

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

PHYSICS

7–9 forms

Education program
for general education institutions ¹

¹ This program is ratified by the Order of Ministry of Education and Science of Ukraine as of 07.06.2017 No. 804

Syllabus of course in Physics in secondary school is divided in the following way:

No	Form	Hours per week	Sections
1	7	2 hours	‘Physics as a natural science. Understanding nature.’ ‘Mechanical motion.’ ‘Interaction of objects. Force’ ‘Mechanical work and energy’
2	8	2 hours	‘Heating phenomenon, ‘Electric phenomenon. Electric current’
3	9	3 / 2,5 hours	‘Magnetic phenomenon’, ‘Light phenomenon’, ‘Mechanical and electromagnetic waves’, ‘Atom and nuclear physics. Physical principles of nuclear power industry’, ‘Motion and interaction. Conservation principles.’

7th form

(70 hours, 2 hours per week, with reserved 4 hours)

Hours	Learning outcomes	Syllabus
INTRODUCTION		
1	<p><i>Pupil</i> <i>Knowledge component:</i> <i>knows safety requirements of science classroom; location and purpose of main areas of science classroom and own working area.</i></p> <p><i>Activity component:</i> <i>stick to the rules of safety conduct using physical instruments and equipment.</i></p>	<p>Physics as a school subject.</p> <p><i>Physical instruments, physical experiments. Safety rules of working with physical equipment in science classroom.</i></p>
Section 1. PHYSICS AS A NATURAL SCIENCE. UNDERSTANDING NATURE		
7	<i>Pupil</i>	<i>Physics as a fundamental nature</i>

	<p><i>Knowledge component:</i> names characteristics of physical phenomena and their differences from biological, chemical and other phenomena; gives examples of physical phenomena, physical objects and physical quantities; knows symbols and measurement units of basic physical quantities. understands fundamental principles of atomic theory; understands difference between matter and field.</p> <p><i>Activity component:</i> writes value of a physical quantity, uses prefixes to create multiple and partial units; uses the simplest way of measurement; identifies scale division value; compares values of physical quantity; measures linear dimensions; volume of solid objects, liquids and bulk materials; makes experiments (individual and in groups) according to pupil's own plan or according to teacher's instruction, analyzes results, make conclusions.</p>	<p>science.</p> <p>Matter and field. Basic principles of atomic theory. Initial information on atomic structure.</p> <p>Physical objects and physical phenomena.</p> <p>Physical quantities and their measurement. International system of units of physical quantities.</p> <p><i>Laboratory works</i> No. 1. Introduction of measuring equipment. Identification of scale division value. No. 2. Measurement of volume of solid objects, liquids and bulk materials. No. 3. Measurement of dimensions of small objects in different ways.</p> <p><i>Demonstration</i> 1. Examples of physical phenomenon: mechanical, heating, electric, light etc. 2. Molecular models. 3. Examples of application of physical phenomenon for industry. 3. Units of measurement</p>
1	<i>Defense of class projects</i>	
Section 2. MECHANICAL MOTION		
17	<p>Pupil <i>Knowledge component:</i> names types of mechanical</p>	Mechanical motion. Relativity of motion. Object of reference. System of reference. Material particle. Trajectory.

	<p>motion; understands the concept, defines physical quantities (speed, rotation, displacement, oscillation amplitude, oscillation period and frequency and <i>can</i> chose its unit; <i>names</i> units of time, way, speed, rotation period, oscillation period and frequency; <i>describes</i> physical quantity according to general plans; <i>understands</i> relativity of motion.</p> <p><i>Activity component:</i> <i>can</i> apply concept of ‘material particle’ and define application of this physical model; <i>distinguishes</i> types of mechanical motion by its trajectory and motion pattern of object; <i>can describe</i> mechanic motion graphically and analytically and analyze it; <i>counts</i> way of object, determines speed of motion, period of rotation and oscillation frequency of thread pendulum to solve physical problems; <i>presents</i> measuring results as tables and graphics; <i>uses</i> knowledge for life safety.</p>	<p>Way. Displacement.</p> <p>Rectilinear uniform motion. Speed of motion. Time diagram.</p> <p>Rectilinear non-uniform motion. Average speed of non-uniform motion.</p> <p>Uniform motion of material particle in circle. Rotation period.</p> <p>Oscillation motion. Oscillation amplitude. Oscillation period and frequency. Pendulums.</p> <p><i>Laboratory works</i> No. 4. Determination of rotation period. No. 5. Analysis of oscillation frequency of thread pendulum.</p> <p><i>Demonstration</i> 1. Different types of mechanic motion. 2. Relativity of motion, trajectory form, speed</p>
1	<i>Defense of class projects</i>	
Section 3. INTERRACTION OF OBJECTS. FORCE		
26	<i>Pupil</i> <i>Knowledge component:</i>	Inertia. Inertia of object. Object weight. Density of matter.

