONSTRATIVE EXPERIMENTS AND LABORATORY EXERCISES BASED ON PHYSICAL EQUIPMENT

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Abstract. *Improving the effectiveness of physics teaching is an urgent problem of today. An approach to assessing the acquisition of new physical knowledge, which is a system of criteria levels, where the transition to each subsequent level can be made only if the previous one is available. A method of teaching experimental activity to physics students based on the implementation of the system-activity approach with the help of a school physical experiment is offered. The main thing is the activity of methodology students in mastering not only the content, but also the process of acquiring new knowledge.*

Keywords: *practical competence, cognitive, laboratory, experiment, observation, experiment, physical experiment.*

Analyzing the results of the learning programs for the in-depth study of physics, it is worth saying that the results of science education are determined by schoolchildren's ability to study various physical phenomena, check the balance of theoretical and practical knowledge through physical experiments, and master the methods of their transfer. It is clear from this that the preparation of educational materials for active learning-cognitive activity of students by means of physical experiments is one of the important directions of physics education. Any physical experience encourages the student to work independently, teaches him to analyze, think and observe the information obtained from the experience. Any physical experience encourages the student to work independently, teaches him to analyze, think and observe the information obtained from the experience. Therefore, setting up an experiment and carrying it out is not a passive observation process for the student, but is useful in motivating him to active activity. On the basis of physical experiments, students develop not only physical knowledge, but also solve the organizational tasks of setting up an experiment and the problem of conducting it. The teacher advises students to work accurately, to deal with measuring instruments and educational equipment, to perform laboratory work, prepares them to conduct experiments and compare, analyze and generalize the obtained results. It is known that in the process of education, physical experiments simultaneously perform the functions of a source of knowledge, a teaching method, and an instructive function. Educational-research descriptive educational experiments organized on a planned basis in a certain consistency play an important role in the "subjective" discovery of physical phenomena, processes and laws by students and in their assimilation of new knowledge. The environment is the methodological basis of knowledge of existence, including the events and processes taking place in it, the unity of theoretical and empirical methods of scientific knowledge that complement each other [3].

The theoretical level of scientific knowledge includes methods that ensure the creation of a scientific theory, which is a logical system of knowledge about the objective laws of real existence.

The empirical level of scientific knowledge is directly related to the reality of natural phenomena and processes, and is related to practice, which is the subject of scientific knowledge. Such methods include observation, experimentation, statement of results obtained on the basis of scientific facts, analysis and generalizations. In didactics, as in other disciplines, the process of scientific knowledge works based on empirical and theoretical methods and their interconnections. I.A. Krutova emphasizes the importance of students getting acquainted with the empirical and theoretical methods of knowledge for the following reasons [4]: First, physical experiments serve as an important tool for acquiring new knowledge, because without such knowledge, it is impossible to start or complete the process of knowledge, get materials for generalization, theoretical it will not be possible to verify the validity of the theoretical knowledge obtained by means of observation.

Since the experiment is one of the important methods of learning, it can be considered by students as a task in the description of independent research. Secondly, the empirical level of students' cognitive activities depends on the educational institution's material and methodological support. Thirdly, according to the logic of scientific knowledge, the achievements (laws, theories, etc.) achieved as a result of the organization of students' cognitive activities in physics lessons, as they were once discovered by scientists, students also experience feelings of positive mood and satisfaction from research. Fourthly, the empirical method of knowledge reflects the activity of rationally solving a number of life and professional issues, and has a clearly set goal for specialists in various fields, including the development of experimental research methods, the ability to use tools correctly, to clarify understanding, imagination, scientific facts and laws. provides activities such as specific observation and generalization in order to achieve. One of the important conceptual elements of the physics teaching methodology is the physical experiment, which is not only a tool in teaching, but also a method of mastering the nature of an object or a physical process using an experimental method. This, in turn, is considered one of the important requirements for training competent specialists. These requirements for the development of students' competence are causing changes in all spheres of human activity, including in the field of education. Educational technology aimed at developing students' ability to observe, understand and explain physical processes and phenomena serves to increase students' logical thinking and their learning motivation [5]. As an example, the following: connection of conductors in series

We will provide a brief description of the procedure for performing the laboratory exercise.

CONNECTION OF CONDUCTORS IN SERIES

The purpose of the work: to learn how to connect conductors in series and parallel, to make electrical circuits and to calculate.

Required tools and equipment: ammeter, voltmeter, current source, resistors, rheostat, switch, connecting wires.

I. Brief theoretical concepts

When the conductors are connected in series, the end of one is connected to the beginning of the second, the end of the second to the beginning of the third, and so on.

