
# Organization of Classes on the Basis of Master-Klass in Secondary School to Solve Problems from Solid State Physics

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ABSTRACT

In this article, the author shows the role and importance of the process of solving physical problems in the study of natural phenomena and laws, understanding the physical picture of the world. Also, in order to increase interest in physics, to jointly solve existing physical problems, methods of organizing master classes on modern forms of education were developed, the history of development, their role, goals and objectives in higher education and recommendations on the chosen topic were revealed. It is noted that master classes in physics, which were organized in the past centuries, subsequently led to great discoveries. It was shown that the organization of master classes allows future professionals to work together, learn non-standard thinking, develop creativity and practice their thinking.

**Keywords:** Master class, motivation, technology, solids, mechanical properties of solids, types of solids, Hooke's law, elastic force, problem solving.

**Introduction.** Development of basic thinking in physics in the secondary education system, Introduction to the application of the acquired knowledge in life. In the system of secondary education is the development of basic thinking in physics, teaching to apply the acquired knowledge in life. As a result of educational reforms, curricula have been improved in line with modern requirements, the content of classroom lessons and topics has been created in accordance with modern requirements, students' interest in topics of solid state physics has increased, and they want to learn more. The modern education system is qualitatively characterized by the following features: it is recommended to determine the main indicators of the introduction and development of education, science, modern advanced educational technologies at the level of competition among the developed countries of the world.

Why is it necessary to teach topics related to solid state physics in the general education system? It is necessary to study natural phenomena, to know the physics of solids, to create, to develop, to solve problems of high complexity. When is a student interested in learning, understanding, creating, developing? Does he make discoveries every day, every hour and every minute? There is only one way to create an environment in the classroom that continuously promotes the intellectual growth of students, freeing the child's mind, taking advantage of the rich opportunities that nature has given him. The teacher's task is to create an environment in the classroom where the student's constant intellectual growth takes place.

**Relevance of the topic.** Today, in the rapid development of science and technology, educating young people who are enthusiastic, modern-minded, intelligent, flexible in thinking and highly generalizing, able to see and analyze unusual things and achieve high results based on analysis, takes the student to a new stage of intellectual creativity. .

One of the most effective teaching methods that solves the above problems is the

use of modern master class sessions. It is known that the main tasks of teaching solid state physics are to develop thinking, to teach students to apply the acquired knowledge in practice.

**Main part.** The process of solving problems in solid state physics always requires a number of studies by scientists. "Improving the problem-solving process in physics has always been one of the researches carried out by scientists, B.N. Damitov, P.M. Friedman in their research considered all aspects of problem-solving. They have also shown in their research that problem-solving in physics leads to the definition of a theory, and that systematic problem-solving leads to a sharpening of the intellect and knowledge". [1, p. 100] Solving problems in solid state physics. The need to solve problems systematically, which is an important factor in mastering the science of physics, is important in understanding the physical meaning of events, the application of theoretical knowledge in practice.

In-depth study of events and phenomena in nature through the use of the latest modern forms and methods of teaching in the process of practical training in solid state physics, strengthening students 'knowledge gained during the lesson, increasing students' creativity and interest in science and increasing learning effectiveness. Solving problems related to the teaching of solid state physics in education not only helps students to better understand the laws of nature, but also to constantly develop their thinking and reasoning skills. One of the modern forms of teaching topics in solid state physics is the organization of master classes. Master classes in physics can be conducted to teach students how to solve highly complex problems, issues, and experiments in the teaching of topics related to solid state physics.

Master classes in physics can be conducted to teach students how to solve highly complex problems, issues, and experiments in the teaching of topics related to solid state physics. Masterclass (English Master class, German Meisterkurs, Musikpädagogik, fr. Classe de maître, in Russian the term "творческая мастерская" is used) - a unique method of teaching and a specific form of teaching conducted by a specialist in a particular field of creative activity. "This course was originally designed for people who were sufficiently professional in the fields of fine arts, literature, directing, acting, design, as well as science, pedagogy and crafts". [2, Pegs. 169-175].

"It is also possible to fill the master class with theoretical knowledge about modern problems and technologies, but its main task is to skillfully convey the methods of work. It can be a method, a method, a technique, or a technology. It is not just about reporting, transmitting or assimilating information about them. Often the master class ends with a discussion of the results of the joint work of the master and the audience". [3] The organization of master classes does not have a strictly uniform standard. This form of training is not regulated in a timely manner and the master class can last from one hour to the entire working day. The number of direct participants can be two or more. Usually the master class is based on the practical needs of the teacher and the student. During the master class, the teacher performs any creative activity and the teacher clearly explains to him how to do it, explains his point of view and demonstrates the individual elements of the activity, explains the most common mistakes.

