Variant 1

1. Deformation: types, physical characteristics.
2. Nature of alpha-radiation. Effects of alpha particles on the human body. Protection from alpha-radiation.
3. Light polarization. Optically active substances.
4. Calculate Young's modulus (E) for bone: l_o = 31.5 cm, F = 12 N, Δl = 0.28 mm, S = 2.5 cm^2.

Variant 2

1. Mechanical stress. The general patterns of dependence between deformation and mechanical stress. Hooke's law.
2. Optical activity. Polarimetry.
3. Action of radiation on living tissue.
4. Calculate the mechanical tension that arises in the bone when F = 12 N and cross-sectional area S = 2.5 cm^2.

Variant 3

1. Features of the mechanical properties of biological tissues.
2. Polarization of light. Malus law.
3. Absorbed dose of radiation. Unit of measurement.
4. Calculate the relative blood viscosity if Hess viscometer shows: l_{water} = 100 mm, l_{blood} = 68 mm.

Variant 4

1. Oscillatory processes and their physical characteristics. Oscillating processes in biological systems.
2. Direct current, its characteristics. Ohm's law (general).
3. Types of radiation.
4. Calculate the wavelength (λ) of ultraviolet radiation with frequency = $1.2 \cdot 10^{15}$ Hz.

Variant 5

1. Free harmonic oscillations: graph, equation.
2. Light, its physical nature. The interaction of light with matter.
3. Nature of alpha-radiation. Protection from it.
4. Which volume level corresponds to the sound intensity of 10^{-7} W/m^2? (1 kHz frequency).

Variant 6

1. Damped oscillations: decrement, graph.
2. The total magnification. Resolution of the human eye.
3. Types of transport of substances through biological membranes.
4. Calculate the volume of blood for the patient with mass 10 kg, 70 kg and 100 kg.

Variant 7

1. Laminar and turbulent flow. Reynolds number.
2. The principle of the gas discharge counter. Radiometry.
3. The therapeutic effect of thermal radiation on the human body.
4. After passing through the barrier sound intensity decreased in 1000. How much the volume decreased if the sound frequency is 1 kHz?

Variant 8

1. The interaction of X-ray radiation with biological tissues. Radiotherapy.
2. The electrical conductivity of biological tissues. Electrokinetic phenomena in biological systems.
3. The phenomenon of total internal reflection: the conditions of origin, technical implementation in the refractometers.
4. The maximum frequency of sound that the human ear can registered is 20 kHz. Find the wavelength (λ), which corresponds to this frequency, if the speed of sound in air is V = 340 m/s.

Variant 9

1. Radioactivity. Unit of measurement.
2. Electrocardiography. Basics of Einthoven theory.
3. The absorption of light. Bouguer-Lambert-Beer law.
4. What is the overall magnification of microscope if the lens magnification is 20^x and magnification of ocular is 15^x?

Variant 10

1. Radioactivity. The law of radioactive decay. The half-life.
2. Electrophoresis: a phenomenon, types, application in medical practice.
3. Biophysical mechanism of resting electrical potential in living cells.
4. 10% sugar solution C_1 turns the plane of polarization at $\varphi_1=30^0$. What will be the concentration of sugar in another C_2 solution if in the same circumstances plane of polarization is rotated at $\varphi_2=20^0$?

Variant 11

1. The mechanical properties of biological tissues (bone, skin, tissue of the tooth).
2. Nature of beta-radiation. The action of beta particles to living organisms. Protection from beta-radiation.
3. The phenomenon of reflection and refraction of light (laws).
4. Determine the concentration of sugar in the urine of diabetic patients using polarimeter. According to the measurement the angle of the plane polarization rotation is $\varphi=7^0$. Find the concentration of sugar, knowing that the tube length l = 20 cm, specific polarization angle $[\varphi_0]$=6,67 degree·cm^2/g.

Variant 12

1. Moistening. Measurements of the surface tension of the liquid.
2. The phenomenon of reflection and refraction of light. Application of optical devices in medical practice.
3. Basics of rheography.
4. Calculate the distance resolution Z of the optical microscope with wavelength λ = 555 nm (to which the human eye is most sensitive) if air is between the object and the lens. Aperture angle is $\boldsymbol{\theta} = 90^0$.

Variant 13

1. Capillary phenomena in biological systems. Surface-active substances of biological origin.
2. The phenomenon of total internal reflection. Application of effects in medical research methods of the human body.
3. Specific action of alternating electromagnetic field on the human body.
4. Calculate the distance resolution Z of the optical microscope for wavelength λ = 555 nm (to which the human eye is most sensitive) if between the object and the lens is Vaseline oil with a refractive index n = 1,503. Aperture angle of microscope is $\boldsymbol{\theta} = 90^0$.

Variant 14

1. Absorption of light. Bouguer-Lambert-Beer law. Concentration colorimetry.
2. The electric field, its physical characteristics.
3. The proteins in biological membranes and their role.
4. What is the value of a point (1 mm square) horizontally in seconds or milliseconds if the recording speed of the cardiograph is 50 mm/s, 25 mm/s?

Variant 15

1. The real fluid. Newton's formula for internal friction.
2. Solar radiation, its spectrum. Heliotherapy.
3. Exposure dose. Unit of measurement.
4. Cardiograph calibration impulse is 1 mV (10^{-3} V), which corresponds to 20 mm on a moving strip of cardiograph. Determine the amplitude of the R wave in the ECG in mV if its height is 24 mm.

Variant 16

1. Ideal liquid. Conditions of stream continuity.
2. Acoustic methods of clinical studies of the human body. Audiometry.
3. What is the difference between mechanical and electromagnetic waves?
4. Calculate the value of minute blood volume (MBV) in liters (l) if stroke volume (SV) is 70 ml and heart rate is 80 beats/min.

