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THE ROLE OF PHYSICS IN THE TEACHING OF EXACT AND NATURAL SCIENCES

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ABSTRACT

This article shows how to use integrated learning technologies in teaching physics in general secondary education and secondary special education. It also shows how important the study of concepts in physics is in the study of other sciences.

Keywords: physics, mathematics, chemistry, interdisciplinary communication, educational technologies, efficiency.

INTRODUCTION

One of the factors in improving the educational process at all stages of education is the emphasis on interdisciplinary links in the teaching of subjects. The interrelationships in the teaching of science and how skillfully this work is done, the effective method, the appropriate use of tools are great educational importance.

The use and strengthening of interdisciplinary links helps to ensure that the knowledge gained from the basics of science is complete, in-depth and thorough. Bringing this interdisciplinary connection to the reader has recently become one of the main problems of didactics. This can be done by opening up aspects of interdisciplinary links between physics, mathematics, chemistry and other disciplines in general secondary education, secondary special education and their active use in the teaching process. Today, many scientific discoveries have been made in mathematics, physics, including astrophysics [1-5], but the effectiveness of using these results in the teaching of these sciences remains low. The teaching of physics is also based not only on knowledge derived from physics, but also on knowledge derived from other natural and human sciences. For example, from the course of

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mathematics for the study of mechanics, vibration and waves, from the course of trigonometric functions, from the course of chemistry in the study of electrolysis, atomic and nuclear physics, from the course of history on the requirements of industry in the XIX century. The knowledge gained from geography is used in the study of data, atmosphere, conventions, phenomena of earth magnetism. While the knowledge gained from the natural sciences is the basis for the consolidation and deepening and expansion of scientifically based knowledge in the teaching of physics [6-9], the humanities are the basis for arousing interest in physics and as a means of facilitating imagination.

Ensuring interdisciplinary synchronous (in terms of time) communication is a very complex task. Because the school must logically preserve this subject in each subject, which in turn determines the sequence of subjects. From a pedagogical point of view, it is expedient to implement a process of interdisciplinary two-way communication. This process involves not only the scientific preparation of students in the study of related academic disciplines, but also the study of related scientific disciplines in order to study their own subject. In order to make interdisciplinary connections, it is necessary to take into account the creation of curricula, textbooks and manuals for existing subjects. It is also a key task for teachers at all stages of education to ensure that the physical information provided in the textbooks is relevant to the information in other subjects. Therefore, this article shows how to use integrated learning technologies in teaching physics at the general secondary and secondary special education levels.

METODS AND MATERIALS

The results of the integrated lesson are reflected in the development of creative disciplines of teachers. Interdisciplinary integration is not about showing the interrelated areas of several subjects, but about giving students an idea of the integrity of the world around us through integrated learning. It should be noted that integration accelerates the formation of the student's worldview.

The following levels of integration can be defined.

1. Thematic (thematic) integration
2. Problem integration
3. Conceptual integration
4. Theoretical integration

In thematic integration, two or three different subjects reveal a single theme. This level can be called illustrative-descriptive. Solving one problem with different

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subject possibilities is problematic integration. In conceptual integration, a single concept is considered using the tools and methods of different subjects. Theoretical integration is the mutual philosophical assimilation of different theories.

Accordingly, in the optimized curriculum in mathematics, the topic of decimal fractions was moved from 6th to 5th grade. Solving problems requires solving unknown quadratic equations. Finding an unknown number from an equation is taught in elementary school, and solving quadratic equations is taught in 8th grade math. The coordinate line, in which the placement of numbers, gives an idea of negative numbers, allows students to learn the structure and principle of operation of the thermometer. The concept of surface studied in mathematics allows to master the concept of pressure in physics, and the concept of volume in physics. In elementary school, students are accustomed to clear solutions to all problems. The solution of some problems in physics is approximate. Accordingly, mathematics and physics teachers will need to be taught to perform approximate calculations in solving some examples together. In physics, too, it is necessary to allow for approximations in some measurements and to explain the approximate value of the quantities associated with it.

Students do a lot of measurements during the experiment. They use this skill because they have previously practiced mathematics, solved problems related to measuring length, surface area, volume, mass, velocity, and some of them have been measured directly. Mathematical knowledge also helps to form such a concept as the accuracy of measuring instruments in measurements.

