

INCORPORATING THE BASICS OF NANOSCALE SCIENCE AND TECHNOLOGY IN THE CYCLE OF NATURAL AND MATHEMATICAL SCIENCES OF SECONDARY SCHOOL

It's known that the educational process should reveal and implement those priorities in education, recognized by society at this stage of its development. In last years the nanotechnologies takes an important place in the science and production.

"First generation" of nano- and metamaterials is a common thing in our time. Passive nanomaterials which includes titanium dioxide in sunscreen, cosmetics, surface coatings, and some food products widely use in everyday life. For example, Carbon allotropes used to produce gecko tape; silver in food packaging, clothing, disinfectants and household appliances; zinc oxide in sunscreens and cosmetics, surface coatings, paints and outdoor furniture varnishes; and cerium oxide as a fuel catalyst.

The new generation of nano- and metamaterials field includes subfields which develop or study materials having unique properties arising from their nanoscale dimensions. Interface and colloid science has given rise to many materials which may be useful in nanotechnology, such as carbon nanotubes and other fullerenes, and various nanoparticles and nanorods. Nano- and metamaterials with fast ion transport are related also to nanoionics and nanoelectronics.

Ukraine's accession to the sixth technological structure and development of competitive industries can be accelerated by adapting the international experience training for nanoscale science and technology, development and implementation in schools and universities courses of the latest achievements and problems of nanotechnology. Comparing the educational courses explicitly seen that this issue becomes interdisciplinary. There are practically no methodological development to address the study of nanoscale science and technology in secondary school in Ukraine. Therefore, the study of teaching issues related to the development of nanotechnology in schools is urgent now.

Scientific methods of teaching involves primarily state educational standards, curricula and training programs of educational courses. In this case, the development of regulations that would define the content of education in the field of nanotechnology, especially state education standards is a requirement of time. Implementation of these standards will meet the demand for the relevant specialists and achieve greater levels of training [1].

The amount of hours allocated to the students acquainted with nanoworld in teaching physics to form a complete picture of the world and prepare students for conscious perception of a fundamentally new approach to the study of the structure of the matter and the creation of new materials is precious few. One of the possible options of the partial solution of this problem may be including of the specific issues of nanotechnology related to specific learning material in the process of learning natural sciences using the reserve training time. For example, in the study of the wetting phenomena in physics course in secondary school students can introduce so-called "lotus effect" and gradually moving to study the properties of nano-objects. However, it should be noted that the main drawback of this method of studying nanoscale science and technology is inevitable fragmentation of knowledge of pupils and immaturity complete representations of the nanoworld. A more promising and effective direction is the development and implementation of the learning process based on nanotechnology in the form of elective courses [2].

Awareness of pupils of the educational material in nanoscale science and technology is an important didactic problem, given the size of the objects of study. This problem can be successfully solved only in a visualization their basic features significant multimedia.

During the last decades it has been used widely the new information technologies for teaching nanotechnology. The main method of study is recognized as modeling method. There are a number of software tools designed to simulate the phenomena of molecular physics (RasMol, QuteMol, Jmol, Jsmol, Gromacs, XMD) [3]. Programs are free, open source molecule viewer for students, educators, and researchers in chemistry and biochemistry. Programs intended a molecular graphics for the visualisation of proteins, nucleic acids and small molecules. There are aimed at display, teaching and generation of publication quality images this programs. Computer modeling tools allow you to create visual images of the objects and define the physical characteristics of objects and monitor their changes over time. The represented dynamic digital models based on disclosure of component-based consistency of the mathematical and physical knowledge and aimed at enabling a deep and full understanding of the nature of the students.

The activities plan of demonstration experiment developed in the methodical of for teaching physics is stored in the case of virtual experiment [4].

Hence, the contradictions that emerged today between the new needs of society for qualified specialists in the field of nanoscale science and technology and content of traditional education system, can be resolved by implementing the learning process of secondary and higher educational institutions of the new interdisciplinary courses related to the development of nanoscale science and technology .

References

1. Standards catalogue. 17: Metrology and measurement. Physical phenomena. [Electronic resource]. - Access mode : http://www.iso.org/iso/catalogue_ics_browse?ICS1=17&
2. Пасько. О.О. Місце нанотехнологій у навчальних програмах з фізики та стандартах загальної середньої освіти – перспективи розвитку. / О.О. Пасько, О.Є. Аврамчук / Вісник Чернігівського національного педагогічного університету. Вип. 127. (Серія педагогічні науки). / – Чернігів : ЧНПУ, 2015. – С. 160-162.
3. Стадник А.Д. Методические аспекты обучения нанотехнологиям. // А.Д. Стадник, И.А. Мороз, А.В. Яременко, О.А. Пасько / XIII Международная научно-практическая конференция: «Отечественная наука в эпоху изменений: постулаты прошлого и теории нового времени». Ежемесячный научный журнал. Часть 2. : Екатеринбург. - № 8 (13). – 2015.
4. Каленик М.В. Методика віртуального демонстраційного фізичного експерименту / М.В. Каленик, О.О. Пасько // Фізика та астрономія в школі: Науково-методичний журнал. – 2009. –№ 1 (70). – С. 29-32
5. <http://www.openrasmol.org/>

АННОТАЦІЯ

Пасько О.О. Вивчення основ нанотехнологій у циклі природничо-математичних дисциплін старшої школи.

Автором охарактеризовано стан викладання в загальноосвітніх навчальних закладах питань, пов'язаних з розвитком нанотехнологій. Обґрунтовано доцільність розробки і впровадження в навчальний процес основ нанотехнологій у формі елективних курсів. Розглянута проблема ефективного вивчення нанотехнологій у загальноосвітніх навчальних закладах, безпосередньо пов'язаного з досягнутим рівнем інформатизації та комп'ютеризації освіти.

Ключові слова: нанотехнології; технологічний уклад; наноб'єкт.

АННОТАЦИЯ

Пасько О.А. Изучение основ нанотехнологий в цикле естественно-математических дисциплин старшей школы.

Автором охарактеризовано состояние преподавания в общеобразовательных учебных заведениях вопросов, связанных с развитием нанотехнологий. Обоснована целесообразность разработки и внедрения в учебный процесс основ нанотехнологий в форме элективных курсов. Рассмотрена проблема эффективного изучения нанотехнологий в общеобразовательных учебных заведениях, непосредственно связанного с достигнутым уровнем информатизации и компьютеризации образования.

Ключевые слова: нанотехнологии; технологический уклад; нанобъект.

SUMMARY

Pasko O. Incorporating the basics of Nanoscale Science and Technology in the cycle of Natural and Mathematical Sciences of Secondary School.

The fundamental aspect of research problem is teaching reorientation to the needs of society in nanotechnology. The author substantiated expediency of development of elective courses in nanotechnology and their implementation in the educational process of secondary school. It is directly related to the achieved level of informatization and computerization of education. Author propose to use of certain computer software for modeling and visualization of nano-objects.

Key words: nanotechnology; technological way; nano- and metamaterials; nanoobject.