After that, the student resumes his / her activity taking into account the teacher's explanations. The advantages of this method of teaching are: constant communication between teacher and student, practical character and individual approach to the student.

If the master class is held regularly for a long time and with regular participants, then this form of teaching is usually called a creative workshop [4, p. 175].

A master class is a form of learning process in which practical experience is passed from teacher to student. The topic is selected → the current problem is covered → the theory of solving this problem is explained → practical exercises are organized to strengthen the theory → a useful skill that can be applied after the lesson is formed. If students do not learn

something new after the lesson, it is not a master class - it should be seen as a lecture, story, public speech, or other form of learning. A distinctive feature of master classes is that students or trainees acquire defined skills on a topic covered in the learning process. There are no strict rules and structure of the master class, but it depends on the complexity of the chosen topic, the skills of students or listeners, the qualifications of teachers or speakers, the level of equipment, conditions and other circumstances of the place where the educational process is organized [5, Pegs. 37-41].

The process of teaching the content of solid state physics in general education schools in the future, focusing on the next stages of continuing education.

One of the main directions in the formation of a comprehensively developed personality is the formation of students' skills in solid state physics. One of them is the use of modern pedagogical and information technologies in physics lessons. Lessons on the methodology used so far do not arouse the interest of students today, leading to a rapid loss of attention. New forms of reading should always be used to test students 'knowledge and skills to attract attention, develop interest and independence in work.

If a teacher decides to prepare lessons independently using a master class, several questions arise:

- how to do it;
- where to find the material;
- How to use it in class.

The master class is dedicated to teaching students how to solve problems of high complexity in teaching topics related to solid state physics. Solving physical problems in education allows students not only to better understand the laws of nature, but also to develop continuous thinking. It is very important for current graduates of schools who have passed the exam in physics to solve difficult problems, because in the future in the process of professional activity will be formed the ability to solve such problems.

Nowadays, master class is increasingly used as a more specific teaching method in the learning process. This form of education is distinguished by a number of its features, and the master class in physics aims to solve the following tasks:

- to help students gain a deeper understanding of the nature of physical phenomena and laws, allowing them to acquire new knowledge and increase their previous knowledge, strengthen fundamental knowledge and skills;
- Develop skills and competencies in the use of technical devices (physical equipment) by identifying the importance of physics in the teaching of solid-state physics topics (e.g., their role in the development of inventions, discoveries, etc.).

The methodology of conducting master classes in physics lessons is based on the teacher's pedagogical intuition and the student's thinking related to the use and imagination of physical phenomena, equipment. A master class is a two-way process where the relationship between teacher and student is absolutely improved.

The main part. Master class on physics in the system of secondary education on "Mechanical properties of solids."

Objective: To increase students 'activity, develop participants' competence in conducting research, gain personal experience in problem solving and teach them to work with literature.

Functions:

- to identify the system of knowledge that needs to be mastered, in our example "Mechanical properties of solids": to demonstrate methods and tools for developing thinking in strengthening concepts such as types of solids, Hooke's law, deformation and its types, collapse and strength;
- Creating conditions for active, collaborative interaction between the participants of the master class;
- To determine the effectiveness of the master class, to organize the reflection of experimental results.

The master class offered by us will be held in the following order.

Step One: Greetings.

- Hello dear readers and listeners! We would like to share with you the experience of using the technology of conducting master classes in physics in the study of "Mechanical properties of solids."

Second stage: Motivation. This stage is a "motivation", which should create an internal and external need to solve the problem, so that students are actively involved in solving problems. The stronger the need, the better the students will do their best to solve the problem and try to the maximum, resulting in a high level of satisfaction. These students will recall previously acquired and mastered knowledge, stimulate interest in the topic, and identify goals for future study material. To do this, students are asked the following questions that activate.

What do you mean by a solid body? Can you list the types of solids and explain the differences? How and where does Hooke's law apply? What is deformation? Can you list the types of deformations? What is decay? and what is consistency?

After a question and answer session with the students, they move on to the next step.

Third stage: "Revival". At this stage, students can be asked to solve non-standard tests. To do this, students are allowed to work collaboratively, using textbooks, literature and dictionaries. For example:

The change in shape and size of objects under the influence of an external force is called…. Fill in the dots instead.

