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
PHYSICS INTERVIEWS
FOR OBTAINING THE FIRST (BACHELOR'S) LEVEL OF HIGHER EDUCATION

when entering training
on the basis of 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 interview program was drawn up in accordance with the program of external independent evaluation in physics, approved by the Order of the Ministry of Education and Science of Ukraine dated 26.06.2018 No. 696.

The program of external independent evaluation in physics is concluded on the basis of existing educational programs: physics for 7-9 grades of general secondary education institutions, approved by the Order of the Ministry of Education and Science of Ukraine No. 804 dated 07.06.2017 and educational programs for grades 10-11 of general secondary education institutions 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 order of the Ministry of Education and Science of Ukraine on November 24, 2017 No. 1539 "On providing the stamp of the Ministry of Education and Science with educational programs in physics and astronomy for students of grades 10-11 and Polish for students of grades 5-9 and 10-11 of general secondary education institutions".

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

The purpose of external independent evaluation in physics is to evaluate the educational achievements of participants in external independent evaluation:

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 course of physics of general secondary education institutions;
- to determine the general features and significant differences in the content of physical phenomena and processes, the limits of the application of physical laws;
- use theoretical knowledge to solve problems of various types (qualitative, calculated, graphic, experimental, combined, etc.);
- to draw up a plan of practical actions for the implementation of the experiment, to use measuring instruments, equipment, to process the results of the study, including taking into account errors, to draw conclusions about the results obtained;
- explain the principle of operation of simple devices, mechanisms and measuring instruments from a physical point of view;

- analyze graphs of dependencies between physical quantities, draw conclusions;
- correctly determine and use units of physical quantities.

Basic content of educational material	*Results of training related to the requirements of the State Standard and training programs*	
	Known component	*Activity component*
MECHANICS		
Basics of kinematics. Mechanical motion. Frame of reference. Relativity of motion. Material point. Trajectory. Path and movement. Speed. Add speeds. Uneven movement. Medium and instantaneous speed. Uniform and evenly accelerated movements. Acceleration. Graphs of dependence of kinematic quantities on time in uniform and uniform motions. Uniform movement in a circle. Period and frequency. Linear and angular velocity. Centrifugal acceleration. **Basics of dynamics.** Newton's First Law: Inertial Reference Systems: Galileo's Principle of Relativity. Interaction of bodies. Mass. Force. 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 influence of gravity. Body weight. Weightlessness. Movement of artificial satellites. The first cosmic velocity. Forces of elasticity. Hooke's Law. Forces of friction. Friction coefficient. Moment of strength. Conditions of balance of the body. Look at the balance. **Conservation laws in mechanics.** Momentum of the body. The law of conservation of momentum. Reactive movement.	Know, explain and practically apply: **Phenomena and processes:** movement, inertia, free fall of bodies, interaction of bodies, deformation, swimming of bodies, etc. **Fundamental experiments:** Archimedes, Torricelli, B. Pascal, G. Galileo, G. Cavendish. **Basic concepts:** mechanical motion, reference system, material point, trajectory, coordinate, movement, path, speed, acceleration, inertia, inertia, mass, force, weight, moment of force, pressure, pulse, mechanical work, power, efficiency, kinetic and potential energy, period and frequency. **Idealized models:** material point, closed system. **Laws, principles:** laws of kinematics; laws of Newton's dynamics; laws of conservation of momentum and energy, universal gravitation, Hooke, Pascal, Archimedes; conditions of equilibrium and swimming of bodies; principle: relativity of Galileo. **Theories:** Basics of Classical Mechanics **Practical application theoretical material:** solving the main problem of mechanics, the movement of bodies under the influence of one or more forces; free fall; movement of transport, projectiles, planets, artificial satellites; equilibrium of bodies, efficiency of simple mechanisms, transfer of pressure by liquids and gases, swimming of bodies, principle of operation of	recognize the manifestations of mechanical phenomena and processes in nature and examples of their practical application in technology, apply 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 movement; • solve: 1) calculated tasks for the use of formulas of straight uniform and uniform motions, medium and instantaneous speed of uneven movement, uniform movement in a circle, movement of the body under the action of constant gravity: uniform and evenly accelerated straight movements; relative movement- uniform movement in a circle; movement of bodies under the influence of one or more forces, movement of bound bodies; conditions of equilibrium and swimming of bodies; universal attraction; laws of Newton, Hooke, Pascal, Archimedes; preservation of momentum and energy; 2) tasks for analyzing the graphs of the movement of bodies and determining their parameters, . plotting the change of one value according to the schedule of another; 3) tasks that involve the processing and analysis of the results of the experiment,