Variant 17

1. Real Newton fluid for internal friction. Newtonian and non-Newtonian fluids.
2. Mechanical stress. The general patterns of dependence between deformation and mechanical stress. Hooke's law.
3. What physical parameters can be determined by polarimetry? Draw the path of rays in a polarimeter.
4. Calculate bone deformation (Δl) at the force F = 12 N, if the initial bone length l_o = 31.5 cm, and Young's modulus for bone is 5.4 10^7 N/m2. Consider bone cross-sectional area as S = 2.5 cm^2.

Variant 18

1. Forced oscillations. Equation. Conditions. Resonance.
2. Resolution of the human eye. Microscopy.
3. Absorbed dose of radiation. Equivalent absorbed dose of radiation.
4. Calculate the average volumetric rate of blood in the aorta if SV = 70 ml and takes 0.9 s.

Variant 19

1. Wave process. Wave equation.
2. The magnetic field. Its physical properties.
3. The structure and main characteristics of the optical microscope.
4. Calculate the relative blood viscosity if Hess viscometer shows: l_{water} = 100 mm, l_{blood} = 68 mm.

Variant 20

1. The dependence of the velocity of sound waves from the properties of the medium. Wave processes in the human body
2. The influence of magnetic field on the matter. Paramagnetism. Diamagnetism. Ferromagnetism.
3. What is a calibration graph? Give examples of such graphs for colorimetry and refractometry.
4. Calculate the relative humidity in the house, if water vapor density ρ = 18 g/m^3, and the density of water vapor that saturates the air at the same temperature $\rho_{sat.}$ = 24 g/m^3.

Variant 21

1. Laminar and turbulent flow. Reynolds number.
2. Electrocardiography. Basics of Einthoven theory.
3. Formula for radioactive decay law, draw the graph for such phenomenon. Show half-life ($T_{1/2}$) of radioactive elements nuclei on this graph.

4. Calculate the electric field (E) on biological membrane 6 nm thickness if the membrane potential difference is 80 mV.

Variant 22

1. Surface tension, surface-active substances.
2. Dispersion of electrical conductivity of biological tissues. Basics of rheography.
3. Ultrasound. Its physical properties, application.
4. Calculate the volume of blood for the patient with weight 10 kg, 70 kg and 100 kg.

Variant 23

1. The effect of direct electric field on biological tissues. Polarization.
2. Absorption of light. Bouguer-Lambert-Beer law. Concentration colorimetry.
3. Thermal radiation. What is the main thesis of Kirchhoff's law for blackbody radiation?
4. After passing through the barrier sound intensity decreased in 1000. How much the volume decreased if the sound frequency is 1 kHz?

Variant 24

1. X-rays radiation: braking and characteristic.
2. Effects of magnetic field on living organisms. Therapeutic constant magnetic field methods.
3. The structure and the main characteristics of the optical microscope.
4. The maximum frequency of sound that the human ear can registered is 20 kHz. Find the wavelength (λ), which corresponds to this frequency, if the speed of sound in air is V = 340 m/s.

Variant 25

1. Block diagram of X-ray apparatus. The X-ray tube.
2. Absorption of light. Bouguer-Lambert-Beer law. Concentration colorimetry.
3. The formula for the impedance of the circuit elements for alternating electric current. Explain the meaning of physical parameters that are included in this formula.
4. What is the overall magnification of microscope if the lens magnification is 20^x and magnification of ocular is 15^x?

Variant 26

1. Features of effects of ionizing radiation on the human body.
2. Modern conceptions about the structure and function of biological membranes.
3. What a surface-active substance is? What physical characteristics will change if you add a surface-active substance to the liquid?

4. 10% sugar solution C_1 turns the plane of polarization at $\varphi_1=30^0$. What will be the concentration of sugar in another C_2 solution if in the same circumstances plane of polarization is rotated at $\varphi_2=20^0$?

Variant 27

1. Absorbed dose of radiation. Unit of measurement.
2. The action of alternating electric current to biological tissue. The impedance of biological tissues.
3. Main characteristics and features of visible light.
4. Determine the concentration of sugar in the urine of diabetic patients using polarimeter. According to the measurement the angle of the plane polarization rotation is $\varphi=7^0$. Find the concentration of sugar, knowing that the tube length l = 20 cm, specific polarization angle $[\varphi_0]$=6,67 degree·cm^2/g.

Variant 28

1. Dispersion of electrical conductivity of biological tissues. Basics of rheography.
2. The path of rays in the optical system. The human eye.
3. Viscosity. The Newton's formula for viscosity. Methods for viscosity determination.
4. Calculate the distance resolution Z of the optical microscope with wavelength λ = 555 nm (to which the human eye is most sensitive) if air is between the object and the lens. Aperture angle is $\boldsymbol{\theta} = 90^0$.

Variant 29

1. Exposure dose units. The biological equivalent dose units.
2. The electromagnetic field. Scale of electromagnetic waves.
3. The phenomenon of total internal reflection. Application of of this phenomenon in medicine
4. Calculate the distance resolution Z of the optical microscope for wavelength λ = 555 nm (to which the human eye is most sensitive) if between the object and the lens is Vaseline oil with a refractive index n = 1,503. Aperture angle of microscope is $\boldsymbol{\theta} = 90^0$.

Variant 30

1. Poiseuille's formula. Hemodynamic resistance.
2. Effects of direct electric field on biological tissues. Electrophoresis: a phenomenon, types and application in medical practice.
3. Nature of gamma-radiation. The action of gamma-radiation on living organisms. Protection from gamma rays.
4. What is the value of a point (1 mm square) horizontally in seconds or milliseconds if the recording speed of the cardiograph is 50 mm/s, 25 mm/s?