<p><i>knows and describes</i> physical phenomenon and processes (inertia, deformation, gravity, friction, pressure); <i>knows</i> concepts, define physical quantities (weight, density, force, friction coefficient, pressure, pressure force) and can choose its unit; <i>formulates</i> Hooke's law, Pascal's law, Archimedes' law; <i>knows</i> swimming conditions of objects; explains causes of atmospheric pressure and its dependence of height, dependence of elastic force on deformation; dependence of bottom and wall-pressure on vessel height and density of matter; <i>knows and understands</i> structure and operating principles of dynamometer, manometer, barometer, scales.</p> <p><i>Activity component:</i> <i>applies</i> Hooke's law, Pascal's law, Archimedes' law, swimming conditions, formulas of force of gravity, object weight, force of sliding friction, force of pressure, buoyancy force to solve different problems or doing laboratory works; <i>is able to suggest</i> ways to increase/decrease force of friction, elastic force and pressure in practical situations; <i>presents</i> forces in graphics; <i>uses</i> dynamometer and scales;</p>	<p>Interactions of objects. Force. Deformation. Elastic force. Hooke's law. Dynamometer.</p> <p>Composition of forces. Resultant force. Graphic presentation of forces.</p> <p>Force of gravity. Object weight. Weightlessness (zero gravity).</p> <p>Friction. Power of friction. Coefficient of sliding friction. Friction in nature and industry.</p> <p>Pressure of solids on surface. Force of pressure.</p> <p>Pressure of gases and liquids. Pascal's law. Communicating vessels. Manometers.</p> <p>Atmospheric pressure. Measurement of atmospheric pressure. Barometers.</p> <p>Buoyancy force. Archimedes' law.</p> <p><i>Laboratory works</i> No 6. Measurement of object weight. No 7. Determination of density (solids and liquids) No 8. Study of elastic properties. No 9. Determination of coefficient of sliding friction No 10. Determination of object swimming conditions.</p> <p><i>Demonstration</i></p>
--	--

	<i>reads</i> manometer, barometer; <i>applies</i> knowledge in learning activities and real world	<ol style="list-style-type: none"> 1. Experiments demonstrating inertia and interaction of objects. 2. Deformation of objects. 3. Composition of forces on straight line. 4. Displays and measurement of force of sliding friction, rolling force, balance. 5. Ways to increase/decrease force of friction. 6. Pressure dependence of force and space. 7. Propagation of pressure by liquids and gasses. 8. Liquid bottom and wall-pressure on vessel height. 9. Change of pressure in liquids with depth. 10. Communicating vessels. 11. Measurement of atmospheric pressure. 13. Structure and operating principles of manometer. 14. Archimedes' buoyant force. 15. Equality of Archimedes' buoyant force to weight of displaced liquid in volume of object part under liquid. 16. Swimming of object.
1	<i>Defense of class projects</i>	
Section 4. MECHANICAL WORK AND ENERGY		
11	<i>Pupil</i> <i>Knowledge component:</i> <i>knows</i> concepts, define physical quantities (mechanical work, power, kinetic and potential energy, moment of force, efficiency) and <i>choose</i> its unit; <i>understands</i> conservation	Mechanical work. Power. Mechanical energy and its types. Conservation principle of mechanical energy and its application. Simple mechanisms. Moment of force. Lever. Condition of lever balance.