Mechanical work. Kinetic and potential energy. The law of conservation of energy in mechanical processes. Power. Efficiency. Simple mechanisms **Elements of fluid and gas mechanics.** Pressure. Pascal's Law for Liquids and Gases. Atmospheric pressure. Pressure of fixed liquid to the bottom and walls of the vessel. Archimedes power. Condition of swimming bodies.	measuring instruments and technical devices: scales, dynamometer, strobe light, barometer, pressure gauge, ball bearing, pump, lever, vessels, blocks, inclined plane, plumbing, gateway, hydraulic press, pumps.	depicted in the photo or scematic figure; 4) combined problems, for the solution of which concepts and patterns from several sections of mechanics are used.
MOLECULAR PHYSICS AND THERMODYNAMICS		
Fundamentals of molecular Kinetic theory. The main provisions of molecular-kinetic theory and their experimental substantiation. Mass and size of molecules. Steel Avogadro. The average quadratic velocity of thermal movement of molecules. The perfect gas. The basic equation of molecular-kinetic theory of ideal gas. Temperature and its measurement. Scale of absolute temperatures. Equation of the state of the ideal gas. Isoprocesses in gases. **Basics of thermodynamics.** Heat movement. Internal energy and ways to change it. 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. Non-reversal: thermal processes. The principle of operation of thermal engines. The efficiency of the heat engine and its maximum value. Environmental consequences of the action of thermal machines. **Properties of gases, liquids and solids.** Vaporization (evaporation and boiling). Condensation. Specific heat of vaporization. Saturated and unsaturated steam,	Know, explain and practically apply: **Phenomena and processes:** Brownian motion, diffusion, compression of gases, gas pressure, heat exchange processes (thermal conductivity, convection, radiation), establishment of thermal equilibrium, irreversible thermal phenomena, aggregate transformation of matter, deformation of solids, wetting, capillary phenomena, etc. **Fundamental experiments:** R. Boyle, E. Mariotta, J. Charles, J. Gay-Lussac. **Basic concepts:** the amount of matter, became Avogadro, molar mass, the average quadratic speed of thermal movement of molecules, temperature, pressure, volume, concentration, density, heat exchange, work, internal energy, amount of heat, adiabatic process, isoprocesses, specific heat capacity of the substance, specific melting heat, specific heat of steam formation, specific heat of combustion of fuel, surface energy, surface tension force, saturated and unsaturated steam, relative humidity, dew point, crystalline and amorphous bodies, anisotropy of monocrystals, elastic and plastic deformation, elongation, mechanical stress. **Idealized models:** ideal gas, perfect heat machine. **Laws, principles and limits of their application:** the basic	recognize the manifestations of thermal phenomena and processes in nature and their practical application in technology, in particular diffusion, the use of compressed gas, changes in internal energy (aggregate state of the substance), types of heat exchange, the phenomenon of wetting and capillary, various types of deformation, the 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 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 between: aggregate states of matter, saturated and unsaturated steam, crystalline and amorphous bodies; • solve: 1) calculation problems, applying functional dependencies between the main physical quantities, on: the equation of molecular-kinetic theory of ideal gas, the

