

List of requirements for the exam

Structure of matter: Fundamental particles and forces; Wave properties of particles, quantum properties of waves; Quantum numbers; Emission, ionization and excitation; Structure of electron shells in atoms; Atomic nucleus; Binding energy in atomic nucleus; Physical principles of mass spectroscopy; Physical principles of nuclear magnetic resonance.

Molecular biophysics: Phase states of matter; State equation of ideal gas; Maxwell-Boltzmann distribution; Equipartition theorem; Bernoulli equation, equation of continuity; Law of Laplace; Gibbs's phase rule, phase diagram of water; Water as solvent; Dispersion systems and their classification; Properties of colloids; Dialysis; Principle of electrophoresis, electrokinetic potential; Viscosity and its measurement; Diffusion, 1st law of Fick; Surface tension, adsorption; Colligative properties of solutions; Osmotic pressure; Blood pressure measurement; Fluid exchange in capillaries.

Thermodynamics: Thermodynamic system, state quantities; p-V diagram and mechanical work; First law of thermodynamics; Second law of thermodynamics; Entropy; Definitions of thermodynamic potential functions (U, H, F, G); Chemical potential; Thermoregulation in organisms; Measurement of temperature; Calorimetric measurements; Specific heat, latent heat.

Physical and physiological acoustics: Physical properties of acoustic waves; Acoustic impedance; Doppler's effect; Sound intensity and loudness, units; Field of hearing; Weber-Fechner's law in acoustics; Biophysics of hearing, the organ of Corti; Cochlear implants; Audiometry, presbycusis; Ultrasound generators; Physical principles of the diagnostic use of ultrasound.

Optics: General classification of electromagnetic waves; Planck's law, Stefan-Boltzmann and Wien laws; Lens equation; Extinction, Lambert-Beer law; Scattering of light; Dispersion of light; Refraction and its use in spectroscopy; Interference and light reflection; Refractometry, Polarimetry; Biophysics of vision; Eye defects; Absorption spectral analysis; Optical properties of colloids; Principle of laser; Optical and electron microscopy.

Bioelectric phenomena: Coulomb's law, permittivity; Intensity of electric field, Electric current, voltage, resistance, impedance and their measurement, units; Electrochemical potential; Measurement of el. conductivity in solutions; Ion channels, Nernst reversal potential; Rest membrane potential; Action potential in neurons; Action potentials of heart muscle and their detection; Effects of electric current on the organism; Use of electricity in diagnostics, rheobase, chronaxie.

X-rays: Production of X-rays, energy spectra; Control of the energy and intensity of X-rays; X-ray apparatus; X-ray absorption; X-ray contrast; Use of X-rays for diagnostic purposes; X-ray therapy; Depth dose; Principle of Computed Tomography.

Radioactivity and ionising radiation: Radioactive decay; α , β and γ radiation; Radioactive equilibrium; Physical, biological and effective half-life; Absorption of γ radiation; Absorption of α and β radiation; Selective and integral detection of γ radiation; Detectors of ionising radiation; Scintillation detector; Geiger-Muller tube; Accelerators of particles; Ionisation chamber; Methods of personal dosimetry; Units of exposition and absorbed dose of irradiation; Positron emission tomography.