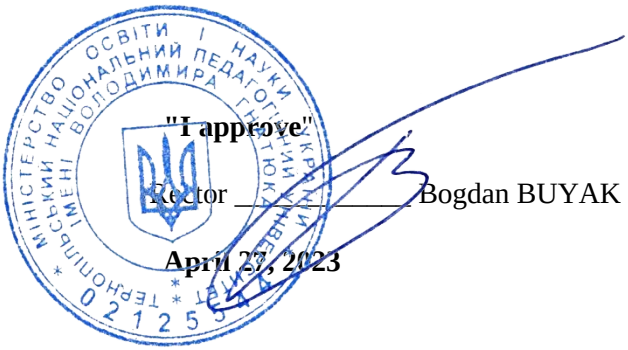
MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

TERNOPIL VOLODYMYR HNATIUK NATIONAL PEDAGOGICAL UNIVERSITY

FACULTY OF PHYSICS AND MATHEMATICS



"I approve"

Rector _____ Bogdan BUYAK

April 27, 2023

PROGRAM
ENTRANCE EXAM IN PHYSICS
TO OBTAIN THE FIRST (BACHELOR'S) LEVEL OF HIGHER EDUCATION

when entering the study
based on complete general secondary education

Reviewed and approved
at the meeting of the Department of
Physics and Methods of Its Teaching
(Protocol No. 10 of April 19, 2023)

TERNOPIL, 2023

EXPLANATORY NOTE

The program of the entrance exam is made following the program of external independent assessment in physics, approved by the order of the Ministry of Education and Science on June 26, 2018 №696.

The program of external independent assessment in physics is based on current curricula: physics for 7-9 grades of general secondary education, approved by the order of the Ministry of Education and Science of Ukraine № 804 from 07.06.2017 and curricula for 10-11 grades of general secondary education in physics (standard level, profile level) of the author's team under the leadership of Loktev V.M., in physics and astronomy (standard level, profile level) of the author's team under the leadership of Lyashenko O. I., approved by the Ministry of Education and Science of Ukraine 24.11 .2017 № 1539 "On granting the stamp of the Ministry of Education and Science to the curricula of physics and astronomy for students of 10-11 grades and the Polish language for students of 5-9 and 10-11 grades of general secondary education".

The material of the external independent evaluation program in physics is divided into five thematic blocks: "Mechanics", "Molecular Physics and Thermodynamics", "Electrodynamics", "Oscillations and Waves. Optics", "Elements of the theory of relativity. Quantum Physics", which, in turn, are distributed according to the key elements of the content of the physical component of the course "Physics and Astronomy" for general secondary education.

The purpose of external independent assessment in physics is to assess the academic achievement of participants in external independent assessment:

- to establish a connection between the phenomena of the surrounding world on the basis of knowledge of the laws of physics, fundamental physical experiments, and laboratory physical demonstrations and experiments;
- apply the basic laws, rules, concepts, and principles studied in the physics course of general secondary education;
- to determine the general features and significant differences in the content of physical phenomena and processes, the limits of application of physical laws;
- use theoretical knowledge to solve problems of different types (quality, calculation, graphics, experimental, combined, etc.);
- to make the plan of practical actions concerning the performance of the experiment, to use measuring instruments, the equipment, to process the results of research, including taking into account errors, to draw conclusions concerning the received results;
- explain the principle of operation of simple devices, mechanisms, and measuring instruments from a physical point of view;
- analyze the graphs of relationships between physical quantities, conclude;

- correctly determine and use units of physical quantities.

