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WAYS TO INCREASE THE EFFICIENCY OF PRACTICAL LESSONS IN NUCLEAR PHYSICS

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ABSTRACT

This article is devoted to the problems of improving the efficiency of practical training of the yard physics department As a result of the further development of this department, new topics and the content of practical exercises corresponding to them have been developed. The ways of consolidating knowledge in practical trainings are described as well.

Keywords: atomic nucleus, radioactivity, nuclear reactions, bond energy, mastering efficiency, pedagogy, methodology, practical training.

INTRODUCTION

Practical training in physics in higher educational institutions includes problem solving, laboratory training and conducting seminars. Working with problems occupies a special place in the system of scientific knowledge, that is, it is a means of strengthening the acquired theoretical knowledge and applying it in practice. In this process, students develop practical and thinking methods, skills and abilities. It is important to work on problems in preparation for participation in creative works, in independent work in the development of thinking, in finding effective ways to increase the productivity of the lesson.

Achievements of science and technology, scientific discoveries, advanced ideas and scientific views of our country's scientists, problem working has an important educational value. The educational aspect of the work is to make students willing to work hard, to strive for the goal, and to ensure that they have sufficient methodological training to teach the young generation in the future.

One of the important conditions for preventing students' knowledge from becoming shallow and superficial and teaching them to apply their acquired knowledge in practice is performance.

Teaching students to solve problems in general physics is one of the most difficult problems of teaching. The effectiveness of problem-solving depends on the methodology used by the teacher and students' mastery of generalized methods of problem-solving. The process of problem solving can be divided into the following four stages:

1. Acquaintance with the condition of the matter.
2. Creating a work plan for the issue.
3. Work on the issue.
4. Checking that the issue is handled correctly.

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Practical training - specified in the curriculum, which serves to teach students to deepen, expand and apply the knowledge of physics acquired in lectures and independent work, educational work in higher educational institutions. is a type. If you compare the practical training with the lecture, it becomes clear that it is a logical continuation of the material presented in the lecture. If we say that a lecture on physics forms the foundation of imparting knowledge in a generalized form, practical training strengthens, expands and clarifies this knowledge.

If the lecture makes it possible to get acquainted with and understand the educational material, in practical training, students should master the material at a high level, in other words, acquire the skills and abilities to master it with skill and creativity. it is necessary, in most cases, in practical training, unlike lectures, students' scientific thinking and speech develop. Because listening to the teacher's logical and grammatically correct words is one thing, and doing them is another.

In conclusion, it can be said that practical training not only forms students' interest in science, but also serves to consciously form the culture of learning and scientific work in them.

LITERATURE ANALYSIS AND METHODOLOGY

Teaching physics means teaching the structure of the Universe, introducing its founders, explaining the essence of understanding the physical processes occurring in nature. Practical exercises are of great importance in teaching physics. Practical training is mainly conducted in the form of problem solving, laboratory work and seminar training.

Problem solving is an integral part of the physics education process, in which theoretical knowledge is strengthened in every way, physical concepts are formed, physical thoughts are developed, the skills and competences of practical application of the acquired knowledge are formed, developed and improved. Providing new information by solving physics problems, creating problematic situations and posing problems to students, developing practical skills and competencies, testing the strength of students' knowledge and imagination, strengthening, summarizing and repeating theoretical material, introducing technical achievements, students' creative abilities can be developed. Through problem solving, students are also taught to think and act independently [2].

Nuclear physics is taught as a branch of general physics in pedagogic higher education institutions. Studies have shown that 1. Collection of problems from the general physics course (edited by M.S. Cedric), 2. V.S. Volkenstein Problem set guides from a general physics course are recommended. 1. A set of problems from the general physics course (under the editorship of M.S. Cedric) contains problems related to the nuclear structure, the law of radioactive decay, nuclear reactions and thermonuclear reactions. 2. V.S. Volkenstein's set of problems from the general physics course contains problems on the topics of radioactivity and nuclear reactions. Literature recommended as additional literature 3. A.G. Chertov, A.A. Voronsov. In the set of problems from physics, problems related to the structure of atomic nuclei, radioactivity, elements of dosimetry of ionizing radiation, mass defect and binding energy of atomic nuclei and nuclear reactions are given. 4. Polvonov S.R., Kanakov Z., Ruzimov Sh.M. In the collection of problems from atomic and nuclear physics, problems related to the main properties of the atomic nucleus, radioactivity, interaction of nuclear radiation with matter, and nuclear reactions are given.

DISCUSSION

The science program of general physics was approved by the report No. 3 of August 14, 2020 of the Council for Coordinating the Activities of Educational and Methodological Associations in Higher and Professional Education.

According to the order of the Ministry of Higher and Secondary Special Education of the Republic of Uzbekistan No. 418 of August 14, 2020, approved science programs were approved by the base higher education institution.

Subjects of general physics (atomic, nuclear and elementary particle physics) lectures are divided into:

Topic 1: The structure of the atomic nucleus. The structure of the atomic nucleus. The composition of the atomic nucleus. Nuclear charge, mass, radius. Ways to identify them. Binding energy of the nucleus. Relative binding energy. Weissäcker's semi-empirical formula for bond energy.

Topic 2: Nuclear forces. Nuclear models. Nuclear forces. Properties of nuclear forces, structure of nuclei. Nuclear spin and orbital magnetic moment. Ways to determine it. Couple. Its conservation law. Isotopic spin. Nuclear models. Liquid-droplet model of the nucleus. Fermi gas model. Shell model. Generalized model.

Topic 3: Radioactivity. Radioactivity. Discovery of radioactivity. Law of radioactive decay. Concept and units of activity. Types of decay. Alpha and Beta decays. Alpha decay and Beta decay. Energy relations in beta decay.