	<p>principle of mechanical energy, condition of lever balance, operation principles of simple mechanisms; <i>knows</i> differences of levers.</p> <p><i>Activity component:</i> <i>applies</i> conservation principle of energy, power, efficiency of simple mechanism, kinetic energy of object, potential energy of object raise above the surface, deformed objects, moment of force for solving different problems and doing laboratory works, for practical activities; <i>uses</i> simple mechanisms (lever, movable and immovable controller, slide); <i>uses</i> knowledge for life safety</p>	<p>Efficiency of simple mechanisms.</p> <p><i>Laboratory works</i> No 11. Study of condition of lever balance. No 12. Determine efficiency of simple mechanism.</p> <p><i>Demonstration</i> 1. Conversion of mechanical energy. 2. Conditions of balance. 3. Lever. 4. Movable and immovable controller. 5. Slide. 6. Using simple mechanisms.</p>
1	<i>Defense of class projects</i>	

8th form

(70 hours, 2 hours per week, with reserved 4 hours)

Section 1.

HEATING PHENOMENON

30

Pupil

Knowledge component:
understands properties of thermal motion, properties of atomic and molecular motion in different aggregative states; physical properties of solids, liquids and gases;
knows concepts, define physical quantities (temperature, internal energy, quantity of heat, specific heat, specific heat of fusion, evaporation, fuel combustion) and their units; knows methods of temperature measurement; principles of grading Celsius temperature scale; two ways of changes of internal energy of object; ways of heat exchange; types of thermal machines;
explains graphics of thermal processes (heating/cooling, melting/hardening, evaporation/condensation); dependence of physical properties on temperature.
Activity component:
applies knowledge for solving different problems and doing laboratory works;
applies equation of heat balance;
analyzes graphics of thermal

Molecular motion and thermal state of object. Temperature. Thermometers. Temperature scale. Thermal balance.

Dependence of size of physical objects of temperature.

Aggregative states of matter. Physical properties of solids, liquids and gases.

Internal energy. Ways to change internal energy. Ways of heat exchange. Amount of heat. Calculation of heat while heating/cooling.

Crystalline and amorphous bodies. Melting temperature. Calculation of heat while melting/hardening.

Evaporation and condensation. Calculation of heat while evaporation/condensation.

Boiling. Boiling temperature.

Equation of heat balance.

Fuel combustion. Calculation of heat while fuel combusting.

Heat engines. Operating principles of heat engines. Efficiency of heat engine.

	<p>processes; <i>explains</i> operating principles of heat engines; <i>uses</i> thermometer and calorimeter; <i>stick to the rules of safety</i> experiments;</p>	<p><i>Laboratory works</i> No 1. Study of thermal balance under provisions of water mix of different temperatures. No 2. Determination of specific heat.</p> <p><i>Demonstration</i> 1. Diffusion of gases and liquids. 2. Expansion of objects while heating. 3. Model of Brownian agitation 4. Change of internal energy after doing work. 5. Operation principle of heat engine. 6. Models of heat engines.</p>
3	<i>Defense of class projects</i>	
Section 2.		
ELECTRIC PHENOMENON. ELECTRIC CURRENT		
30	<p><i>Pupil</i> <i>Knowledge component:</i> <i>knows</i> concepts of electric charge, electrization mechanisms, character of cooperation of electrified objects; <i>understands</i> nature of electric current in different environment; <i>defines</i> physical quantities (current intensity, voltage, conductor resistance, electric power, electrochemical equivalent) and their units; <i>formulates</i> Coulomb's law, conservation principle of electric charge, Ohm's law, Joule-Lenz's law, Faraday's</p>	<p>Electric phenomenon. Electrization. Electric charge. Two types of electric charges. Cooperation of electrified objects. Coulomb's law. Law of conservation of electric charge.</p> <p>Electric field. Electric current. Flow of electric current. Electric conductors, semiconductors, dielectric. Current in metals. Sources of current. Electric circuits and its main elements.</p> <p>Current intensity. Ampere meter.</p> <p>Electric voltage. Voltmeter.</p> <p>Electric resistance. Dependence of conductor resistance on its length, section</p>