The basic content of educational material	*Learning outcomes that correspond to the requirements of the State Standard and curricula*	
	Knowledge component	*Activity component*
MECHANICS		
Fundamentals of kinematics. Mechanical movement. Reference system. Relativity of motion. Material point. Trajectory. Path and movement. Speed. Adding speeds. Uneven movement. Average and instantaneous speed. Uniform and uniformly accelerated motion. Acceleration. Graphs of the dependence of kinematic quantities on time in uniform and uniformly accelerated motions. Uniform movement in a circle. Period and frequency. Linear and angular velocities. Centripetal acceleration. **Fundamentals of dynamics.** Newton's first law. Inertial reference systems. Galileo's principle of relativity. Interaction of bodies. Mass. Power. Adding strength. Newton's second law. Newton's third law. Gravitational forces. The law of universal gravitation. Gravity. The movement of the body under the action of gravity. Bodyweight. Weightlessness. Movement of artificial satellites. The first space speed. Elastic forces. Hooke's law. Friction forces. Coefficient of friction. Moment of strength. Conditions of body balance. Types of balance. **Laws of conservation in mechanics.** The impulse of the body. The law of conservation of	Know, explain, and practical apply: **Phenomena and processes:** motion, inertia, free fall of bodies, the interaction of bodies, deformation, swimming of bodies, etc. **Fundamental experiments:** Archimedes, Torricelli, B. Pascal, G. Galileo, G. Cavendish. **Basic concepts:** mechanical motion, frame of reference, material point, trajectory, coordinate, displacement, path, velocity, acceleration, inertia, inertia, mass, force, weight, a moment of force, pressure, momentum, mechanical work, power, efficiency, kinetic and potential energy, period and frequency. **Idealized models:** material point, closed system. **Laws, principles:** laws of kinematics; Newton's laws of dynamics; the laws of conservation of momentum and energy, universal gravitation, Hooke, Pascal, Archimedes; conditions of equilibrium and swimming of bodies; principle: the relativity of Galileo. **Theories:** basics of classical mechanics **Practical implementation theoretical material:** solving the main problem of mechanics, the motion of bodies under the action of one or more forces; free fall; movement of transport, shells, planets, artificial satellites; equilibrium of bodies, the efficiency of simple mechanisms, pressure transfer by liquids and gases, swimming of bodies, principle of operation of measuring instruments and technical devices: scales, dynamometer, stroboscope,	recognize the manifestations of mechanical phenomena and processes in nature and examples of their practical application in technology, • apply the basic concepts and laws, principles, rules of mechanics, formulas for determining physical quantities and their units; mathematical expressions of laws and laws of mechanics; • determine the limits of application of the laws of mechanics; • distinguish between types of mechanical motion; • solve: 1) calculation problems for the use of the formulas of rectilinear uniform and uniform movements, average and instantaneous velocities of non-uniform motion, uniform circular motion, body motion under the action of constant gravity: uniform and uniformly accelerated rectilinear motions; relative motion - uniform motion in a circle; motion of bodies under the action of one or more forces, motion of connected bodies; conditions of equilibrium and swimming of bodies; universal attraction; the laws of Newton, Hooke, Pascal, Archimedes; conservation of momentum and energy; 2) tasks for the analysis of graphs of motion of bodies and determination of their parameters,. plotting the change of one quantity on the schedule of another; 3) tasks that involve processing and analysis of experimental results depicted in a photo or schematic drawing; 4) combined problems, for the solution of which concepts and regularities from several sections of mechanics are used.