A) Deformation. B) Hooke's law. C) Inertia. D) Elastic force.

Answer: A.

The fourth stage: "Comprehension" - is essential, during which the student is engaged in practical work, in our example, is engaged in solving problems directly, in addition, the work is focused, focused on a specific topic and meaningful. The condition of the matter is analyzed, the quantities sought are determined, and the specific features are compared. In this process, students will of course recall similarly solved problems in memory, trying to determine the degree of relevance to the problem. What is the purpose of solving physical problems for students before starting this phase? the question is asked. Students say they will definitely find the answer. The teacher states that the answer can also be learned from the back of the book. Then the students begin to express their opinions. The teacher then suggests solving the following problems to better understand why the problem needs to be solved.

Issue 1. An object suspended from a wire attached to a support is subjected to a gravitational force of 300 N. If the wire is stretched by 0.5 mm under the influence of this force, find its bending. [6, Peg. 70] (see Figure 1)

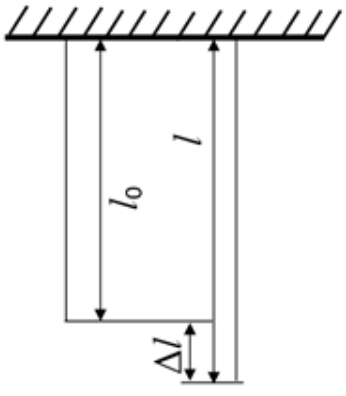


**Figure 1**

| Given: | SI | Formula | Soliton |
|---|---|---|---|
| $F_{ef} = 300\ N$<br>$\Delta l = 0{,}5\ mm$<br>$k$ - ? | $5 \cdot 10^{-4}\ m$ | $F_{ef} = k \cdot \Delta l$<br>$k = \frac{F_{ef}}{\Delta l}$ | $k = \frac{300\ N}{5 \cdot 10^{-4}\ m} = 600\ \frac{kN}{m}$<br>***Answer:*** $k = 600\ \frac{kN}{m}$ |

Answer. 600 kN / m

Fifth stage: Hooke's law - the stage of expression and definition. At this stage, students express their personal attitude to the solution of the problem and offer him their solution. This is where our own ideas are reviewed and tests and problem solving are discussed

Table 1.

| Tests | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Answers | A | | | | | | |

Table 2

| Problems | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Answers | 600 kN/m | | | | | |

Teacher: Exchange notebooks and check each other's work. Put a “+” sign for each correct answer. Return the notebooks. Put a "+" sign in your notebook. Who scored thirteen "+"? etc. At the end of the lesson, ideas about what is the solution to the problem of mechanical properties of solid state physics are summarized.

Sixth stage: "Conclusion".

The teacher asks students and participants to evaluate the lesson. To do this, he distributes the cards and asks to be marked.

1. Everyone liked _____
2. None of them liked _____
3. Nothing clear _____
4. It was interesting _____
5. It was boring _____
6. Understood _____
7. It was difficult _____
8. I received a lot of new information _____
9. I didn't learn anything _____

The master class was summarized as follows.

**Conclusion.**

First, knowledge of the mechanical properties of solids was strengthened in the course of practical exercises, the problem-solving process was explained in a certain sequence, mapping, linking physical laws, finding the basic formula and substituting given values have the ability.

Second, the process of solving problems from the mechanical properties of solids to find connections between general theoretical data (concepts, laws, formulas), to apply mathematical operations, to understand interdisciplinary connections (physics, geometry, mathematics and chemistry), to choose the number system and coordinates, to draw diagrams he realized he needed to know.

Third, conducting the session in the form of a master class turned each student into a participant who actively mastered the process of learning from a passive participant, gaining knowledge, skills and competencies on the chosen topic.

Fourth, as a result of working with literature and collaborative research, students gained some solid, highly understood, practical knowledge.

Fifth, it ensures that the learner has communicative, design, research, multicultural, learning skills that can be applied to the next stages of education and later in their professional activities while completing learning tasks.

**Recommendations.**

The process of solving problems in solid state physics is the basis for explaining the physical landscape of the world on a natural-scientific basis, focusing on the formation of general scientific ideas about natural phenomena and laws, solids, solids, deformation, mechanical properties of solids, Guck's law, solving physical problems. knowledge, skills formation and expansion.

Carrying out the process of solving problems related to the physics of solids in a collaborative, interest-based manner, encouraging students not only to know the laws of nature, but also to constantly practice their thinking, to form a passion for solving creative problems.

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