their properties. Relative humidity and its measurement. Melting and hardening of bodies. Specific heat melting. Heat of combustion of fuel. The equation of thermal balance 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 module.	equation of the molecular-kinetic theory of ideal gas, the equation of the state of the ideal gas, gas laws, the first law of thermodynamics, the equation of thermal balance. **Theories:** fundamentals of thermodynamics and molecular-kinetic theory. **Practical application of theoretical material:** individual cases of the equation of the state of ideal gas and their application in the technique, the use of compressed gas and heat machines, the phenomenon of diffusion, boiling under increased pressure, heat treatment of metals, mechanical properties of various materials and the use of elastic properties of bodies in technology, etc.; the principle of operation of measuring instruments and technical devices: calorimeter, thermometer, psychrometer, heat machine (thermal machine) engines, steam and gas turbines).	relationship between the mass of gas and the number of molecules; dependence of gas pressure on the concentration of molecules and temperature; internal energy of single-atom gas; dependence of density and pressure of saturated steam on temperature; equations of the state of ideal gas, gas laws; the work of the thermodynamic process, the first law of thermodynamics; equation of thermal balance; surface and capillary phenomena, elastic deformation of bodies, relative humidity of air; 2) tasks for analyzing isoprocess graphs and constructing them in different coordinate systems; calculation according to the schedule of dependence of gas pressure on its volume; work done by gas; analysis of graphs of thermal processes; analysis of the metal stretching diagram; 3) tasks that involve the processing and analysis of the results of the experiment, depicted in the photo or scematic figure; 4) combined problems, for the solution of which concepts and patterns from several sections are used
ELECTRODYNAMICS		
Basics of electrostatics. Electric charge. The law of conservation of electric charge. Coulomb's Law. Electric field. The intensity of the electric field. The principle of superposition of fields. Conductors and dielectrics in the electrostatic field. The operation of the electric field when moving the charge. Potential and potential difference. Voltage. The relationship between the voltage and the intensity of a homogeneous electric field. Electrical capacity. Capacitors. Electrical intensity of a flat capacitor. Connection of	Know, explain and practically apply: **Phenomena and processes:** electrification, interaction of charged bodies, two types of electric charges, free carriers of charges in conductors, polarization of dielectrics, electric current action, electrolysis, thermoelectronic emission, ionization of gases, magnetic interaction, existence of the Earth's magnetic field, electromagnetic induction and self-induction, etc. **Fundamental experiments:** S. Coulon, Joffe-Milliken, E. Ohm, X. Ersted, A.-M. Ampere, M. Faraday.	• recognize the manifestations of electromagnetic phenomena and processes in nature and their practical application in technology, in particular electrostatic protection, the use of conductors and insulators, capacitors, the action of electric current, the use of magnetic properties of matter, electrolysis in technology (extraction of pure metals, galvanostegia, galvanoplasty), electromagnets of electric motors, inductance coils, capacitors; • apply basic concepts and laws, principles, rules of electrodynamics, formulas for determining physical quantities

