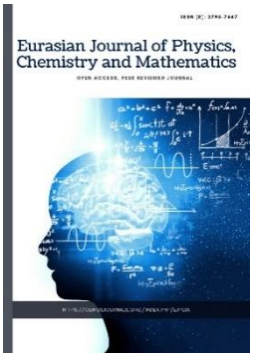

To Increase Students' Interest In Physics By Using Modern Equipment And Laboratory Work

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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 is possible only if the previous one is available. A method of teaching experimental activity to students in physics 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, experience, physical experiment.

Introduction

In order for the students to have the required level of knowledge about the basic laws and regulations related to each topic of physics, in addition to the oral presentation of the educational materials, they can conduct experiments related to this topic, they can see the phenomenon being studied. it is necessary for them to bring it to their attention and to develop their thinking activity in this regard. There are topics in the physics course that require the use of not a single instrument, but devices made up of a number of instruments and details.

The successful performance of laboratory work depends on the material and technical support of the physics teaching laboratory. Changing the content, structure and technical equipment of the work in accordance with the changing needs of the times, i.e. replacing it with modern tools and equipment, allows the results obtained in laboratory training to be more accurate and perfect.

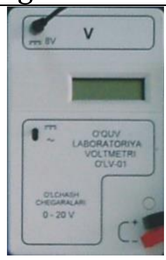
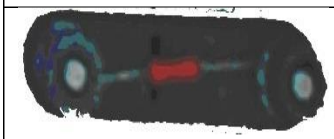
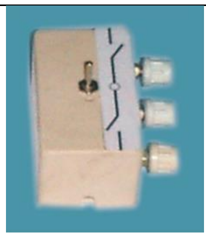
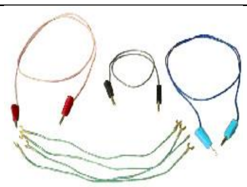
In laboratory training, the culture of working individually and as a team is formed in students, skills and competencies are formed based on a pre-arranged plan, and teachers are required to regularly check the knowledge, skills and competencies of students from the physics course, and and gives the possibility of self-control.

The process of developing educational and research skills among students increases. The introduction of a collective approach in the educational process allows for the successful development of students' practical competencies based on physical experiments. As an example, we cite the following laboratory exercise: In this laboratory exercise, all the working formulas are presented, in which order to perform the work, to obtain the results, and what to pay attention to. Pupils get to know the work and do it independently.

Parallel and series connection of the capacitor

The purpose of the work: to check the discharge of the capacitor, to determine its capacity and to learn how to calculate the resulting capacity when capacitors are connected in series and parallel.

Necessary tools and equipment: Laboratory universal supply source, two electrolytic capacitors with a capacity of 2200 µF designed for 16 V, educational laboratory microammeter - O'LMKA-01, educational laboratory voltmeter - O'LV -01, resistor with a resistance of 51 kOhm, moment meter - LO'-01M, switch and connecting wires

 The laboratory is a source of universal supply	 Two 2200 µF electrolytic capacitors for 16V	 Educational laboratory microampermeter - OLMKA-01	 Educational laboratory voltmeter - O'LV-01
 A resistor with a resistance of 51 kOm	 Moment meter - LO'-01M	 Key	 Connecting wires

A SHORT THEORY

A capacitor consists of two identical conductors, and a dielectric layer is placed between these conductors, the thickness of which is much smaller than their dimensions. Conductors forming a capacitor are called its covers. The capacitance of the capacitor is determined using the following expression:

$$C = \frac{q}{U} \quad (1)$$

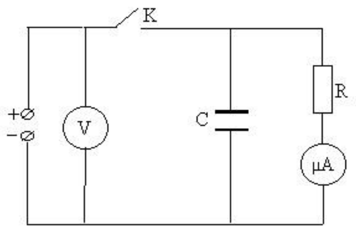
When capacitors with capacity C1, C2, C3 ....Cn are connected in series, their electrical capacity is calculated using the following expression:

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \ldots + \frac{1}{C_n} \quad (2)$$

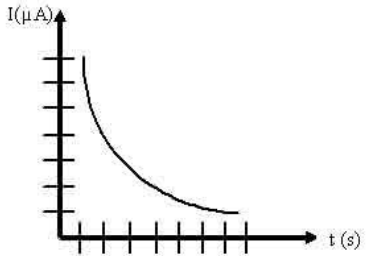
When capacitors with capacity C1, C2, C3 .... Cn are connected in parallel, their electrical capacity is calculated using the following expression:

$$C = C_1 + C_2 + C_3 + \ldots . + C_n \quad (3)$$

There is a way to determine the capacity of a capacitor by discharging it. This method is based on the electrical circuit shown in diagram 1. First of all, the capacitor is charged from the current source, then its discharge process is observed through the resistance. This method of determining the electric capacity of the capacitor is based on the measurement of the charge given by the capacitor when it is discharged. To determine the charge, it is necessary to know how the discharge current depends on time. In this work, this connection is checked and I=I(t) graph is drawn based on the obtained data (Chart 2). The area bounded by the graph and coordinate axes is numerically equal to the charge given by the capacitor. To calculate the charge, it is necessary to calculate the entire surface of the bounded area on the graph. After determining the charge and measuring the potential difference before the start of charging on the capacitor covers with a voltmeter, the capacity of the capacitor is calculated using the expression (1) using the following formula.