momentum. Reactive motion. Mechanical work. Kinetic and potential energy. The law of conservation of energy in mechanical processes. Power. Coefficient of performance. Simple mechanisms **Elements of mechanics of liquids and gases.** Pressure. Pascal's law for liquids and gases. Atmospheric pressure. The pressure of the stationary liquid on the bottom and walls of the vessel. Archimedean force. Condition of swimming bodies.	barometer, manometer, ball bearing, pump, lever, connected vessels, blocks, inclined plane, water pipe, gateway, hydraulic press, pumps.	
MOLECULAR PHYSICS AND THERMODYNAMICS		
Fundamentals of molecular kinetic theory. The main provisions of molecular kinetic theory and their experimental justification. Mass and size of molecules. Became Avogadro. The root mean square velocity of the thermal motion of molecules. The perfect gas. The basic equation of the molecular kinetic theory of an ideal gas. Temperature and its measurements. Scale of absolute temperatures. Equation of state of an ideal gas. Isoprocesses in gases. **Fundamentals of thermodynamics.** Thermal motion. Internal energy and ways to change it. The amount of heat. Specific heat capacity of the substance. Work in thermodynamics. The law of conservation of energy in thermal processes (the first law of thermodynamics). Application of the first law of thermodynamics to isoprocesses. Adiabatic process. Irreversibility: thermal processes. The	Know, explain and put into practice: **Phenomena and processes:** Brownian motion, diffusion, gas compression, gas pressure, heat transfer processes (thermal conductivity, convection, radiation), establishment of thermal equilibrium, irreversibility of thermal phenomena, aggregate transformations of matter, deformation of solids, wetting, capillary phenomena, etc. **Fundamental experiments:** R. Boyle, E. Marriott, J. Charles, J. Gay-Lussac. **Basic concepts:** the amount of matter, Avogadro's constant, molar mass, root mean square thermal velocity of molecules, temperature, pressure, volume, concentration, density, heat transfer, work, internal energy, amount of heat, adiabatic process, isoprocesses, specific heat of matter, specific heat of fusion, specific heat of vaporization, specific heat of combustion of fuel, surface energy, surface tension force, surface tension, saturated and unsaturated vapor, relative humidity, dew point, dew point, crystalline and amorphous bodies, anisotropy of single crystals, elastic	recognize the manifestations of thermal phenomena and processes in nature and their practical application in technology, including diffusion, use of compressed gas, changes in internal energy (physical state of matter), types of heat transfer, wetting and capillarity, various types of deformation, properties of crystals and other materials in technology and nature, the creation of materials with specified properties, the use of heat engines in transport, energy, agriculture, methods of prevention and control of environmental pollution; apply the basic concepts and laws, principles, rules of molecular physics and thermodynamics, formulas for determining physical quantities and their units; mathematical expressions of the laws of molecular physics and thermodynamics; determine the limits of application of the laws of molecular physics and thermodynamics; distinguish: physical states of matter, saturated and unsaturated vapor, crystalline and amorphous bodies; • solve: 1) computational problems, applying the functional relationships between basic physical quantities, to: the equation of molecular kinetic theory of an ideal gas, the relationship between gas mass and number of molecules; the dependence of gas pressure on the

principle of operation of heat engines. Efficiency of the heat engine and its maximum value. Environmental consequences of heat engines. **Properties of gases, liquids and solids.** Vaporization (evaporation and boiling). Condensation. Specific heat of vaporization. Saturated and unsaturated steam, their properties. Relative humidity and its measurement. Melting and solidification of bodies. Specific heat of fusion. Heat of fuel combustion. Heat balance equation for the simplest thermal processes. Surface tension of liquids. Surface tension force. Wetting. Capillary phenomena. Crystalline and amorphous bodies. Mechanical properties of solids. Types of deformations. Jung's module.	and plastic deformation mechanical stress. **Idealized models:** perfect gas, perfect heat engine. **Laws, principles and limits of their application:** the basic equation of molecular kinetic theory of ideal gas, the equation of state of ideal gas, gas laws, the first law of thermodynamics, the equation of heat balance. **Theories:** basics of thermodynamics and molecular kinetic theory. **Practical application of theoretical material:** some cases of the equation of state of an ideal gas and their application in. engineering, use of compressed gas and heat engines, diffusion phenomena, boiling under increased pressure, heat treatment of metals, mechanical properties of various materials and the use of elastic properties of bodies in engineering, etc .; principle of operation of measuring instruments and technical devices: calorimeter, thermometer, psychrometer, heat engine (heat engines, steam and gas turbines).	concentration of molecules and temperature; internal energy of monoatomic gas; dependence of saturated vapor density and pressure on temperature; equations of state of ideal gas, gas laws; work of thermodynamic process, the first law of thermodynamics; heat balance equation; on surface and capillary phenomena, elastic deformation of bodies, relative humidity; 2) problems for the analysis of graphs of isoprocesses and their construction in different coordinate systems; calculation of the dependence of gas pressure on its volume; work performed by gas; analysis of thermal process schedules; analysis of the tensile diagram of metals; 3) tasks that involve processing and analysis of experimental results depicted in a photo or schematic drawing; 4) combined problems, for the solution of which concepts and regularities from several sections are used
ELECTRODYNAMICS		
Fundamentals of electrostatics. Electric charge. The law of conservation of electric charge. Coulomb's law. Electric field. Electric field strength. The principle of superposition of fields. Conductors and dielectrics in an electrostatic field. The work of the electric field when moving the charge. Potential and potential difference. High-voltage. Relationship between voltage and uniform electric field strength. Electric capacity. Capacitors. The capacitance of a flat capacitor. Capacitor	Know, explain and put into practice: **Phenomena and processes:** electrification, interaction of charged bodies, two types of electric charges, free charge carriers in conductors, polarization of dielectrics, electric current, electrolysis, thermoelectron emission, ionization of gases, magnetic interaction, existence of the Earth's magnetic field, electromagnetic induction, etc. **Fundamental experiments:** S. Coulomb, Joffe-Milliken, E. Ohm, X. Oersted, A.-M. Ampere, M. Faraday. **Basic concepts:** electric charge, elementary charge, electrostatic field, voltage, lines of tension (power lines), conductors and	• recognize the manifestations of electromagnetic phenomena and processes in nature and their practical application in technology, including electrostatic protection, use of conductors and insulators, capacitors, electric current, use of magnetic properties, electrolysis in technology (extraction of pure metals, electroplating, electroplating), electromagnets electric motors, inductors, capacitors; • apply the basic concepts and laws, principles, rules of electrodynamics, formulas for determining physical quantities and their units; mathematical expressions of the laws of electrodynamics; • determine the limits of application of Coulomb and Ohm's laws;