capacitors. Energy of the electric field. **Dc laws.** Electric current. Conditions of existence of direct electric current. Current strength. Ohm's law for a section of the circle. Resistance of conductors. Serial and parallel connection of conductors. Electromovable force. Ohm's Law for a full circle. Operation and power of electric current. Joule-Lentz's 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-self-contained and independent discharges. The concept of plasma. Electric current in a vacuum. Electric current in semiconductors. Own and impurity electrical 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's strength. Lorenz's strength. Magnetic properties of substances. Magnetic permeability. Ferromagnetics. Magnetic flux. The phenomenon of electromagnetic induction. The Law of Electromagnetic Induction. The Lentz Rule. The phenomenon of self-induction. Inductance. Energy of the magnetic field.	**Basic concepts:** electric charge, elementary charge, electrostatic field, tension, power lines (power lines), conductors and dielectrics, dielectric permeability of matter, operation of electrostatic field forces, potential charge energy in an electric field, potential; potential; potential difference, voltage, electro capacity, energy of charged condensationcurrent, electrical resistance, electromotive force, superconductivity, vacuum, thermoelectronic emission, own and impurity conductivity of semiconductors, electronic conduction of metals, dissociation, chemical equivalent, ionization, recombination, plasma, non-self-contained and independent discharges, magnetic induction, Ampere force, Lorenz force, magnetic permeability, electromagnetic induction, induction current, magnetic flux, EMF induction, electromagnetic field, self-induction, inductance, EMF self-induction, the energy of the magnetic field. **Idealized models:** point charge, infinite evenly charged plane. **Laws, principles, rules, hypotheses:** laws of conservation of electric charge, Coulomb, Ohm (for the site and full electric circuit), Joule-Lentz, electrolysis, electromagnetic induction; principle of superposition of electric fields; rules: drill (right screw), left hand, Lentz; Ampere hypothesis, Maxwell hypothesis. **Theories:** the basis of classical electronic theory, the theory of the electromagnetic field. **Practical application of theoretical material:** the use of electrostatic protection, insulators and conductors, capacitors, the action of electric current, the laws of current for the calculation of electrical circuits, electrolysis, plasma, in technology, types of independent discharge, the movement of electrical charges in	and their units; mathematical expressions of the laws of electrodynamics; • to determine the limits of application of the laws of Coulomb and Ohm; • distinguish between: conductors and dielectrics, polar and non-polar dielectrics, types of magnets, non-self-contained and independent discharges in gases, own and admixture conductivity of semiconductors; • compare the properties of the magnetic field, electrostatic and eddy electric fields; • solve: 1) calculated tasks requiring the use of functional dependencies between the main physical quantities, on: the interaction of point charges (application of coulomb's law); the intensity of the point charge field, the conductive ball, the principle of superposition; the action of the electric field on the charge; electrical intensity of a flat capacitor, connection of capacitors, energy of a charged capacitor; calculation of electric circuits (including mixed conductor connections) using Ohm's laws; operation, power and thermal action of electric current; passing electric current through electrolytes; determination of the direction and module of the magnetic induction vector; Ampere forces, Lorenz forces, EMF induction in moving conductors, the law of electromagnetic induction, EMF self-induction, the energy of the magnetic field of the conductor with current; 2) tasks for the analysis of the graphic image 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

	electric and magnetic fields, the magnetic properties of matter, etc.; principle of operation of measuring instruments and technical devices: electroscope, electrometer, capacitor, current sources (battery, galvanic element, generator), electrical measuring devices (ammeter, voltmeter), current consumers (engines, resistor, electric heating devices, melting fuses, reposts), electron beam tube, semiconductor devices, electromagnets, loudspeaker, electrodynamic microphone.	characteristic of the semiconductor diode; 3) tasks that involve the processing and analysis of the results of the experiment, depicted in the photo or scematic figure; 4) combined problems, for the solution of which concepts and patterns of mechanics, molecular physics and electrodynamics are used; • make a plan for performing experiments, working with measuring instruments and devices, in particular an electroscope, electrometer, capacitors, current sources, current converters, devices for measuring current characteristics, current consumers, electromagnet, solenoid; • make generalizations about electric charge carriers in different environments; magnetic properties of various substances.
VIBRATIONS AND WAVES. OPTICS		
Mechanical vibrations and waves. Oscium motion. Free mechanical vibrations: Harmonic vibrations. Displacement, amplitude, period, frequency and phase of harmonic oscillations. Vibration of cargo on the spring. Thread pendulum, the period of oscillations of the thread: pendulum. Energy conversion with harmonic fluctuations. Forced mechanical vibrations. The phenomenon of resonance. The spread of vibrations in elastic environments. Transverse and longitudinal waves. Wavelength. The relationship between the wavelength, the speed of its propagation and the period (frequency). Sound waves. Speed of sound. Volume and intensity of sound. The height of the tone and timbre of sound. Infra- and ultrasound. **Electromagnetic oscillations and waves.** Free electromagnetic oscillations in the oscillation	Know, explain and practically apply: **Phenomena and processes:** vibrations of the body on a thread and spring, resonance, propagation of oscillations in space, reflection ;waves, straightening of light in a homogeneous environment, formation of shadow and penumbra, lunar and solar eclipses, refraction of light at the boundary of two media, finiteness of the speed of light propagation and radio waves, etc. **Fundamental experiments:** G. Hertz; I. Newton, I. Puluj and V. Roentgen. **Basic concepts:** harmonic vibrations, displacement, amplitude, period, frequency and phase, resonance, transverse and longitudinal waves, wavelength, sound speed, volume and intensity of sound, pitch height, timbre of sound, infra- and ultrasound, free and forced electromagnetic oscillations, oscillatory circuit,	• recognize the manifestations of oscillations and wave (in particular light) phenomena and processes in nature and their practical application in technology, in particular the propagation of transverse and longitudinal waves, the practical use of sound and ultrasonic waves in technology, the use of electromagnetic radiation of different ranges, the use of interference phenomena, diffraction and polarization of light, the use of line spectra; • apply basic concepts and laws for oscular 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 vibrations and waves of different nature, radiation and absorption spectra;

