

QUESTIONS OF COLLOQUIUM No.2

«MEDICAL AND BIOLOGICAL PHYSICS»

Anglophone Students of the 1 Course

Specialty «GENERAL MEDICINE»

2 term of 2025/2025

1. Absorption of light by a matter. Bouguer's Law. Absorption of light by solutions. Absorption cross-section. Bouguer-Lambert-Beer Law.
2. Transmittance coefficient. Optical Density. Absorption spectrum. Concentration colorimetry.
3. Light scattering. Tyndall and Rayleigh scattering. Application of the scattering phenomenon in Biology and Medicine: turbidimetry, nephelometry, flow cytometry.
4. Structure of the eye. Structure of the retina Light-conducting and light-sensing apparatus of the eye. Accommodation. Distance of the best vision.
5. Near point of the eye. Reduced eye. Resolving power of the eye, visual acuity. Defects of vision and modes of their correction by lenses.
6. Thermal radiation and its quantitative characteristics. Absorption coefficient. Black, white and grey bodies.
7. Laws of thermal radiation. Features of thermal radiation of the human body. Thermography.
8. Spontaneous and stimulated emission. Principles of laser operation. Laser classification: by type of gain (active) medium; by intensity of laser radiation; by hazard class; by field of application in medicine.
9. Characteristics of laser radiation. Interaction of laser radiation with biological tissues. Application of lasers in medicine. Safety measures when working with the laser.
10. Radioactivity: natural and artificial. Law of Radioactive decay. Half-life time and its relationship with the Decay Constant. Activity.
11. Types of radioactive decay. Types of ionizing radiation. Application of radioisotopes and ionizing radiation for medical diagnosis and treatment. Nuclear Medicine.
12. X-radiation. X-ray tube device. Braking (Bremsstrahlung) and Characteristic X-ray radiation.
13. Interaction of X-ray radiation with a matter: coherent scattering, incoherent scattering, photoelectric effect. Application of Roentgen radiation in Medicine.
14. Interaction of ionizing radiation with a matter. Linear Ionization Density (Specific Ionization), Linear Stopping Power, Path Range.
15. Elements of Dosimetry. Absorbed and Exposure Doses. Dose Rate, relationship between the Exposure Dose Rate and Activity of radioactive substance.
16. Equivalent dose. Relative Biological Effectiveness (RBE). Effective Equivalent Dose. Coefficient of Radiation Hazard.
17. Types of ionizing radiation detectors: trace and integral detectors, counters. Dosimetry devices. Protection against ionizing radiation. Maximum permissible doses. Natural background radiation.
18. *Luminescence. Luminescence kinds. Photoluminescence: fluorescence and phosphorescence; Kasha's rule and Stokes law. Quantum yield of luminescence. Luminescent methods of analysis in Biology and Medicine.*
19. *Photobiological processes: definition, their types and stages. Quantum yield of photochemical reaction. Effective cross-section of the molecule for photochemical transformation. Absorption spectra. Action spectra. Photomedicine. Phototherapy.*
20. *Magnetic resonance imaging. Nuclear magnetic moment. Resonance conditions. Radiofrequency excitation. Free induction signal decay and spin-echo, stimulated echo. Spin-lattice and spin-spin relaxation. T₁, T₂, T₂^{*} times. Saturation phenomenon. (N)MRS spectroscopy. Imaging with NMR. Main components of a whole-body MRI imaging system.*