TEACHING THE SUBJECT OF "IONIZING RADIATION" IN THE MODULE SYSTEM IN THE SYSTEM OF HIGHER EDUCATION METHODS

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ANNOTATION

This article consists of three main parts and a conclusion. This article is dedicated to methods of teaching the subject of ionizing radiations and their use in medicine, phenomenon of radioactivity at Samarkand State Medical Institute . The first part contains methodological instructions of the module system, and the second part contains practical lesson information. In the third part, the evaluation of students through the scores obtained from exposure and control tests in the module system, mutual question-answers, independent work and activity in the class is presented.

Key words: *X-rays, teaching in the module system, practical lesson, independent work, radioactivity.*

I. IN THE MODULE SYSTEM METHODOLOGICAL GUIDELINES

Information that the student must know about this topic:

1. Ionizing radiation.
2. X-ray tube structure and X-ray devices.
3. Distinguish between bremsstrahlung and characteristic X-rays.
4. Principles of computer tomography.
5. The mechanism of obtaining images in the computer tomography application.
6. Ionizing radiations and their effects on the human body.

a) The purpose of the lesson: according to the state educational standards, students should know the following. What is ionizing radiation and what kind of particle

flow is it made of? Knowledge of the nature of X-rays, radioactive radiations, g-rays, which are widely used in medicine, for treatment and diagnosis purposes. Information about x-ray devices, x-ray, x-ray, fluorography, x-ray computed tomography and mammography. Questions about the interaction of ionizing radiation with matter and dosimetry of radiation for students.

b) Orientation of students to the topic: Diagnosis in X-ray devices. Obtaining images of these organs and tissues in computer tomography, which is a modern diagnostic method. Learning to know the effects of ionizing radiation on living tissues. To give an understanding of the danger of radiation to a person's normal life, the biological effect of radiation depends on the type of ionizing radiation, the time of exposure, the affected surface, the power of radiation and the sensitivity of various organs, and the methods of protection against radiation dose in the area where people live.

c) Practical lesson plan:

1. Ionizing radiations.
2. X-rays.
3. The structure of the X-ray tube.
4. Bremsstrahlung and characteristic X-rays.
5. Use of X-rays in diagnosis
6. Use of X-rays for therapeutic purposes
7. Computer tomography

d) Plan for independent preparation of the student:

1. The discovery of X-rays.
2. The main properties of X-rays.
3. Interaction and absorption of X-rays with substances.
4. Coherent, incoherent (Compton effect) and photoeffect phenomena.
5. Types of ionizing radiation.
6. Effects of ionizing radiation on living tissues.
7. Radioactive decay.
8. Use of ionizing radiation in medicine.

II. PRACTICAL LESSON INFORMATION:

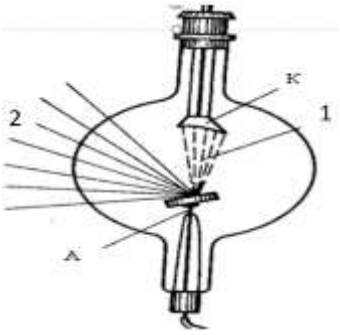

Figure 1. X-ray tube. 1-Electron flow. 2-X-ray beam. K-Cathode. A-Anode

X-ray radiation refers to electromagnetic waves with a wavelength of l≈80-10 $^{-5}$ nm . X-rays are generated in an X-ray tube (Figure 1). A bunch of thermoelectrons are separated from the heated cathode and get accelerated in the electric field between the cathode and the anode.

near-velocity electrons are braked in the electrostatic field of the atom of the anode element and braked X-rays are produced. Anode is made of heat-resistant metal. During electron braking, part of its energy goes to generate X-rays, and part to heat the anode element. The graph of the dependence of the wavelength of the generated X-rays on the voltage of the electrodes of the X-ray tube is shown in Fig. 2.