circuit. Energy conversion in the oscular circuit. Own frequency and period of electromagnetic oscillations. Thomson's formula. Forced electrical fluctuations. Alternating electric current. ALTERNator. Electrical resonance. Transformer. The principle of transmission of electricity over long distances. Electromagnetic field. Electromagnetic waves and the speed of their propagation. Scale of electromagnetic waves. Properties of electromagnetic radiation of different ranges. **Optics.** The directness of the propagation of light in a homogeneous environment. Laws of light reflection. Building images that a flat mirror gives. Laws of refraction of light. Absolute and relative refractive indexes. Complete reflection. Lens. Optical force of the lens. The formula of a thin lens. Building images that a thin lens gives. Interference of light and its practical application. Diffraction of light. Diffraction grids and their use to determine the length of a light wave. Dispersion of light. Continuous and line spectra. Spectral analysis. Polarization of light.	alternating current, acting voltage values and current strength, active, inductive and capacitive support, AC operation and power, resonance, auto-chipping, auto-cooling system, period (frequency) of free electromagnetic oscillations in the electrical circuit, electrical resonance, alternating electric current, transformation coefficient, electromagnetic waves, optical force and focus of lenses, refractive index; complete reflection, sources of coherent radiation, interference, diffraction, dispersion, polarization of light. **Idealized models:** mathematical (filamentous) pendulum, ideal oscallational contour. **Laws, principles: equations** of non-fading harmonic oscillations, the law of straightforward propagation of light in a homogeneous environment, the independence of propagation, light beams, the laws of reflection and refraction of waves, the conditions for the emergence of interference, maximum and minimum; huygens principle, Doppler principle. **Theory:** The basis of the theory of the electromagnetic field. **Practical application of theoretical material:** transmission of electrical energy over a distance, transmission of information by electromagnetic waves, radar, use of electromagnetic radiation of different ranges, application of interference phenomena, diffraction and polarization of light, use of line spectra, spectral analysis; principle of operation of measuring instruments and technical devices: generator on transistor, alternating current generator, transformer, the simplest radio, glasses, camera, projection apparatus, magnifying glass, microscope, light drive, spectroscope.	• distinguish between: transverse and longitudinal waves, radiation of different ranges; • solve: 1) settlement tasks, applying functional dependencies between the main physical quantities, on: dependence of the period of own fluctuations on the parameters of the system; the law of conservation of energy in the oscular process; harmonic vibrations, wavelength; laws of geometric optics, fine lens formula; interference and diffraction of light; transformer; 2) tasks for analyzing the graphs of non-fading (harmonic) and fading vibrations, dependence of the amplitude of forced oscillations on the frequency of external periodic force, the image of the course of light rays on the border 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 patterns of different sections of physics are used; 4) tasks that involve processing and analyzing the results of the experiment, depicted in the photo or scematic figure; • make a plan for performing experiments and experiments, working with measuring instruments and devices (in particular, a body on a thread), a generator on a transistor, a transformer, light sources, a flat mirror, a lens, a transparent flat-parallel plate, diffraction grids.