connections. Electric field energy. **Laws of direct current.** Electric current. Conditions for the existence of direct electric current. Amperage. Ohm's law for a section of a circle. Resistance of conductors. Serial and parallel connection of conductors. Electromotive force. Ohm's law for a full circle. Operation and power of electric current. Joule-Lenz law. **Electric current in different environments.** Electric current in metals. Electronic conductivity of metals. Dependence of metal resistance on temperature. Superconductivity. Electric current in solutions and melts of electrolytes. Laws of electrolysis. Application of electrolysis. Electric current in gases. Non-independent and independent categories. The concept of plasma. Electric current in vacuum. Electric current in semiconductors. Intrinsic and impurity conductivity of semiconductors. Dependence of resistance of semiconductors on temperature. Electron-hole transition. Semiconductor diode. Transistor. **Magnetic field, electromagnetic induction.** Interaction of currents. Magnetic field. Magnetic induction. Ampere force. Lorentz power. Magnetic properties of substances. Magnetic permeability. Ferromagnets. Magnetic flux. The phenomenon of electromagnetic induction. Law of electromagnetic induction. Lenz's rule. The phenomenon of self-induction.	dielectrics, dielectric constant of matter, work of electrostatic field forces, potential energy of charge in an electric field, potential; potential difference, voltage, electric capacitance, charged capacitor energy, current strength, electrical resistance, electromotive force, superconductivity, vacuum, thermoelectronic emission, intrinsic and impurity conductivity of semiconductors, electronic conductivity of metals, dissociation, dissonance, chemical equivocation self-discharges, magnetic induction, Ampere force, Lorentz force, magnetic permeability, electromagnetic induction, induction current, magnetic flux, EMF induction, electromagnetic field, self-induction, inductance, EMF self-induction, magnetic field energy. **Idealized models:** point charge, infinite uniformly charged plane. **Laws, principles, rules, hypotheses:** laws of conservation of electric charge, Coulomb, Ohm (for a section and a complete electric circuit), Joule-Lenz, electrolysis, electromagnetic induction; the principle of superposition of electric fields; rules: drill (right screw), left hand, Lenz; Ampere's hypothesis, Maxwell's hypothesis. **Theories:** basics of classical electronic theory, electromagnetic field theory. **Practical application of theoretical material:** use of electrostatic protection, insulators and conductors, capacitors, electric current, laws of current for calculation of electric circuits, electrolysis, plasma, in engineering, types of independent discharge, movement of electric charges in electric and magnetic fields, magnetic properties of matter, etc .; principle of operation of measuring instruments and technical devices: electroscope, electrometer, capacitor, current	• distinguish between: conductors and dielectrics, polar and nonpolar dielectrics, types of magnets, non-independent and independent discharges in gases, intrinsic and impurity conductivity of semiconductors; • compare the properties of magnetic fields, electrostatic and vortex electric fields; • solve: 1) computational problems that require the use of functional dependencies between basic physical quantities, on: the interaction of point charges (application of Coulomb's law); field strength of a point charge, a leading sphere, the principle of superposition; the action of an electric field on a charge; capacitance of a flat capacitor, connection of capacitors, energy of a charged capacitor; calculation of electrical circuits (including mixed conductor connections) using Ohm's laws; operation, power and thermal action of electric current; passage of electric current through electrolytes; determination of the direction and modulus of the magnetic induction vector; Ampere forces, Lorentz forces, EMF induction in moving conductors, the law of electromagnetic induction, EMF self-induction, magnetic field energy of the conductor with current; 2) problems for the analysis of the graphical representation of electrostatic and magnetic fields, the application of Ohm's law, the dependence of the resistance of the metal conductor and semiconductor on temperature, the volt-ampere characteristic of the semiconductor diode; 3) tasks that involve processing and analysis of experimental results depicted in a photo or schematic drawing; 4) combined problems, for the solution of which the concepts and laws of mechanics, molecular physics and electrodynamics are used; • make a plan for experiments, work with measuring instruments and devices, including electroscope, electrometer, capacitors, current sources, current converters, devices for measuring