Here U $_0$ <U $_1$ <U $_2$ are the voltages between the electrodes.

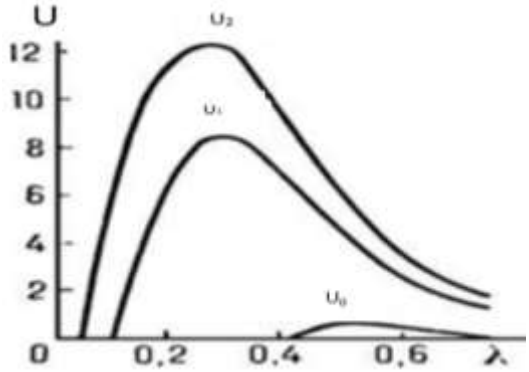

Figure 2. The voltage between the electrodes of the X-ray tube to the wavelength боғлиқлиги графиги

X-rays are detected by wavelength.

$$eU = h\nu_{max} = hc/\lambda_{min},\ \lambda_{min} = \frac{hc}{eU} \text{ or } \lambda_{min} = 12{,}3/U.$$

where h = $6.63 \cdot 10^{-34}$ j*s -Planck's constant, e=$1.6 \cdot 10^{-19}$Kl-electron charge , s ≈$3 \cdot 10^{8}$m/s speed of light.

Depending on the wavelength, X-rays γ are divided into soft X-rays - near ultraviolet rays and hard X-rays - near the field of radiation. X-ray flux

$$\Phi = \kappa I U^2 Z$$

is found by the formula Here I and U are the current and voltage between the electrodes of the X-ray tube, the proportionality coefficient k =10 $^{-9}$ B $^{-1}$ and the charge of the material of the anode element Z.

To generate high-energy electrons, the voltage between the electrodes of the X-ray tube is increased, and line spectra appear in the gross spectrum, which is called the characteristic X-ray radiation spectrum. characteristic X-rays are produced.

Processes that occur when X-rays interact with substances.

1. Coherent scattering.
2. Incoherent scattering-Compton effect

When X-rays interact with substances, their intensity decreases, that is, they are partially absorbed. The law of absorption: $\Phi = \Phi_0 e^{-\mu x}$is determined by the formula. Here m is the linear absorption coefficient and is equal to$\mu = \mu_к + \mu_{н.к} + \mu_ф$

$\mu_к$ - Absorption coefficient formed by Compton effect, - $\mu_{н.к}$ Absorption coefficient formed by incoherent scattering, $\mu_ф$- Absorption coefficient formed by photo effect.

The mass coefficient of absorption $\mu_м = \kappa\lambda^3 z^3$is found by the formula. Here is k-proportionality coefficient, λ-x-ray wavelength and Z-nuclear charge. Absorption of x-rays in bone ($Ca_3(PO_4)_2$) in lung tissue (H_2O in water) (Sa=20, R=15, Considering that O=8, N=1).

$$\frac{\mu_{м\ groove}}{\mu_{м\ young}} = \frac{3 * 20^3 + 2 * 15^3 + 8 + 8^3}{2 * 1^3 + 8^3} = 68$$

It is absorbed 68 times more in bone.

X-rays with an energy of 60-120 keV are used for diagnosis. Due to the different absorption of X-rays in organs of different density, it is possible to obtain a shadow projection of internal organs.

The following directions are used in X-ray diagnosis.

1. Roentgenoscopy
2. Radiography
3. Fluorography

4. Mammography
5. Computed X-ray tomography and management

Advantages of CT compared to ordinary X-ray examinations:

1. Extremely sensitive and accurate inspection.

2. CT makes it possible to obtain the speed of the organ and the pathological center only in the examined cross-section.

3. With the help of CT, it is possible to obtain accurate information about the size and density of individual organ tissues and pathological formations.

4. CT allows to obtain information not only about the pathology of the studied organ, but also about the relationship of the pathological process with the neighboring organs and tissues.

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