QUANTUM PHYSICS. ELEMENTS OF RELATIVITY		
Elements of relativity. Einstein's theory of relativism: Relativistic law of addition of velours. **Light quanta.** Planck's hypothesis. Photo effect and experimentally established its laws. Einstein's equation for the photoelectric effect. The use of photoelectric effect in technology. Pressure of light. **The atom and the atomic nucleus.** Rutherford's experiment. Nuclear model of the atom. Quantum postulates bohr. Radiation and light absorption atom. The composition of the nucleus of the atom. Isotopes. The energy of the bond of atomic nuclei. Nuclear reactions. Separation of uranium nuclei. Nuclear reactor. Thermonuclear reaction. Radioactivity. Alpha, beta, gamma radiation. Methods of registration of ionizing radiation.	Know, explain and practically apply: **Phenomena and processes:** the movement of elementary particles in accelerators, the discovery of spectral lines, radioactivity, isotopes, the loss of negative charge by metals when irradiated by light, the dependence of the energy of photoelectrons on the frequency of light and independence from its intensity, the diffraction of photons and electrons. **Fundamental experiments:** A. Stoletov; P. Lebedev; E. Rutherford; A. Becquerel. **Basic concepts:** quanta of light (photons), photo effect, the red limit of the photoelectric effect, the pressure of light, isotopes, radioactivity, alpha and beta particles, gamma radiation, the quantum nature of radiation and the absorption of light by atoms, induced radiation, proton, neutron, nuclear forces, radioactive decay, half-time; energy of communication of atomic nuclei, mass defect, energy output of nuclear reactions, chain nuclear reaction, critical mass. **Idealized models:** planetary model of the atom, proton-neutron model of the nucleus. **Laws, principles, hypotheses:** postulates of relativity, the law of connection between mass and energy, the laws of the photoelectric effect, Einstein's equation for the photoelectric effect, the quantum tenacities of Bohr, the preservation of the number of nucleons and charge in nuclear reactions, the law of radioactive decay, the Planck hypothesis. **Theories: basics** of special relativity, photoelectric theory, corpuscular-wave dualism, theory of the structure of the atom and nucleus.	- to recognize the manifestations of quantum phenomena and processes in nature and their practical application in technology, in particular facts confirming the conclusions of the special theory of relativity; phenomena confirming the corpuscular-wave dualism of the properties of light; the use of photoelectric effect laws in technology, methods of observation and registration of microparticles; apply the basic concepts and laws of special relativity, photoelectric theory, theory of the structure of the atom and nucleus, 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 magnetic fields; formation of different types of spectra, general features of processes occurring during radioactive decay of nuclei, the conditions for the occurrence of chain and thermonuclear reactions; nature of alpha, beta, gamma radiation; - make generalizations about the properties of the substance and the field, solve: 1) calculated tasks, applying functional dependencies between the main physical quantities, on: relativistic law of adding speeds, application of formulas of connection between mass, momentum and energy; application of Bohr's quantum postulates to the processes of radiation and energy absorption of an atom; application of Einstein's equation for photoelectric effect, compilation of equations of nuclear reactions on the basis of conservation laws; calculation of defect in mass, energy of communication of

	Practical application of theoretical material: the use of a photoelectric effect, the structure and properties of atomic nuclei, explanation of line spectra of radiation and absorption, the use of lasers, nuclear energy, the principle of operation of measuring instruments and technical devices: photocell, devices for recording charged particles, laser, nuclear reactor.	atomic nuclei, energy output 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 period of half-fall; 2) tasks for analyzing graphs of changes in the number of radioactive nuclei over time, schemes of energy levels to explain the absorption and radiation of light; 3) combined problems, for the solution of which the concepts and patterns of different sections of physics are used; 4) tasks involving the processing and analysis of the results of the experiment, depicted in the photo or scematic figure, in particular, to determine the characteristics of elementary particles or nuclei by photographs of their tracks (in particular in the magnetic field); - make a plan for the implementation of experiments and experiments, work with measuring instruments and devices, in particular a photocell.