Inductance. Magnetic field energy.	sources (battery, galvanic cell, generator), electrical measuring instruments (ammeter, voltmeter), current consumers (motors, resistor, electric heaters, fuses, electronics), rheostats) -radiation tube, semiconductor devices, electromagnets, loudspeaker, electrodynamic microphone.	current characteristics, current consumers, electromagnet, solenoid; • make generalizations about the carriers of electric charge in different environments; magnetic properties of various substances.
OSCILLATIONS AND WAVES. OPTICS		
Mechanical oscillations and waves. Oscillatory motion. Free mechanical oscillations: Harmonic oscillations. Displacement, amplitude, period, frequency, and phase of harmonic oscillations. Oscillations of the load on the spring. Filament pendulum, period of oscillations of filament: pendulum. Energy conversion under harmonic oscillations. Forced mechanical oscillations. The phenomenon of resonance. Propagation of oscillations in elastic media. Transverse and longitudinal waves. Wavelength. Relationship between wavelength, speed of propagation, and period (frequency). Sound waves. Speed of sound. Volume and intensity of sound.Tone pitch and timbre of a sound. Infrared and ultrasound. **Electromagnetic oscillations and waves.** Free electromagnetic oscillations in the oscillatory circuit.Energy conversion in an oscillatory circuit. Natural frequency and period of electromagnetic oscillations.Thomson's formula. Forced electrical oscillations. Alternating electric current.Alternator. Electrical resonance. Transformer. The principle	Know, explain and put into practice: **Phenomena and processes:** oscillations of a body on a thread and spring, resonance, propagation of oscillations in space, reflection, waves, rectilinear propagation of light in a homogeneous medium, formation of shadows and penumbra, lunar and solar eclipses, refraction of light at two media, finiteness of light propagation and radio waves, etc. **Fundamental experiments:** G. Hertz; I. Newton, I. Pulyuy and W. Roentgen. **Basic concepts:** harmonic oscillations, displacement, amplitude, period, frequency and phase, resonance, transverse and longitudinal waves, wavelength, speed of sound, volume and intensity of sound, pitch, timbre, infrared and ultrasound, free and forced electromagnetic oscillations, oscillating circuit, alternating current, current-voltage values and current strength, active, inductive, and capacitive resistance, work and power of alternating current, resonance, self-oscillation, self-oscillating system, period (frequency) of free electromagnetic oscillations in the electric circuit, electric resonance, alternating electric current, transformation coefficient, electromagnetic waves, optical power and lens focus, refractive index; total reflection, sources of coherent radiation, interference, diffraction, dispersion, and the polarization of light.	• recognize the manifestations of oscillatory and wave (including light) phenomena and processes in nature and their practical application in technology, including the propagation of transverse and longitudinal waves, practical application of sound and ultrasonic waves in technology, use of electromagnetic radiation of different ranges, interference, diffraction and polarization of light, use of linear spectra; • apply the basic concepts and laws for oscillatory motion and wave processes, formulas for determining physical quantities and their units; mathematical expressions of laws; • determine the limits of application of the laws of geometric optics; • compare the features of oscillations and waves of different nature, the spectra of radiation and absorption; • distinguish: transverse and longitudinal waves, radiation of different ranges; • solve: 1) calculation problems, applying the functional dependencies between the basic physical quantities, on: the dependence of the period of natural oscillations on the parameters of the system; the law of conservation of energy in the oscillatory process; harmonic oscillations, wavelength; laws of geometric optics, the formula of a thin lens; interference and diffraction of light; transformer; 2) problems for the analysis of graphs of undamped (harmonic) and damped oscillations, the dependence of the amplitude of forced oscillations on the frequency of external periodic force, the image of the course of light rays at