<p>law; <i>knows</i> conditions of electric current occurrence; <i>differentiates</i> types of electric current in gases.</p> <p><i>Activity component:</i> <i>applies</i> Coulomb's law, conservation principle of electric charge, Ohm's law, Joule-Lenz's law, Faraday's law for electrolysis, formulas of electric current, power, resistance of serial and parallel connection, dependence of conductor resistance on its length, section area and electrical resistivity, performance and power of electric current for solving for different problems and doing laboratory works; <i>depicts</i> electric field graphically; draws schemes of simple electrical circles; <i>makes</i> simple electrical circles; <i>uses</i> measuring equipment to determine power, strain, resistance; <i>calculates</i> energy consumption by electric meter reading; stick to the rules of safe usage of electrical tools and devices;</p>	<p>area and material.</p> <p>Resistors.</p> <p>Ohm's law for circle element. Serial and parallel connection of conductors.</p> <p>Performance and voltage of electric current. Joule-Lenz's law. Electrical heater</p> <p>Nature of electric current in electrolytic solutions and melts. Faraday's law for electrolysis.</p> <p>Electric current in gases.</p> <p>Life safety when working with electrical tools and devices</p> <p><i>Laboratory works</i> No 3. Measurement of conductor resistance with ampere meter and voltmeter. No 4. Study of electric circle with serial connection of conductors. No 5. Study of electric circle with parallel connection of conductors. <i>Demonstration</i> 1. Electrization of different bodies. 2. Cooperation of electrified objects. 3. Two types of electrical charges. 4. Divisibility of electrical charge. 5. Structure and operating principles of electroscopes. 6. Electric current and its performance. 7. Conductors and dielectrics. 8. Sources of current: galvanic cells, accumulators, power supply units.</p>
--	--

		<p>9. Measurement of current by ampere meter.</p> <p>10. Measurement of current by voltmeter.</p> <p>11. Dependence of current on power on circle part and on resistance of its part.</p> <p>12. Measurement of resistance.</p> <p>13. Dependence of conductor resistance on its length, section area and material.</p> <p>14. Structure and operating principles of rheostat.</p> <p>15. Serial and parallel connection of conductors</p> <p>16. Electrolysis.</p> <p>17. Gas current</p>
3	<i>Defense of class projects</i>	

9th form (105/87 hours, 3/2,5 hours per week, with reserved 4 hours) ²		
Section 1. MAGNETIC PHENOMENON		
17/ 14	<p>Pupil <i>Knowledge component:</i> <i>understands</i> mechanisms of magnetic interaction, magnetic induction, magnetic levitation; materiality of magnetic field, Ampere hypothesis; knows concepts, <i>defines</i> physical quantities (magnetic induction) and their units; <i>explains</i> Oersted's law, Faraday's law, operating principle of electromagnet, electromotor, electrical measuring instruments; <i>knows</i> magnetic field displays on the Earth;</p> <p><i>Activity component:</i> <i>applies</i> Ampere force formula to solve different problems; <i>depicts</i> magnetic field graphically; <i>defines</i> induction directions of magnetic field, Ampere forces, induction current; <i>put together</i> electromagnet.</p>	<p>Magnetic phenomenon. Oersted's law</p> <p>Magnetic field.</p> <p>Magnetic field of energized conductor. Effect of magnetic field on energized conductor.</p> <p>Magnetic field density. Ampere force.</p> <p>Magnetic properties of matter and their application. Ampere hypothesis.</p> <p>Permanent magnets, interaction of magnets. Magnetic field of the Earth.</p> <p>Electromagnets. Magnetic levitation.</p> <p>Electromotors, speakers.</p> <p>Electrical measuring instruments.</p> <p>Magnetic induction. Faraday's law. Induction current.</p> <p>Generating units of induction current. Industrial sources of electrical energy.</p> <p><i>Laboratory works</i> No 1. Putting together and using electromagnet. No 2. Observation of magnetic</p>

² As the Order No. 409 of the Ministry of Education and Science, Youth and Sports of Ukraine as of 03.04.2012 provide 3 or 2,5 hours for physics in the 9th grade, academic hours for each section are written with a slash

		<p>induction.</p> <p><i>Demonstration</i></p> <ol style="list-style-type: none"> 1. Permanents magnets. 2. Configurations of magnetic fields. 3. Magnetic field of the Earth. 4. Oersted's law. 5. Electromagnet. 6. Effect of magnetic field on current. 7. Electromotor. 8. Magnetic induction 9. Generating units of induction current
1	<i>Defense of class projects</i>	
Section 2.		
LIGHT PHENOMENON		
18/ 13	<p><i>Pupil</i></p> <p><i>Knowledge component:</i> <i>understands</i> concepts of ray of light, point source of light, thin lens; <i>defines</i> physical quantities (focal distance, optical power of lens, light refraction); law of rectilinear propagation of light, law of reflection of light and snell's law of refraction; operation principles of the simplest optical equipment; visual defects, their correction and prevention; units of optical power and lens focal length, spectral composition of white light, reasons of diversity of colors</p> <p><i>Activity component:</i> <i>applies</i> law of rectilinear</p>	<p>Light phenomenon.</p> <p>Speed of light propagation.</p> <p>Ray of light.</p> <p>Law of rectilinear propagation of light. Sun and moon eclipse.</p> <p>Reflection of light. Law of reflection of light. Plane mirror.</p> <p>Reflection of light at the limit of two environments. Snell's law of refraction.</p> <p>Laying white color into colors. Creation of colors.</p> <p>Lenses. Optical power and lens focal length. Thin lens formula. Image acquisition by the lens.</p>

