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АКТУАЛЬНІ ПРОБЛЕМИ ПІДГОТОВКИ ВЧИТЕЛІВ ДИСЦИПЛІН ПРИРОДНИЧО-МАТЕМАТИЧНОГО ЦИКЛУ В УМОВАХ РЕФОРМУВАННЯ ЗАГАЛЬНОЇ СЕРЕДНЬОЇ ТА ВИЩОЇ ОСВІТИ

PRINCIPLE OF CONFORMITY IN THE STUDY OF MODERN PHYSICAL THEORIES

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The problem of modernization of natural knowledge, including physics, is actively discussed in scientific and pedagogical groups. Recently, there is a tendency to simplify the school course of physics, especially in non-core classes. Nevertheless, the course of physics not only should reflect in a popular form the individual achievements of modern science, but should also be based on the methodological principles of this science: symmetry, conservation, causality, conformity, the principle of observation and simplicity to specify the types of symmetry, the principle of unity to adjust existing theories, and so on. It is necessary not to facilitate the course of physics in educational institutions, but to radically restructure it in the manner, when classical physics would act in dialectical unity with the modern one. The laws of classical physics must be understood from the standpoint of modern science: on the basis of the dialectic of necessary and accidental, the dialectic of symmetry and asymmetry, the dialectic of the process of cognition. This is necessary in order to prevent fragmentary thinking and to form in students a scientific picture of the world and a scientific worldview.

The principle of conformity is one of the most important achievements of theoretical physics and all physical and mathematical science of the twentieth century. It can be formulated as follows: when new more general theories appear, the old theories, the validity of which has been experimentally established for one or another area of physical phenomena, should not be rejected as false, but should be preserved as a limiting form and a partial case of new theories.

For example, studying electricity in high school physics, the basic ideas of the classical electronic theory of metal conductivity, which is based on the idea of free valence electrons inside the metal, is considered. It is said that the current source causes an electric field inside the metal. This electric field causes the "electron wind" - the directed movement of electrons, which is superimposed on their chaotic motion. It is explained that the physical meaning of resistance is the collision of electrons with the nodes of the crystal lattice. It is said that the energy, that electrons transfer to the lattice nodes, causes heat dissipation in the conductor.

The presentation of these questions in the spirit of classical electronic theory of metals creates the illusion that the classical electronic theory of metals is quite correct and corresponds to the experimental facts. As a rule, the presentation of the electronic theory of metal conductivity ends with Ohm's law. However, it is also advisable to analyze the correspondence between the conclusions of classical theory and experimental facts. Such an analysis is possible for high school students. Its purpose is to consider the difficulties that arose in the classical theory of electrical conductivity:

1. The temperature dependence of pure metals’ resistance.
2. The magnitude of the electron average free path in the metal.
3. Comparison of the resistivity for metals of different valence.
4. The greatest difficulty of the classical electronic theory of metals is the explanation of the heat capacity of metals.

Thus, classical electronic conductivity theory cannot satisfactorily explain the whole set of experimental facts related to the electrical conductivity of metals. Thus, the classical description of the behavior of electrons in solids, in particular in metals, is not entirely correct, because it turned out to be unsuitable for explaining the electrical properties of solids.

The modern theory of electrical conductivity of metals arose almost immediately after the creation of the foundations of wave mechanics. It is worth getting acquainted with it in high school after considering a number of basic principles of modern physics, which are strikingly different from the usual "classical" ideas: the presence of wave properties in electrons and other elementary particles; discrete (quantum) change of some physical quantities that characterize the behavior of atoms, molecules, electrons and nuclei; the nature of the distribution of electrons by energy states in the atom (or in another atomic system: molecules, crystals of a solid). This information is enough to explain to students how modern electronic theory of electrical conductivity solves the difficulties of classical electronic conductivity of metals. For example, it is explained that an electron that has wave properties can pass through the nodes of the crystal lattice, because the electron waves "envelop" them, and therefore the free path length can be much greater than the distance between the nodes. Etc.

Thus, due to the principle of conformity, the history of physical science appears before us not as a chaotic change of various more or less successful theoretical points of view, not as a series of catastrophic destructions, but as a natural and consistent process of cognition development. each degree of which has its value and adds a particle of relative truth, which becomes more and more complete.

The principle of conformity, which originated in the bosom of quantum mechanics as a heuristic principle, has become a general methodological principle that determines the general pattern of development of the natural sciences.