One of the most important forms of interaction between physics and mathematics is the solution of mathematical problems in the physical context. It is useful to solve problems related to both physics and mathematics (motion, density) at the same time. Physics is not only about arithmetic or algebraic expressions of mathematics, but also about geometry. Objects can be rectangular, square, circle, triangle, polygon, sphere, cube, rectangular parallelepiped, etc. may be in the form of At the same time, of course, their size is determined using the knowledge gained in geometry.

In the study of some topics it is shown that there are opportunities for the formation of interdisciplinary competencies. In particular, to measure soil moisture, the mass of wet soil is measured, then the mass of dry soil is measured and the amount of water in it is found. It is used to measure the mass of a substance on a scale. It is said that the quality of many agricultural crops can be determined by

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measuring their density. There is a saying among our people that melons look the same, but they are heavier by hand.

This means that the density of sweet melons is higher than other experiments. Experiments have shown that potatoes with a similar density have a higher starch content than others. From this knowledge, the task of solving problems that are measured in everyday life, that is, the formation of a competent person, is performed.

When studying the topic "Temperature", the temperatures of pets are given. The temperature of the earth for planting crops, the importance of sunlight for plants and animals, and therefore the energy supply of nutrients require a close connection between the physical and biological sciences. Oxidation of nutrients occurs constantly in the human body. It uses carbohydrates and fats, as well as some proteins, as fuel. As a result of oxidation of 1 g of protein and carbohydrates in the body, 17 J of energy is released. Using this information, it is possible to calculate the amount of food a student needs to consume in a day for people who are physically or mentally active. This forms the elements of competencies for self-development as a person.

There are many opportunities to use the knowledge, skills and abilities acquired in the process of labor education in the teaching of physics, and the knowledge acquired in physics in the teaching of labor. For example, metal shears, the principle of operation of various hoppers in the "lever", clamps for tightening the tool for processing wood or metal in the "screw", the handle of the thread-drilling tool in the "ring", hammer and ax handles In the "wedge" it is explained that the unloading and unloading of loads coming to the workshop should be in accordance with the rule of moments on the "inclined plane".

An example of a change in internal energy is the heating of metals when they are welded or treated with metals. Flattening fabrics with an iron shows changes in the properties of materials under the influence of heat. When making items from wood, metal or fabric, they are measured with a measuring tape, a caliper. These instruments are used in physics to measure length or distance. Interdisciplinary competencies are also formed by explaining that sharpening the blades of scissors, saws, axes and other cutting tools is performed to increase pressure.

One of the areas of labor education is agricultural labor. At the same time, the concept of pressure in the hoe, sickle, sickle, shovel, used in agriculture, rotational and progressive movements in machines and mechanisms form the competencies to apply their knowledge in practice in the study of these topics in physics.

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RESULTS

Since physics is a science of nature, it is done in an integral connection with all the sciences. At present, all natural sciences have separate branches of physics:

- ✓ In astronomy-astrophysics
- ✓ In biology-biophysics
- ✓ Chemistry-physicochemistry
- ✓ Electrotechnics-electrophysics
- ✓ In geology-geophysics

Physics is therefore the foundation for the creation of all the natural and applied sciences. The study of physics is based not only on students' previous knowledge of physics, but also on their knowledge of the natural sciences.

For example, the importance of mathematics as a scientific method is widely and deeply reflected in the teaching of physics, the laws of physics are expressed in mathematical formulas, mathematical formulas and operations in drawing conclusions from the laws of physics, proving some of its cases, estimating accuracy, is important in determining the limits of application, in determining their level of reliability, as well as in calculating and comparing and contrasting the physical parameters determined by different experimental methods.

Although the form of formulas does not change in the formal application of mathematical operations to physics problems, they do acquire and change to some extent new meaning and content. Such changes are made naturally, not artificially, to make the solution of a physical problem seem convenient, but from the nature of the laws and phenomena of physics.

Physical processes and events can be reduced to quantities represented by unique physical-mathematical concepts. Size is the different quantity, criterion, and sign of any desired process or event. Students are introduced to the concept of size before learning a physics course in mathematics (in grades 1-5 with face, size, weight, temperature, path, time, etc.). When physics is studied, the concept of quantities is developed and clarified, in particular, methods of measuring quantities, accuracy of measurement, units of measurement, the study of how a single quantity is expressed in different numbers when measured in different units. This does not require students to memorize many definitions of physical concepts, but rather to master a system of concepts.