Topic 4: Gamma radiation. Thermonuclear reaction. Beta decay spectrum and neutrino. Gamma radiation. Gamma radiation, internal convection phenomenon. Mössbauer effect. Nuclear reactions. Law of conservation in nuclear reactions. Cross section of nuclear reactions. Output of nuclear reactions, accelerators. Thermonuclear reaction. Conditions for the formation of thermonuclear reactions. Thermonuclear reactions in the Sun and stars. Prospects of thermonuclear reactions. Nuclear energy. The main features of nuclear fission. Fission products, their energy and mass distribution, chain reaction.

Topic 5: Effects of nuclear radiation on matter. Methods of recording nuclear radiation. Effects of nuclear radiation on substances. Types of interaction of nuclear radiation with substances. Ionization is a loss of energy. Interaction of heavy nuclei with the environment. Vavilov Cherenkov effect. Effects of gamma quanta with substances. Methods of recording nuclear radiation. Dosimetry. Counter detectors. Mass analyzers. Biological effects of nuclear radiation. Radiation dose. Ways of protection against nuclear radiation.

Approximate recommended topics of practical training:

1. Nuclear structure.
2. Law of radioactive decay.
3. Nuclear reactions.

4. Thermonuclear reactions.

As we know, students strengthen their theoretical knowledge in practical training. However, we can see from the above that very few topics (hours) are allocated to practical training, so students face some difficulties in mastering the content of the subject. To overcome these difficulties, it is necessary to perform the following tasks:

1. Study and analysis of existing literature on issues from nuclear physics.
2. Selection and arrangement of problems according to the sequence of study of nuclear physics, preparation of additional problems.
3. Include questions for each problem to provide ways to solve problems and strengthen the theoretical material.
4. Development of additional training tasks and recommendations to strengthen problem solving.
5. Preparation of non-standard tasks for self-assessment of students in the process of solving problems and development of recommendations for their implementation.
6. Development of a methodology for the large-scale use of ICT in the process of solving problems.

RESULTS

The conducted researches show that it is an important and necessary task to effectively organize classes in nuclear physics for students of specialized higher educational institutions of pedagogy, to improve the training process. In particular, improving practical training and developing its content is one of the important tasks of today's education system.

In order to increase the effectiveness of mastering nuclear physics in practical training, the following activities were carried out:

1. Conducting practical training in nuclear physics in pedagogical higher education institutions was studied and analyzed.
2. The available literature in our republic recommended for training was studied and analyzed.
3. A study guide containing problems and their solutions was prepared for conducting practical training aimed at increasing the effectiveness of mastering nuclear physics.
4. Based on Bloom's taxonomy, non-standard tasks were developed to strengthen the topics of practical training and self-assessment of students.

Yuqoridagilardan tashqari quyidagi tartibda yangi masalalar ham tuzish tavsiya qilinadi.

1. How many times larger is the radius of $^{56}_{26}Fe$ iron nucleus than the radius of $^{7}_{4}Be$ beryllium nucleus?

2. How many times longer is the radius of $^{27}_{13}Al$ iron nucleus than the radius of $^{1}_{1}H$ hydrogen nucleus?

3. How many times longer is the radius of the oxygen nucleus $^{16}_{8}O$ than the radius of the deuteron nucleus $^{2}_{1}H$?

4. How many times longer is the radius of $^{24}_{11}Na$ iron nucleus than the radius of $^{3}_{1}H$ tritium nucleus?

5. The radius of the moon is 1,74 Mm, and the average density is 3350 kg/m^3. What would be the radius of the moon if it had such a mass and a density equal to the density of the nuclear material?
6. The radius of the Earth is 6,37 Mm, and the average density is 5518 kg/m^3. What would the Earth's radius be if it had such a mass and a density equal to the density of nuclear matter?
7. The radius of Mars is 3,38 Mm, and the average density is 3940 kg/m^3. What would be the radius of Mars if it had such a mass and a density equal to the density of the nuclear material?
8. A sample of $^{210}_{38}Bi$ radioactive bismuth contains 10^{10} radioactive atoms with a half-life of 5,02 days. How many atoms are disintegrated in one day?
9. Determine the half-decay constant for radium $^{226}_{88}Ra$. In 3100 years, how much of the initial atoms will be disintegrated?
10. How long will it take for 25% of the atoms in a sample of $^{45}_{20}Ca$ calcium to decay if radioactive decay products are carried away without stopping?
11. If the initial mass of $^{226}_{88}Ra$ radium is 2 g, how long will it take for its 20 mg mass to decay?
12. If the radioactive isotope of $^{210}_{84}Po$ iridium initially has a mass of 2 g, how many nuclei will decay in 1 s and how many atoms will remain after 60 days?
13. A radioactive sample with an activity of 3.7 109 s^{-1} was placed in a calorimeter with a heat capacity of 4,19 J/K. If this sample emits α-particles with an energy of 5,3 MeV, how much will the temperature inside the calometer rise in 1 hour?

These questions are structured similar to the questions in the above-mentioned literature and serve as an additional resource for students to master the subject.

CONCLUSION

The Department of Nuclear Physics is distinguished from other departments by its interestingness, complexity, modernity, and the high level of imagination required for learning. Sufficient supply of new materials covering modern achievements of the nuclear physics department to students will serve as a basis for students' understanding of innovations in this field, broadening of their imaginations, and their independent assimilation. There is no doubt that the newly improved and developed structure and content of practical training, the methodology of its teaching, and the created study guide will serve to develop deep and solid knowledge of nuclear physics department of students in higher educational institutions of pedagogy.

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