

**Specification of the test on Physics for
Unified National Testing and Complex Testing**

(Approved for use in the Unified National Testing and Complex Testing from 2018)

The document was developed in accordance with the State Educational Standards of secondary education and with educational programs in general subjects

1. Test development purpose: Determination of preparedness level of entrants for Physics to admit to higher educational institutions of the Republic of Kazakhstan.

2. Test content: The test consists of 30 test items. There are 3 difficulty levels, which are as follows: 15 the first level, 8 - second level, 7 - third level.

The test includes educational material of Physics in accordance with the curriculum for the general education school.

№	Chapter	№	Topic	№	Subtopic
01	Mechanics	01	Kinematics	01	Mechanical motion. Material point. Distance and displacement.
				02	Reference frame. Relativity of motion. Addition of velocities.
				03	Motion in one dimension with constant speed. Speed. Average speed.
				04	Motion with constant acceleration. Acceleration. Displacement in accelerated motion
				05	Showing motion with graphics.
				06	Free fall. Gravitational acceleration.
				07	Uniform Circular motion. Centripetal acceleration.
		02	Fundamentals of dynamics	01	Mass. Inertia. Density. Newton's laws.
				02	Types of forces (spring force, frictional force).
				03	Weight. Universal law of gravity.
				04	Weight and weightlessness.
				05	Free falling object. Projectile motion. Escape speeds.
		03	Work. Power. Energy	01	Work done by constant force. Power.
				02	Kinetic energy. Work.
				03	Gravitational potential energy. Work done by weight.
				04	Elastic potential energy. Work done by spring force.
		04	Conservation laws	01	Momentum. Impulse. Conservation of the momentum.
				02	Conservation of the mechanical energy.
				03	Simple machines. Condition for equilibrium of the lever. Torque. Efficiency.
				05	Mechanical oscillations
02	Velocity and acceleration in harmonic				

					motion
				03	Simple pendulum and oscillated spring
				04	Conversion of mechanical energy. Resonance.
				05	Wavelength. Speed of the wave.
				06	Sound wave (speed, pitch, loudness).
		06	Pressure	01	Pressure. Hydrostatic pressure. Atmospheric pressure. Pascal's law.
				02	Upthrust force.
02	Molecular physics. Fundamentals of Thermodynamics	01	Fundamentals of the molecular-kinetic theory	01	Fundamentals of the molecular-kinetic theory and its experimental proof. Brownian motion.
				02	Amount of substance. Molar mass. Mass of molecules. Speed of the molecules.
				03	Ideal gas. Temperature. Ideal gas equation. Main equation of MKT.
				04	Isoprocesses of gases.
		02	Fundamentals of Thermodynamics	01	Internal energy. Change of the internal energy.
				02	Work in thermodynamics. Change of the internal energy of monoatomic gas. I and II laws of thermodynamics.
				03	Heat. Phase change. Vaporization, condensation, boiling, melting, crystallization. Thermal balance.
				04	Relative humidity of air. Saturated and unsaturated vapor
				05	Properties of the rigid body. Deformation. Hooke's law.
				06	Heat Engine and efficiency
03	Electrodynamics	01	Electrostatics	01	Electric charge. Conservation of charge.
				02	Coulomb's Law
				03	Electric field
				04	Electric potential and potential difference. Electric potential energy and work
				05	Conductors and dielectrics in electric field
				06	Capacitance and capacitor. Combination of capacitors
				07	Energy of capacitor
		02	DC current	01	Electric current. Voltage. Resistance. Ohm's Law.
				02	Parallel and series combination of resistors. Measurement of current and voltage.
				03	Electric power and energy. Joule-Lentz law.
				04	Electromotive force. Ohm's Law for whole circuit
		03	Electric current	01	Electric current in metals