Mathematical knowledge in secondary schools provides the following: in the 4th grade to measure the linear dimensions, surface, volume of problems; In Grade 5,

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addition and subtraction of positive and negative numbers, coordinate axes, graphs, and type motion graphs are drawn;

In 6th grade, proportions, direct and inverse proportionality, their graphs, squares, cubic functions are studied; In Grade 7, quadratic equations are solved; In Grade 8, exponential, logarithmic functions are studied; In Grade 9, trigonometric functions are drawn.

Ensuring interdisciplinary synchronous (in terms of time) communication is a very complex task. Because the school must maintain the logic of each subject in each subject, which in turn determines the sequence of subjects. From a pedagogical point of view, it is expedient to implement a process of interdisciplinary two-way communication. This process involves not only the scientific preparation of students in the study of related academic disciplines, but also the study of related scientific disciplines in order to study their own subject.

For example, in order to introduce the concepts of velocity and acceleration in the study of mathematics, one will need to know about the concept of product given in a mathematics course.

From a purely mathematical point of view, the concept of product has meaning only for continuous functions, more precisely, only in the field of continuity of functions. In physics, an arbitrary physical quantity can be thought of as a function of one or more quantities.

For example, the path traveled by an object is a function of time, i.e., the path traveled by an object in motion depends on the time of motion. This connection is written in the form S = S (t) in an undisclosed form. Also, the speed and acceleration of motion can also be written as a function of time and in appearance. Some physical quantities, including velocity and acceleration, can also be expressed as a function of coordinates. The simplest example of such sizes is body density. If we denote the axis of the coordinate system perpendicular to the Earth's surface by z, this connection is written as in the functional view. Since the density of objects depends on their size, it is generally determined using a function.

Let us now consider the content of the use of the concept of product in physical examples by means of the concept of density. By definition, the average density of a body is numerically equal to its mass per unit volume, ie. From a mathematical point of view, the density at any point of a body must be determined by a formula, that is, as a product of the mass of the body by volume.

Just as the concepts of derivatives used in mathematics and physics differ in content, so the concept of integrals has different meanings in both cases. In

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mathematics, the practice of integration is defined as the transition to the limit $\lim_{\Delta y \to 0} \sum_{i=0}^{\infty} f(y)\Delta y$, that is

$$\lim_{\Delta y \to 0} \sum_{i=0}^{\infty} f(y)\Delta y = \int_a^b f(y)dy$$

But in physics $\Delta y \to 0$ magnitude cannot be determined. In addition, the value $f(y)$ may not exist at all. Therefore, $f(y)$ the limit under consideration when expressing a physical quantity does not often exist.

If Δy it is small enough, but large enough to think about the average value of the function *f(y)* in the range of these values of the argument, the sum $\sum_{i=0}^{\infty} f(y)\Delta y$ will have a certain physical meaning. Accordingly, in physics, the integral is defined not as the limit of the sum, but as the sum of a very small number of additions, i.e.

$$\int_a^b f(y)dy = \sum_{i=0}^{\infty} f(y)\Delta y$$

In particular, it is possible if the function f(y) expresses the time dependence of the velocity, $f(y) = v(t)$ in which case the path traversed in the time interval Δt according to the definition is represented by the formula $\Delta S = \upsilon \Delta t$.

In physics, the integration process is also used to calculate the average values of physical quantities. Indeed, a certain average velocity is calculated by the formula $\upsilon_y = \frac{S}{t_2 - t_1}$. But if we write the expression of S using an integral, it is a formula

$$\upsilon_y = \frac{S}{t_2 - t_1} \int_{t_1}^{t_2} \upsilon(t)dt$$

appears.

Thus, while the formal application of mathematical operations to physics problems does not change the form of the formulas, their content does change to a certain extent. Such changes are made naturally, based on the nature of the laws and phenomena of physics, to make the solution of a physical problem seem convenient.

DISCUSSION

In physics and chemistry, the structure of matter, atoms and molecules, the structure of the nucleus, nuclear reactions, the amount of matter, crystal lattices, the phenomenon of electrolysis, and other topics are studied in their own direction. The

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elements are used in the periodic table in the departments of molecular physics, electricity, atomic and nuclear physics.