of transmission of electricity over long distances.Electromagnetic field. Electromagnetic waves and their speed of propagation. The scale of electromagnetic waves. Properties of electromagnetic radiation of different ranges. **Optics.** Rectilinearity of light propagation in a homogeneous medium. Speed of light and its measurement.Laws of light reflection. Construct images that give a flat mirror. Laws of refraction. Absolute and relative refractive indices. Complete reflection.Lens. The optical power of the lens. The formula of a thin lens. Construction of images given by a thin lens. Interference of light and its practical application. Diffraction of light. Diffraction gratings and their use to determine the wavelength of light.Dispersion of light. Continuous and linear spectra. Spectral analysis. Polarization of light.	**Idealized models:** mathematical (thread) pendulum, perfect oscillatory circuit **Laws, principles:** the equation of undamped harmonic oscillations, the law of rectilinear propagation of light in a homogeneous medium, the independence of propagation, light beams, the laws of reflection and refraction of waves, the conditions of interference, maximum and minimum; Huygens principle, Doppler principle. **Theories:** basics of electromagnetic field theory. **Practical application of theoretical material:** transmission of electrical energy at a distance, the transmission of information by electromagnetic waves, radar, use of electromagnetic radiation of different ranges, application of interference, diffraction and polarization of light, use of linear spectra, spectral analysis; the principle of operation of measuring instruments and technical devices: generator on transistor, alternator, transformer, the simplest radio receiver, glasses, camera, projection device, magnifier, microscope, light guide, spectroscope.	the boundary of two transparent media; images obtained with a flat mirror and a thin lens; 3) combined problems, for the solution of which the concepts and regularities of different sections of physics are used; 4) tasks that involve processing and analysis of experimental results depicted in a photo or schematic drawing; • make a plan for experiments and experiments, work with measuring instruments and devices (in particular, the body on the thread), generator on the transistor, transformer, light sources, flat mirror, lens, transparent plane-parallel plate, diffraction gratings.
QUANTUM PHYSICS. ELEMENTS OF THE THEORY OF RELATIONSHIP		
Elements of the theory of relativity. Principles (postulates) of Einstein's theory of relativity. Relativistic law of addition of velocities. The relationship between mass and energy. **Light quanta.** Planck's hypothesis. She became Planck. Quanta of light (photons). Photo effect and its experimentally established laws. Einstein's equation for the photo effect. Application of the photo effect in technology. Light pressure. **Atom and an atomic nucleus.** Rutherford's	Know, explain, and put into practice: **Phenomena and processes:** motion of elementary particles in accelerators, the discovery of spectral lines, radioactivity, isotopes, loss of negative charge by metals when irradiated with light, the dependence of photoelectron energy on the light frequency, and independence of its intensity, photon, and electron **Fundamental experiments:** A. Stoletova; P. Lebedev; E. Rutherford; A. Becquerel. **Basic concepts:** quanta of light (photons), photo effect, the red limit of photo effect, light pressure, isotopes, radioactivity, alpha and beta particles, gamma radiation,	- to recognize the manifestations of quantum phenomena and processes in nature and their practical application in technology, in particular, the facts that confirm the conclusions of the special theory of relativity; phenomena that confirm the corpuscular-wave dualism of the properties of light; use of the laws of the photo effect in technology, methods of observation and registration of microparticles; apply the basic concepts and laws of special relativity, photo effect theory, theory of atom and nucleus structure, formulas for determining physical quantities and their units; mathematical expressions of laws; - distinguish: types of spectra, radioactivity; - compare the features of microparticle tracks in electric and