	<p>propagation of light, law of reflection of light and snell's law of refraction, thin lens formula for solving different problems and doing laboratory works;</p> <p><i>explains</i> reasons sun and moon eclipse; <i>points</i> course of rays while making drawings received with plane mirror and thin lens; <i>measures</i> lens focal length and identifies lens power.</p>	<p>The simplest optical equipment. Glasses.</p> <p>Eye as an optical device. Sight and vision. Optical defects and their correction.</p> <p><i>Laboratory works</i> No 3. Study of light reflection with plane mirror. No 4. Study of light refraction. No 5. Determination of focus length and optical power of thin lens.</p> <p><i>Demonstration</i> 1. Rectilinear propagation of light. 2. Light reflection. 3. Image in plane mirror 4. Light refraction. 5. Course of rays in lenses. 6. Image creation by the lens. 8. Operating principles and structure of optical devices (camera, projection device) 9. Model of eye. 10. Sight inertia. 11. Laying white color by the prism</p>
1	<i>Defense of class projects</i>	
Section 3. MECHANICAL AND ELECTROMAGNETIC WAVES		
8/8	<p><i>Pupil</i> <i>Knowledge component:</i> <i>understands</i> concept of wave process, conditions of generation of mechanical and electromagnetic waves; <i>defines</i> physical quantities</p>	<p>Generation and propagation of mechanical waves. Sound waves. Sound velocity, length and frequency of sound wave.</p> <p>Volume of sound and pitch of tone.</p>

	<p>(wave length and frequency, volume of sound and pitch of tone)</p> <p><i>knows</i> physical basics of modern wireless devices and means of communication, dependence of electromagnetic waves on frequency</p> <p><i>Activity component:</i> <i>uses</i> formula of interaction of length, frequency and propagation speed, formula of wave propagation speed for solving different problems; <i>compares</i> properties of sound and electromagnetic waves of different frequency.</p>	<p>Intra- and ultrasounds.</p> <p>Electromagnetic field and electromagnetic waves. Propagation speed, length and frequency of electromagnetic waves.</p> <p>Dependence of electromagnetic waves on frequency. Electromagnetic wave spectrum.</p> <p>Physical basics of modern wireless devices and means of communication.</p> <p><i>Laboratory works</i> No 6. Study of sound oscillations of different sound sources with modern digital tools.</p> <p><i>Demonstration</i></p> <ol style="list-style-type: none"> 1. Propagation of mechanic vibrations in elastic medium. 2. Dependence of sound volume on oscillation amplitude. 3. Dependence of pitch tone on oscillation frequency. 4. Electromagnetic radiation and absorption 5. Electromagnetic wave spectrum
1	<i>Defense of class projects</i>	
Section 4. ATOM AND NUCLEAR PHYSICS. PHYSICAL PRINCIPLES OF NUCLEAR POWER INDUSTRY		
12/ 10	<p><i>Pupil</i> <i>Knowledge component:</i> <i>knows</i> modern models of atom and nucleus; <i>describes</i> Rutherford's law, ionization activity of radio-</p>	<p>Modern atom model. Rutherford's law. Neutron-proton model of atomic nucleus. Nuclear forces. Isotopes. Using isotopes.</p> <p>Radioactivity. Radio-active radiation, its</p>