No	Physics	Chemistry
1	Interaction and potential energy of molecules of matter. Basic rules of MKN. Relative molecular mass. The development of the doctrine of the atom	Chemistry and ecology. Atom is a molecular theory. The works of Dalton, Lavuadze, Lomonosov
2	Avogadro's constant. Avogdro's law. Substance and molar mass	The amount of substance. Avogadro's constant. Avagadro's law. Molar mass
3	The development of the atomistic worldview. Atomic structure. Thomson model. Rutherford's experiment and formula. The planetary model of the atom	Atomic structure. Theories of atomic structure, radioactivity. Nuclear reactions
4	Electron spins. Quantum numbers characterizing the atomic system. Pauli principle. Physical explanation of the Mendeleev periodic table	Atomic orbitals, quantum numbers. The order in which electrons are charged in energy fields. Pauli principle. Klechkovsky's rule. Gund's rule
5	The binding and specific binding energies of the nucleus. Nuclear forces. Core models	Types of chemical bonds. Ionic, metallic, hydrogen bonds
6	Electrolytes. Electrolytic dissociation. Electric current in electrolytes. Faraday's laws for electrolysis	Electrolysis Information. Electrolysis of liquids and solutions. Electrolysis laws
7	Laboratory work №10. Determination of the electrochemical equivalent of copper	Laboratory work №15. Electrolysis of a solution of common salt and copper (II) sulfate salt

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8	Application of electrolysis in technology. Electrolysis and ecology	Corrosion of metals and its types. Corrosion protection of metals
9	Spectral series of the hydrogen atom. Boron theory of the hydrogen atom	Hydrogen and its properties

Physics and Biology

Because of the forces of friction in nature, plants cling to the surrounding trees and strive for light. Friction plays an important role in the activities of animals, plants and humans. Vegetable fruits such as spherical peas, ming bean, mix quickly due to lack of friction.

It is known from the course of botany that every fruit contains acid. Using these acids as electrolytes, a galvanic cell can be formed.

On the subject of mechanical motion, jet motion, the motion of animals such as jellyfish, squid, and octopus can be physically explained on the basis of biological knowledge.

No	Physics	Biology
1	Laws of motion	The speed of movement of living things, the speed of growth of plants. The effect of acceleration on a living organism
2	Strength and mass, density. Friction force. The power of Archimedes	Masses of different organisms, density of fluids in plants and animals, swimming of fish
3	The law of conservation of momentum	Jellyfish and octopus movement, jet movement
4	Work and power, energy	Heart function, ergometry
5	Simple mechanisms	The structure of the human arm and leg bones, lower jaw function, and animal paws
6	Vibration movement.	Heart cycle. Sound waves, the structure of

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	Mechanical waves	the auditory organ, the threshold of hearing

The study of atmospheric pressure, heat engines and their operation, and other topics shows the connection between the two disciplines.

There are laws of physics based on knowledge about the structure, size, movement, atmosphere, atmospheric pressure, wind formation, energy sources and energy use of the earth, and this knowledge is also studied in the course of geography.

By 6th grade, students had acquired some knowledge of physics through a course in natural sciences and elementary geography.

In particular, they learned about the Earth, its atmosphere, its parts, and the formation of winds. In the teaching of physics, based on the knowledge imparted through these subjects, it was easy to study the concept of mass, atmospheric pressure, Torichelli's experiment, atmospheric pressure measurement, barometers, convection in the oceans and seas and air, water circulation in nature. In the study of topics such as "The structure of the universe", "Light phenomena", "Earth's own axis and its rotation around the Sun", "Solar and lunar eclipses", geographical data were used in the formation of subject competencies.

Hence, the natural sciences help in the scientific study of the knowledge of physics and are the basis for the thorough, in-depth assimilation of this knowledge.

The collaboration of general education and vocational disciplines is important in directing students to creative work, organizing research, and developing technical creativity. Physics is closely related to mathematics, biology, chemistry and medicine. Therefore, it is now necessary for most professionals to master physics in depth. In particular, students of medical professional colleges must have certain physical concepts in order to study in depth such subjects as chemistry, general biology, special medicine, biophysics.

For medical colleges, a physics program must meet two basic requirements.

1. Knowledge of the scope of the secondary special education program in physics.

2. To prepare students for general medical and clinical care on the basis of the acquired knowledge.

The high school physics textbook is designed for high school students and provides detailed insights into all areas of physics. For students in medical colleges, the concepts presented in this textbook are not sufficient. There is a need for a

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different approach to coverage of certain topics, depending on the chosen career of the students.

To this end, we will consider some aspects of teaching in the Department of Molecular Physics of medical colleges.

It is well-known that biological organisms are open thermodynamic systems that constantly exchange substances with the environment. Because the physical organism is able to carry gases, water, and substances in cells and tissues, the process of metabolism is called permeability.

The whole vital activity of the organism depends on this property, the distribution of substances between the cells and the tissue fluid is due to the formation of biopotentials and other permeabilities.