experiment. Nuclear model of the atom. Quantum postulates of Bohr. Radiation and absorption of light by an atom. Formation of a linear spectrum. Laser. The composition of the atomic nucleus. Isotopes. The binding energy of atomic nuclei. Nuclear reactions. Fission of uranium nuclei. Nuclear reactor. Thermonuclear reaction. Radioactivity. Alpha, beta, gamma radiation. Methods of registration of ionizing radiation.	quantum nature of radiation and absorption of light by atoms, induced radiation, proton, neutron, neutron, radioactive decay, half-life; bond energy of atomic nuclei, mass defect, the energy yield of nuclear reactions, nuclear chain reaction, critical **Idealized models:** a planetary model of the atom, proton-neutron model of the nucleus. **Laws, principles, hypotheses:** postulates of the theory of relativity, law of connection between mass and energy, laws of photo effect, Einstein's equation for photo effect, quantum postulates of Bohr, conservation of nucleons and charge in nuclear reactions, law of radioactive decay, Planck's hypothesis. **Theories:** basics of the special theory of relativity, theory of photo effect, corpuscular-wave dualism, theory of atom and nucleus structure. **Practical application of theoretical material:** application of photo effect, structure, and properties of atomic nuclei, explanation of linear spectra of radiation and absorption, use of lasers, nuclear energy, the principle of operation of measuring instruments, and technical devices: photocell, devices for registration of charged particles, laser, nuclear reactor.	magnetic fields; formation of different types of spectra, general features of the processes occurring during radioactive decay of nuclei, conditions of chain and thermonuclear reactions; the nature of alpha, beta, gamma radiation; - make generalizations about the properties of matter and fields, solve: 1) computational problems, applying the functional relationships between the basic physical quantities, on the relativistic law of addition of velocities, the use of formulas for the relationship between mass, momentum, and energy; application of quantum Bohr postulates to the processes of radiation and energy absorption by the atom; application of Einstein's equation for photo effect, compilation of equations of nuclear reactions on the basis of conservation laws; calculation of the mass defect, the binding energy of atomic nuclei, the energy yield of nuclear reactions; application of the laws of conservation of momentum and energy to the description of collisions of microparticles; application of the law of radioactive decay, determination of the half-life; 2) tasks for the analysis of graphs of changes in the number of radioactive nuclei over time, schemes of energy levels to explain the absorption and emission of light 3) combined problems, for the solution of which the concepts and regularities of different sections of physics are used; 4) tasks involving processing and analysis of experimental results depicted in a photo or schematic drawing, in particular, to determine the characteristics of elementary particles or nuclei from photographs of their tracks (in particular in a magnetic field); - make a plan for experiments and experiments, work with measuring instruments and devices, including photocells.

STRUCTURE AND CONTENT OF THE EXAM, FORM OF CONDUCT

The professional entrance examination is conducted in the form of an oral exam on the basis of tickets approved by the chairman of the selection committee.

The ticket contains one theoretical question and two tasks. The entrant is given 45 minutes to prepare, after which he gives an oral answer to the task of the selected ticket. This time is enough for preparation, problem-solving and psychological adaptation.

Evaluation criteria

The evaluation of the answer is carried out on a 100-point scale, the distribution of points of which is given in the table below.

Theoretical question	Exercise №1	Exercise №2	Sum
40	30	30	100

The transfer of the number of points of the entrance exam to the rating (on a scale of 100-200 points) is carried out according to the table at the end of the program.

