# For General Medicine

# Topic of section: Ionizing radiations

# Topics of seminar: X-rays

**Answer the questions:**

1. Describe mechanism of the bremsstrahlung X-rays appearance. Explain the nature of its continuous spectrum. Write down the formula for the minimum wavelength.
2. Explaine the principles X-rays tube. Describe methods of control of the intensity and the hardness of radiation in the X-rays tube. Write the formula for bremsstrahlung X-rays radiant flux.
3. Compare the thermal radiation spectrum and the X-rays one. Explain their similarity and differences.
4. Describe the differences between the formation mechanisms of the optical spectrum and characteristic X-rays one.
5. Describe mechanisms of the interaction between X-rays and matter. Explain the higher harmfulness for an organism of the hard X-rays in compare with the soft one.
6. Write exponential law for X-rays attenuation in matter. Specify the linear attenuation coefficient. Describe its relation with the half-value layer.
7. Compare the physical principles of ultrasound diagnostics and X-rays one.

**Solve problems:**

1. In X-rays tube the voltage applied between anode and cathode is equal to 60 kV. Calculate the shortest wavelength of the X-rays.
   *Answer: 0.0205 nm*
2. Estimate the energy of electrons suddenly decelerated upon collision with the anode in X-rays tube. Minimum wavelength of X-rays continuous spectrum is equal to 0.01 nm.

*Answer: 123 eV*

3. The half-value layer of a monochromatic X-rays is equal to 10 mm. Determine a linear attenuation coefficient of the material.
   *Answer: 0.069 $mm^{-1}$*
4. Which radiation is harder: the shortest X-rays (a voltage on X-rays tube is 150 kV) or γ-radiation (the energy is 0,074 MeV)?
   *Answer: the X-rays is more hard*

**Literature**

1. Medical and biological physics for medical students, pp. 221-228.