There are several ways to determine permeability in living organisms.

1. Osmotic method.
2. A method based on the use of paints, as well as color indicators.
3. Method of microchemical analysis.
4. The method of labeled atoms.
5. Conductivity method.

In medical colleges, physics is so closely linked to medicine that every condition, movement, clinical, biological, physiological, injection process, and reaction state in the human body is included.

Physiological state of temperature: The basic equation of molecular kinetic theory for an ideal gas is the relationship between microscopic parameters such as easily measured pressure, average kinetic energy and concentration of gas molecules. However, by measuring the pressure of a gas alone, we cannot know the average value of the kinetic energy of molecules or their concentration. So to find the microscopic parameters of a gas, you need to know the average kinetic energy of the molecules, that is, you need to measure a physical quantity. In physics, this is called temperature.

After some time of contact between hot and cold objects, the change in the microscopic parameters of the objects stops. This state of bodies is called heat equilibrium.

The physical parameter that is the same in all parts of a system of bodies in a state of thermal equilibrium is called the body temperature.

The relationship between temperature and the physiological state of medicine is that in physics, the state of any body or gas is observed, while in medicine, the maximum rise in human body temperature is caused by this condition.

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Thermoregulation is a physiological process in the human body that maintains a constant body temperature.

High ambient temperatures affect the skin's thermoreceptors, which cause the skin's capillaries to reflexively dilate and breathing to speed up. This results in heat dissipation at the skin surface, evaporation of perspiration and, to a lesser extent, heat dissipation from the mucous membranes of the respiratory tract and increased heat release due to water evaporation.

In the cold season, instead of overheating, intense physical activity, as well as strong food or both at the same time, can be compensated.

Changes in temperature by several degrees during the day are directly related to oxidative processes or human consumption. In healthy people, the readings also vary depending on where the temperature is measured. These are: the temperature of the oral cavity, vagina, rectal mucosa, and the temperature of the skin of the armpits and groin area is 0.2 ÷ 0.4 ° C higher.

The mass of the thermometer should be much smaller than the mass of the body, otherwise the measurement process can change the temperature of the body significantly.

When the heat exchange between the body and the thermometer stops, the change in the volume of the liquid in the thermometer stops. In this case, the temperature of the liquid in the thermometer is equal to the temperature of the body.

In medicine, a thermometer is used to measure a person's body temperature. Various modifications of thermometers are currently recommended for measuring body temperature. Examples include oral, underarm, rectal, vitreous, chemical, tympanic, and electronic thermometers that measure true temperature.

Timpathic thermometers are electronic devices that run on batteries and are used to determine the temperature of the eardrum.

Chemical thermometers are single-use, thin, flat plastic pieces in the form of dots filled with heat-sensitive chemicals that change color when the temperature changes.

Electronic thermometers are disposable special thermometers that provide quick and accurate temperature measurement.

Pressure plays an important role in physics and medicine. For example, one of the first and most important conditions of molecular kinetic theory was the qualitative and quantitative explanation of the phenomenon of pressure of a gas on the walls of a vessel.

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A qualitative explanation of gas pressure is that ideal gas molecules interact with the walls of the vessel according to mechanical laws, such as an elastic body.

There are so many gas molecules that they hit the wall one after the other with great speed. When the molecules hit the wall of the vessel, the average geometric sum of the forces exerted by the individual molecules is the compressive force of the gas. The pressure of the gas F is equal to the ratio of the wall surface S of the pressure force module:

$$p = \frac{F}{S}.$$

In medicine, the role of pressure is very important, it is observed in the metabolism of the human body, blood circulation, stress. For example:

Blood pressure: is the blood pressure that falls on the vessel wall during systole and diastole. Blood pressure depends on the amount of blood being pumped out of the heart, the blood flow, the resistance of the general peripheral blood vessels, and the elasticity of the blood vessel walls.

Systolic (maximum), diastolic (minimum) blood pressure and pulse blood pressure are different.

Systolic (maximum) pressure is the pressure in the arterial system that occurs after a left ventricular systole when the pulse wave is at its maximum.

Diastolic pressure is the rate at which the heart beats at the end of a diastole.

Blood pressure measurement is an important diagnostic tool for cardiovascular and respiratory diseases. Normally, systolic pressure ranges from 120 mm to 140 mm and diastolic pressure from 70 to 90 mm Hg.

Blood pressure monitors include a symbolic sphygmomanometer (Riva-Rochchi) and a spring-loaded blood pressure monitor. The Riva-Rochchi apparatus is not currently in use. In most cases, it is measured with a spring-loaded device, such as a fanendoscope and a tanometer.