	<p>active radiation; <i>knows</i> concepts of radioactivity, isotopes, radioactive half-life and activity cycle, nuclear and thermonuclear reaction; <i>understands</i> mechanism of ; nuclear reactor; mechanisms of nuclear processes on Sun and sight; <i>knows</i> about impact of radioactive radiation on living things;</p> <p><i>Activity component:</i> <i>explains</i> ionized activity of radioactive radiation; <i>uses</i> dosimeter (if any); <i>uses knowledge for life safety.</i></p>	<p>nature and properties. Radioactive half-life.</p> <p>Ionized activity of radioactive radiation. Natural radioactive background.</p> <p>Dosimeters. Biological activity of radioactive radiation.</p> <p>Fission of heavy nucleus. Nuclear chain reaction of fission. Nuclear reactor. Nuclear power plants. Nuclear power industry in Ukraine. Ecological issues of nuclear power industry.</p> <p>Thermonuclear reaction.</p> <p>Solar energy and sight.</p> <p><i>Demonstration</i></p> <ol style="list-style-type: none"> 1. Model of Rutherford's law. 2. Model of atom. Model of nucleus. 3. Operating principle of ionization counter. 4. Dosimeters (if any)
1	<i>Defense of class projects</i>	
Section 5.		
Motion and interaction. Conservation principles		
34/ 25	<p><i>Pupil</i> <i>Knowledge component:</i> <i>knows</i> characteristics and properties of uniformly accelerated motion; concept of inertial frame of reference, acceleration, object of momentum, free fall acceleration; Newton's law of motion, the universal law of gravitation, the law of</p>	<p>Uniformly accelerated motion. Acceleration. Graphics of uniformly accelerated motion.</p> <p>Inertial frame of reference. Newton's law of motion</p> <p>The universal law of gravitation. Free fall acceleration. Motion of objects under the force and gravity Motion of objects under the action of</p>

<p>conservation of momentum; <i>gives examples of application of physical knowledge for material and intellectual culture; displays and consequences of fundamental interaction, generality of conservation principles of nature; basic laws and patterns, characterizing mechanic motion and interaction, thermal motion, interaction of electrified objects; history of physical phenomenon in the world; significance of Physics as a fundamental nature science; modern physical phenomenon</i></p> <p><i>Activity component:</i> <i>applies</i> knowledge, formula of accelerated motion, object of momentum, equation of uniformly accelerated motion, Newton's law of motion, the law of conservation of momentum for solving different problems and doing laboratory works; <i>characterizes</i> motion of objects under the action of forces (vertically and horizontally and on slide); <i>depicts</i> dependence of speed and motion on uniformly accelerated motion graphically;</p> <p><i>applies</i> conservation principles to explain physical phenomenon and processes; <i>proves</i> organic unity of human</p>	<p>forces (vertically and horizontally and on slide).</p> <p>Interaction of objects. Momentum. The law of conservation of momentum. Reactive motion. Physical basics of rocket engineering. Achievements of space technology</p> <p>Application of the law of conservation of momentum and energy for mechanical phenomenon.</p> <p>Fundamental interaction in nature.</p> <p>Limits of application of physical principles and theories.</p> <p>Fundamental principle of conservation laws of nature.</p> <p>Conservation principles for heating, magnetic and nuclear phenomenon.</p> <p>Evolution of world physical phenomenon. Impact of physics on social development and scientific and technical progress.</p> <p><i>Laboratory works</i> No 7. Study of conservation principle of mechanical energy</p> <p><i>Demonstration</i></p> <ol style="list-style-type: none"> 1. Uniformly accelerated motion. 2. Impingement in air and evacuated space 3. Motion of objects under the action of forces. 4. Inertia.
---	---

	and nature.	5. Interaction of objects. 6. Reactive motion. 7. Conservation principles
4	<i>Defense of class projects</i>	
PHYSICS AND ECOLOGY		
4	<p><i>Pupil</i> <i>Knowledge component:</i> <i>knows</i> physical properties of environmental pollution (mechanical, noise, electromagnetic, radiation); solarization and its impact on living things; ionization and its impact on living things, impact of electromagnetic smog and radioactive radiation; physical and technical fundamentals of warning means and cleaning up and rehabilitating the environment; physical fundamentals of safe energy.</p> <p><i>Activity component:</i> <i>defines</i> physical quantities of life safety using references</p>	<p>Physics and issues of human life safety. Physical fundamentals of rehabilitating the environment and energy conservation. Alternative energy sources.</p> <p><i>Demonstration</i> Video records of popular science programs on current issues of ecology and power engineering in Ukraine and all over the world.</p>