Let two conductors with resistance R1 and R2 be connected in series (Fig. 1). When a constant current is flowing, electric charges do not accumulate in the conductors, and the same charge passes through any section of the conductor in a certain time. Therefore, the power of the current passing through certain resistances is the same.

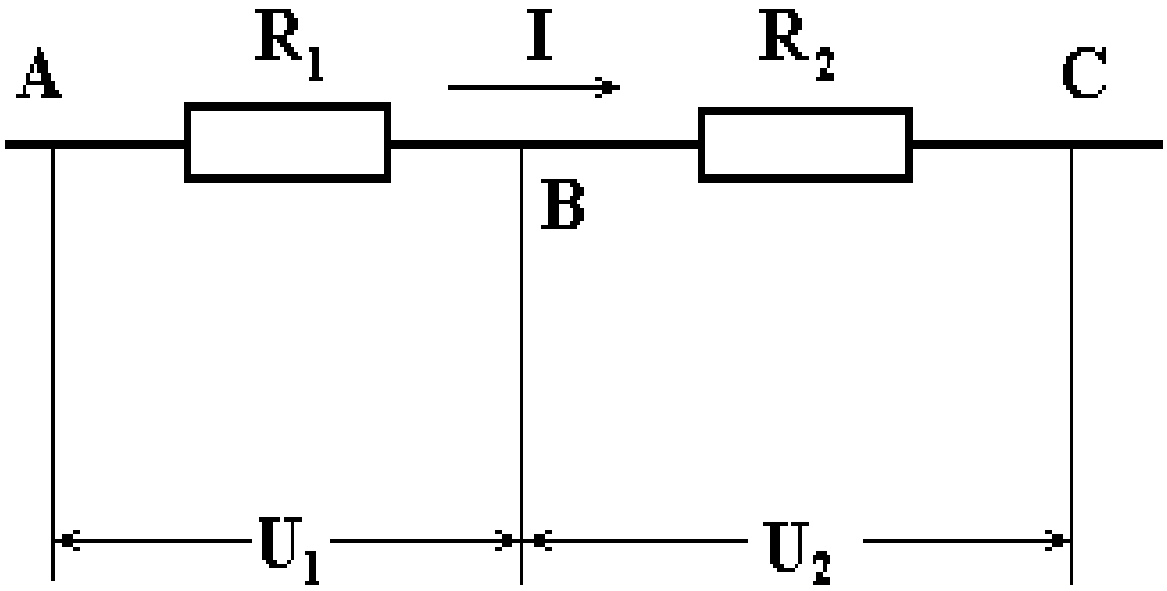

Figure 1.

$$I_1=I_2=I_3 \qquad (1)$$

The voltage at the ends of the tested AC part of the circuit is composed of the voltages at the ends of the AB and BC parts of the circuit:

$$U=U1+U2 \quad (2)$$

We apply Ohm's law to parts AC, AB, BC of the chain:

$$U = IR;\ U1=I1R1;\ U2=I2R2 \quad (3)$$

In this R-full resistance substituting (3) into (2) and taking into account (1), we generate

$$R=R1+R2 \quad (4)$$

Thus, the total electrical resistance of a circuit made up of several conductors connected in series is equal to the algebraic sum of the resistances of individual conductors, i.e.:

$$Rum=R1+R2+...+Rn \quad (5)$$

The structure and operation of the device

Figure 18 shows the electrical scheme of the device for studying the voltage drop in conductors when they are connected in series. The device consists of a current source, an ammeter, a voltmeter, a switch and a set of resistors. With the help of a switch, the resistances are connected to the current source. R1, R2, R3 resistors can be connected separately or in series, and the amount of current passing through them can be recorded with an ammeter, and the voltage drop in them can be recorded with a voltmeter.

Based on the measured values of the current and voltage, the electrical resistance of each individual resistance, as well as the total electrical resistance of the chain of resistances connected in series (according to the expression (5)), is calculated according to Ohm's law.

An overview of the device for studying the voltage drop for series-connected electrical resistances is depicted in Fig. 2.