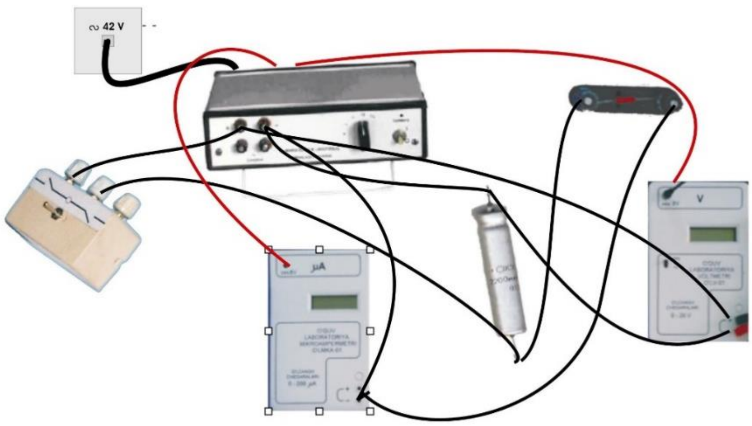
1- picture



2- picture

The structure and operation of the device

The device for checking the discharge of the capacitor and determining its capacity is assembled on the basis of drawing 1. Figure 1 shows an overview of the device. The device consists of a laboratory universal supply source, an electrolytic capacitor, a microammeter, a voltmeter, a resistor, a moment meter, a switch and connecting wires. The corresponding poles of the voltmeter are connected to the terminals of the universal supply source of the laboratory, which provide constant voltage to the consumers, that is, the negative pole of the voltmeter is connected to the negative pole of the capacitor, and the positive pole of the voltmeter is connected to the positive pole of the capacitor through a switch. To check the discharge process of the capacitor, a microammeter is connected in parallel to the capacitor through a resistor. The bolt of the universal power supply of the laboratory is set to 4V. They are prepared for work by connecting the microammeter, moment meter, voltmeter devices to the special slots on the back of the universal supply source of the laboratory.



3- picture

Order of work

1. The chain is assembled based on drawing 3.
2. The switch is connected. In this case, the capacitor is charged up to the potential difference of the voltage source (the capacitor can be charged in almost a minute, because the resistance of the connecting wires is very small). A microammeter measures the current flowing through the resistor. The readings of the microammeter and the voltmeter are recorded.
3. The key is turned off and the timer is started at the same time. In this case, the voltage source is disconnected from the circuit, but the current continues to flow through the circuit due to the discharge of the capacitor. After every 10 s, the current in the chain is determined and recorded.
4. After the capacitor is fully discharged, the experiment is repeated.
5. The average values of currents are calculated.

6. Based on the obtained results, a time graph of the current strength when the capacitor is discharged is drawn. Time (s) is placed along the abscissa axis, and current (mA) is placed along the ordinate axis. (An appropriate scale is selected independently).

7. It is determined how many charges expressed in Coulombs correspond to 1 cm2 surface in the graph. For this, the time corresponding to 1cm on the abscissa axis is multiplied by the current strength corresponding to 1cm on the ordinate axis.

8. The area bounded by the graph and coordinate axes is counted in cm2. The charge corresponding to the entire surface is determined.

9. Knowing the voltage and charge, the capacity of the capacitor is determined.

10. Two capacitors are connected in series and the experiment is repeated.

11. Two capacitors are connected in parallel and the experiment is repeated.

12. The following table is filled based on the measurement results.

Time (s)	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**C**
Connect one capacitor ganda microammeter reading (μA)												
When two capacitors are connected in parallel, microampere-meter reading (μA)												
When two capacitors are connected in series, microampere-meter reading (μA)												

Review questions

1. State the definition and units of measurement of the capacitance of a capacitor.

2. When capacitors are connected in series, what quantity do they have in common, and what formula is used to calculate the resulting capacity?

3. When capacitors are connected in parallel, what quantity do they have in common, and what formula is used to calculate the resulting capacity?

4. Why should polarity be taken into account when connecting an electrolytic capacitor to a circuit?

5. How does a change in the source voltage affect the charging and discharging time of the capacitor? What about the change in resistor resistance?

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