			in various media	02	Electric current in electrolyses
				03	Electric current in Semiconductors.
				04	Electric current in gases, vacuum.
		04	Magnetic field	01	Magnetic field. Induction of magnetic field
				02	Ampere's force
				03	Lorentz force
				04	Magnetic properties of the materials
		05	Electromagnetic field	01	Electromagnetic induction. Faraday's Law of Induction. Magnetic flux. Lenz's Law.
				02	Self Inductance. Energy of magnetic field
		06	Electromagnetic oscillations	01	Oscillated circuit. Period of electromagnetic oscillation . Conversion of energy in electromagnetic oscillation.
				02	Alternating current. Active, inductive and capacitance resistance in AC circuit.
		07	Electromagnetic waves	01	Electromagnetic wave. Properties electromagnetic wave. Scales of electromagnetic wave
				02	Principals of radio connection. Open oscillated circuit. Radiolocation
04	Optics	01	Properties of light	01	Light. Speed of light. Propagation of light.
				02	Reflection and refraction of light. Plane mirror
				03	Properties of light waves (interference, diffraction, dispersion, polarization).
		02	Geometrical optics	01	Lenses. Optical force of lens. Formula for thin lens. Image formation in lens
				02	Optical system (eye). Optical instruments
05	Quantum and atomic physics	01	Elements of relativity theory	01	Elements of relativity theory.
		02	Fundamentals of quantum theory of light	01	Quantum properties of light. Planck' s theory
				02	The photoelectric effect. Application of photoelectric effect
				03	Photons
		03	Atom and nucleus	01	Structure of the atom. Experiments of the Rutherford. Bohr's Postulates
				02	Radioactivity. Types of radiation (alpha, beta, gamma). Natural Radioactivity
				03	Nucleus. Isotopes. Nuclear binding energy.
				04	Nuclear reactions . Nuclear Fission. Chain reactions . Nuclear reactor . Therminuclear reactions
		04	Elementary particles	01	Elementary particles.
06	Qualitative	01	Qualitative	01	Exercises for application

	physics problems		physics problems	02	Exercises for analyze
				03	Exercises for synthesis

3. Characteristics of the content of test items:

Entrants of the secondary school must know:

- 1) Theory (classic mechanics, molecular-kinetic theory, electrodynamics, elements of quantum physics);
- 2) Concepts (model, forecast, rule, postulate, law, theory, mechanical and electromagnetic oscillations, electromagnetic field, electromagnetic waves, atom, quantum, photon, atomic nucleus, radioactive, planet, star, galaxy, world).
- 3) Physical quantities (displacement, kinetic energy of particles, speed, acceleration, mass, force, pressure, impulse, work, power, mechanical energy, internal energy, absolute temperature, heat, period, frequency, oscillation amplitude, wavelength, electric current, voltage, magnetic flux, inductive, magnetic field, electromagnetic field, electromagnetic radiation, electromagnetic radiation, energy, binding energy, half life);
- 4) Laws, principles and postulates (concept, boundary);
- 5) The ability of apply knowledge of physics in kinematics, dynamic motion, electrodynamics and quantum physics to solve problematic situations in everyday life;
- 6) Describes and explains the observations and experimental results.

4. Forms of test items:

The test consists of 20 test items with the choice of one correct answer from 5 proposed and 10 test items with one or more correct answers from multiple choices.

5. Assessment of the test item and the whole test:

The correctly done test item with the choice of one correct answer is given one point, incorrectly done no (zero) points.

In the test items with one or more correct answers (up to three correct answers):

if there is only one correct answer and if a test-taker chooses the correct answer, he/she gets two points;

if there is only one correct answer and if a test-taker chooses the correct answer and one incorrect answer, he/she gets one point;

if there is only one correct answer and if a test-taker chooses two or more incorrect answers, he/she gets no (zero) points;

if there are two correct answers and if a test-taker chooses two correct answers, he/she gets two points;

if there are two correct answers and if a test-taker chooses one correct answer, he / she gets one point;

if there are two correct answers and if a test-taker chooses one correct and one incorrect answer, he/she gets one point;

if there are two correct answers and if a test-taker chooses both correct answers and one incorrect answer, he/she gets one point;

if there are two correct answers and if a test-taker chooses two or more incorrect answers, he/she gets no (zero) points;

if there are three correct answers and if a test-taker chooses all three correct answers, he/she gets two points;

if there are three correct answers and if a test-taker chooses two correct answers, he/she gets one point;

if there are three correct answers and if a test-taker chooses two correct answers and one incorrect answer, he/she gets one point;

if there are three correct answers and if a test-taker chooses three correct answers and one incorrect answer, he/she gets one point;

if there are three correct answers and if a test-taker chooses one correct answer or two and more incorrect answers, he/she gets no (zero) points;

If a test-taker answers the whole test correctly, he / she gets 40 points.