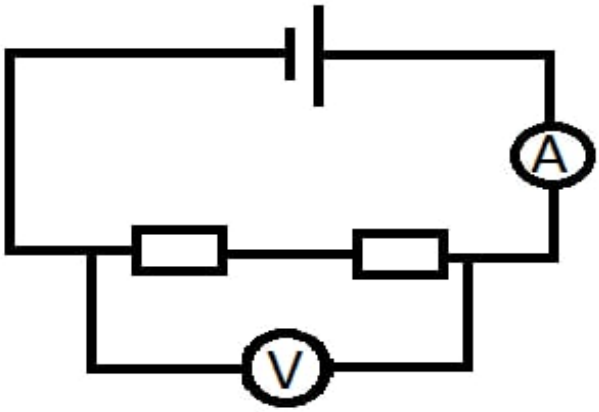

Figure 2

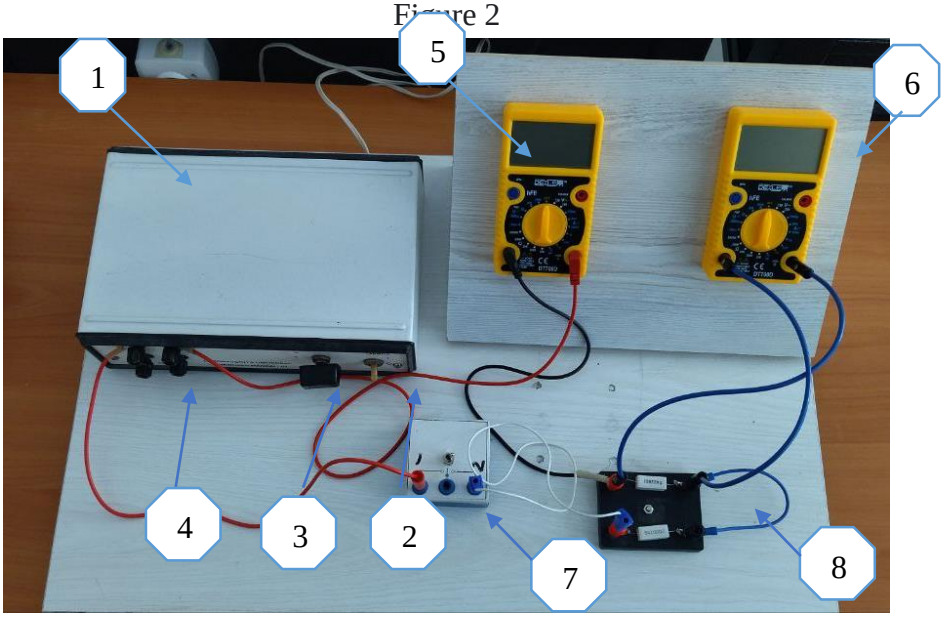

Figure 3. Overview of the experimental device

1st current source; 2- the switch connecting the current source to the electrical network; 3- bolts controlling the value of the voltage supplied to the consumer; clamps connecting the consumer to the current source, 5- voltmeter; 6 - ammeter; 7th key; 8 electrical resistors connected in series

It is desirable that the total resistance of a battery of resistors connected in series to the electrical circuit of the device does not exceed 1500. But unlike the working principle of the Ohm's law probe, the voltage drop across individual resistors connected in series is measured not by using the internal voltmeter of the power source, but by using a voltmeter connected in series.

ORDER OF WORK

1. After familiarizing yourself with the instructions for the laboratory work, get permission from the teacher to start the device.

2. To complete the work, construct the electrical circuit shown in Figure 2 and check it with the teacher.

3. After receiving permission from the teacher to do the work, connect the device to the power source.

4. Using a voltmeter, measure the voltage drop across the series-connected resistors (R1, R2).

5. Determine the current flowing through the circuit according to the ammeter.

6. Calculate the numerical value of resistances R1, R2 according to Ohm's law for part of the circuit.

7. Fill in the following table based on the obtained results

№	U_1 V	U_2 V	I_1 mA	R_1 Ω	R_2 Ω	U_{um} V	R_{um} Ω
1							
2							
3							
…							

8. Repeat the experiment for different electrical resistances.

9. Compare the result obtained from the experiment with the total resistance found theoretically.

Review questions

1. What is electrical resistance?

2. When the conductors are connected in series, what is the current flowing through them? will the magnitude of the force be equal?

3. How do voltage drops interact when conductors are connected in series?

4. Derive an expression for calculating the total electrical resistance when conductors are connected in series.

5. How are ammeters and voltmeters connected to an electric circuit?

SUMMARY

In order to increase students' interest in science and improve their knowledge, skills, and abilities, the students' knowledge of physics will be further strengthened if laboratory works are used during the lesson. As a conclusion, we can emphasize that students not only strengthen their knowledge of physics with the help of practical and laboratory training, but also acquire sufficient skills. When students learn and see with their own eyes, and try to do it in practice, their acquired knowledge will be strengthened.

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