Biophysics semifinal exam, topic list for the starting of talk 2023/24 I. semester (Pharmacy)(EP)

1. The basis of geometrical optics. What phenomena can be explained by it?
2. Image formation and resolution limit of the light microscope, Abbe’s principle.
3. Basis of wave optics. What phenomena can be explained by it?
4. How can you apply the wave-particle duality for light?
5. What quantities and laws can be used to describe radiations?
6. Thermal radiation, laws, principles, spectra in different representations.
7. Luminescence, discrimination of its types, practical applications, spectra.
8. Light scattering and absorption: macro- and microscopic laws. Interaction of light and matter.
9. Light amplification, properties and generation of laser radiation.
10. Production of X-ray radiation, comparison of bremsstrahlung and characteristic radiation by spectra and generation.
11. Radioactive decay types, interactions of nuclear radiations with matter.
12. Radioactive decay law. Properties and applications of radioactive isotopes.
13. Absorption of X-ray and γ-radiation, interaction of high energy photons with matter.
14. Summary of the important experiments about the atomic structure.
15. Summary of the Thomson-, Rutherford-, Bohr atomic models with their critiques.
16. Basis of quantum physics, state function. Bound and free states of the electron.
17. Interpretation of bounds and interactions between atoms.
18. Laws for the description of gases, macro- and microscopic approach. Real and ideal gases.
19. The Boltzmann-distribution and its applications.
20. Fluids. Physical properties of water and their explanation, surface tension.
21. Structure and properties of liquid crystals, applications.
22. Spatial and energetic structure of crystalline materials. relation to optical and electric properties.
23. Defects in crystals, effects of doping.

Practice

1. Absorption of gamma radiation, basis of radiation protection.
2. Analysis of the amplifier, signal processing.
3. Basis of nuclear measurement techniques.
4. Concentration determination with the refractometer.
5. Dosimetry, dose, doserate measuring devices.
6. Force measurement with a spring/cantilever; resonance.
7. Image formation lens, mirrors, microscope.
8. Light absorption and its laboratory applications.
9. Light emission and its laboratory applications
10. Material identification and concentration determination by polarimetry.
11. Optics of the eye, image formation in the eye.
12. Special microscopy methods.