In this case, the blood pressure is measured by the spring resistance force, which is transmitted to the arrows moving along the spherical plate, which is divided into millimeter units.

The device consists of a spring-loaded manometer, a cuff, a point-cylinder and a system of rubber tubes connecting the parts of the instrument.

The pressure should be measured from the brachial artery and the patient should sit still. Because when a person moves, the pressure increases and does not return to normal. There are similar physiological conditions.

Its solution is to incorporate as much of the professional content of physics into each subject as possible. For example, it is possible to analyze the interdisciplinary

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relationship of physics classes for nursing, medical treatment and pharmacy in medical professional colleges. In the disciplines taught in medical professional colleges, "Thermal conductivity and heat balance in the human body", "Evaporation", "Boiling", "Properties of liquids", "The concept of blood pressure", "Atmospheric pressure and its effects on the body ",“ Humidity and its importance for human health ”and other topics.

The most important thing for a person is health. That's why we can't stop using the achievements of physics in medicine. Advances in physics are used in medicine for two different purposes.

The first is as a physician's assistant to diagnose the patient. The help of X-rays in this area is invaluable (x-ray diagnostics). They provide accurate information about bone fractures, growth, and changes in internal organs. In recent years, this task has been replaced by ultrasound devices, which are much less harmful to human health. With the advent of computers, computer tomographs have become an invaluable aid to physicians. It provides complete information about a person's internal organs and displays them on a monitor, as well as takes pictures.

The second is its use in the treatment of various diseases. Ultrasound, magnetic fields, weak currents, and laser light are known to treat nerve fatigue. In particular, the benefits of laser beams for human health are invaluable. Bloodless laser blades can be used to treat diseased cells in the body, connect them, and cut them off if necessary. Laser beams have been used successfully, especially in eye surgery, one of the most delicate human organs.

Physicists are also looking for ways to treat cancer, which is now considered incurable and kills many people. There has been some progress in this area. Experiments have shown that a bunch of proton particles can isolate a cancerous organ and stop the disease from progressing. However, the high cost of this method hinders its widespread use. But we are sure that this problem will not be solved for a long time.

Treatment of wounds caused by burns and difficult to heal is one of the current problems of medicine. Now in this process in our medicine are used film coatings imported from abroad. Film coating based on local raw materials has several advantages in this regard. In particular, it is absorbed into the skin when applied to the wound. Its nanostructured silver particles allow for quick and effective wound healing, strengthening the patient’s immune system. Doctors recognize the healing properties of this invention, which is used in the treatment of burns.

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The introduction of nanotechnology into medicine is also the basis for important discoveries. Nanocapsules are used in the world's leading research centers to deliver drugs directly to the affected area. The advantage of nanocapsules is that they do not harm a healthy part of the body, but only reach the infected cell and have a medical effect.

Scientists are also working on the potential of nanotechnology to develop molecular nanorobots that can treat diseased organs in the future, as well as anti-cell aging agents. According to him, research is underway to introduce into the human body molecular nanocapsules that prevent the destruction of cells in the human body and improve the functioning of tissues in the body.

CONCLUSION

The use and strengthening of interdisciplinary links helps to ensure that the knowledge gained from the basics of science is complete, in-depth and thorough. One of the main tasks facing teachers is to convey this interdisciplinary connection to the student. This can be done by opening up the interdisciplinary aspects of the relationship between physics, mathematics, chemistry and other disciplines in secondary general education, secondary special education and their active use in the teaching process.

This means that the teaching of physics is based not only on knowledge derived from physics, but also on knowledge derived from other natural and human sciences. As the great mathematician Paye said, “Mathematics is the king of the sciences, but the servant of all sciences,” the role of mathematics in the teaching of physics is great. Although the form of formulas does not change in the formal application of mathematical operations to physics problems, they do acquire and change to some extent new meaning and content. Such changes are made naturally, not artificially, to make the solution of a physical problem seem convenient, but from the nature of the laws and phenomena of physics. The role of physics in the teaching of other sciences such as chemistry, biology, geography is great. If students have a deep knowledge of physics, they will have no difficulty in mastering these subjects.

The effectiveness of the lessons was further enhanced by the fact that the textbooks provided logical problems that could be solved through interdisciplinary communication in the selection of questions and assignments. In short, teaching physics in conjunction with the natural sciences helps to deepen the scientific knowledge of physics.

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