THE STRUCTURE AND CONTENT OF THE INTERVIEW
Evaluation criteria

During the interview, the applicant answers three questions. Individual questions can be replaced by tasks. An interview is considered to have been completed if he has provided the correct answers to two of the three questions.

The assessment is "credited" when the applicant discovers the correct understanding of the physical content of the phenomena and laws, laws and theories under consideration, gives definition and interpretation of basic concepts, laws and theories, as well as the correct determination of physical quantities, units and methods of their measurement.

The assessment "not counted" is placed when the applicant does not have the basic knowledge and skills in accordance with the requirements of the program.

LIST OF RECOMMENDED SOURCES

1. EIT tests online in physics. ULR: https://zno.osvita.ua/physics/
2. Shavings N. Physics. Comprehensive preparation for external independent evaluation 2022 / N.Strug, V.Matsyuk, S.Ostapyuk. Ternopil: Textbooks and manuals, 2021. 496 cc.
3. Physics: Improvised. for 9 cl. general education. teach. zack. / [V. G. Baryatar, S. O. Dovgiy, F. Y. Bozhinova, O. O. Kiryukhina] ; for ed. V.G. Baryatshara, S.O. Dovgiy. — Kharkiv: "Morning", 2017. — 272 p. : ill., photo.
4. Physics (standard level, according to the curriculum of the author's team under the leadership of Loktev V.M.) : subpruged. for 10 cl. zack. in general. among. education / [V.G. Baryatar, S.O. Dov guy, F.Y. Bozhinova, O.O. Kiryukhina] ; for ed. V.G. Baryatshara, S.O. Dovgiy. — Kharkiv: "Morning", 2018. — 272 p. : ill.
5. Physics (standard level, according to the curriculum of the author's team under the leadership of Loktev V.M.) : subpruged. for 11 cl. zack. in general. among. education / [Baryatar V.G., Dov gyy S. O., Bozhinova F. Ya., Kiryukhina O. O.] ; for ed. Baryatara V.G., Dovgiy S.O. — Kharkiv: "Ranok" view, 2019. — 272 p. : ill., phot.
6. Physics and astronomy (standard level, according to the curriculum of the author's team under the guidance of Lyashenko O.I.): improvised. for 11 cl. institutions of general secondary education / T. M. Zasekin, D. O. Zasekin. — K.: UOC "Orion", 2019. — 272 p. : ill.
7. Physics and astronomy (standard level, according to the curriculum of the author's team under the guidance of O.I. Lyashenko) textbook for the 11th grade of general secondary education institutions/ aut. M.V. Golovko, I.P. Kryachko, Y.S. Melnyk, L.V. Neporozhnya, V.V. Sipiy — Kyiv: Pedagogical thought, 2019. — 288 p.: ill.
8. Syrotiuk V.D. Physics and astronomy (standard level, according to the teaching program of aut. col. under the leadership of Lyashenko O.I.) : subprug. for the 11th cl. zack. Zag. among. Education / Volodymyr Syrotyuk, Yuriy Myroshnichenko. — Kyiv: Genesise, 2019. — 368 p. : ill.
9. Physics (standard level, according to the curriculum of the author's team under the leadership of Lyashenko O.I.) textbook for the 10th grade of general secondary education institutions / Golovko M.V., Melnyk Y.S., Neporozhnya L.V., Sipiy V.V. — Kyiv: Pedagogical thought, 2018. - 256 p.

10. Zasekina T. M. Physics (standard level): improvised. for 10 cl. institutions of general secondary education / T. M. Zasekin, D. O. Zasekin. — K.: UOC "Orion", 2018. — 208 p. : ill.
11. Syrotiuk V.D. Physics (standard level, according to the teaching program of the team under the leadership of Lyashenko O.I.) : subprug. for the 10th cl. zack. Zag. among. education / V.D. Syrotyuk. — Kyiv: Genesise, 2018. — 256 p. : ill.
12. Zasekina T. M. Physics: improvised. for 9 cl. general education. teach. institutions / T. M. Zasekina, D. O. Zasekin. — K.: UOC "Orion", 2017. — 272 p. : ill.