Assessment of the theoretical part of the entrance test

40-30 - is given if the entrant: reveals the correct understanding of the physical content of the phenomena and laws, laws and theories, gives a precise definition and interpretation of basic concepts, laws, and theories, as well as the correct definition of physical quantities, units, and methods of measurement; correctly executes drawings, diagrams, and graphs accompanying the answer; builds the answer according to own plan, accompanies the story with own examples;

29-20 - is given if the answer satisfies the basic requirements, but it does not use its own story plan, or its own examples, and does not apply knowledge in a new situation.

19-10 - is given if the majority of the answer satisfies the basic requirements, but there are some gaps in the knowledge of theoretical material;

9-0 - is given if the entrant does not have the basic knowledge and skills in accordance with the requirements of this test.

Assessment of the practical part of the entrance test

30-20 - is given if the entrant solves a problem that should end with a formula and a number, or only a formula if the problem does not provide calculations.

19-10 - is given if the correct path is chosen in solving the problem, but the solution is not completed.

9-0 - is given if the correct solution way is selected but there is no solution.

Table of conversion of the number of points of the entrance exam into the rating (on a scale of 100-200 points)

Number of points of the entrance exam	Rating score	Number of points of the entrance exam	Rating score	Number of points of the entrance exam	Rating score
0-9	Not composed	40	140	71	171
10	100	41	141	72	172
11	102	42	142	73	173
12	104	43	143	74	174
13	106	44	144	75	175
14	108	45	145	76	176
15	110	46	146	77	177
16	112	47	147	78	178
17	114	48	148	79	179
18	116	49	149	80	180
19	118	50	150	81	181
20	120	51	151	82	182
21	121	52	152	83	183
22	122	53	153	84	184
23	123	54	154	85	185
24	124	55	155	86	186
25	125	56	156	87	187
26	126	57	157	88	188
27	127	58	158	89	189
28	128	59	159	90	190
29	129	60	160	91	191
30	130	61	161	92	192
31	131	62	162	93	193
32	132	63	163	94	194
33	133	64	164	95	195
34	134	65	165	96	196
35	135	66	166	97	197
36	136	67	167	98	198
37	137	68	168	99	199
38	138	69	169	100	200
39	139	70	170		

Entrants with a rating of **at least 100** are allowed to participate in the competitive selection for admission to study.

LIST OF RECOMMENDED SOURCES

1. EIT tests online in physics. URL: https://zno.osvita.ua/physics/
2. Struzh N. Physics. Comprehensive preparation for external independent evaluation 2022 / N. Struzh, V. Matsyuk, S. Ostapyuk. Ternopil: Textbooks and manuals, 2021. 496 p.
3. Physics: a textbook for 9th-grade secondary schools / [V. G. Baryahtar, S. O. Dovgy, F. Ya. Bozhinova, O.O. Kiryukhina]; for ed. V.G. Baryahtara, S. O. Dovgy. - Kharkiv: Publishing House "Morning", 2017. - 272 p.: il., photo.
4. Physics (standard level, according to the curriculum of the author's team under the leadership of V.M. Loktev): a textbook for a 10th-grade institution of general secondary education / [V. G. Baryakhtar, SO Dovgy, F. Ya. Bozhinova, O.O. Kiryukhina]; for ed. V.G. Baryahtar, S.O. Dovgy. - Kharkiv: Publishing House "Morning", 2018. - 272 p.: il.
5. Physics (standard level, according to the curriculum of the author's team under the leadership of V.M. Loktev): a textbook for an 11th-grade institution of general secondary education / [Baryahtar V.G., Dovgy S.O., Bozhinova F. Ya., Kiryukhina O.O.]; for ed. Baryahtara V.G., Dovhogo S.O. - Kharkiv: Publishing House "Morning", 2019. - 272 p.: il., photo.
6. Physics and astronomy (standard level, according to the curriculum of the author's team under the leadership of O.I. Lyashenko): a textbook for 11th-grade institutions of general secondary education / T.M. Zasekina, D.O. Zasekin. - K.: УОВЦ «Orion», 2019. - 272 c. : il.
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