

Radiation Physics

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2nd Class**

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Lecture 5: Review

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Lecture 1

Atoms are composed of protons and neutrons in the nucleus, which is surrounded by electrons in shell configurations.

Describe the electron shell structure of an atom.

Explain the significance of electron and binding energy.

What is the energy equivalent to the mass of an electron?

Calculate the energy required for the transition of an electron from the K shell to the L shell in an atom (tungsten)

Lecture 2

Compare ionizing and ionizing radiation and give examples of each.

List at least five types of electromagnetic radiation.

Transitions of electrons from outer shells to inner shells result in the release of characteristic photons and/or auger electrons

Examples of electromagnetic radiation in order of increasing wavelength (decreasing frequency and energy) are x and γ rays, ultraviolet, visible, infrared, and radio waves.

Lecture 3

Intensity is energy per unit area per unit time.

Explain the terms inverse square law?

The cathode of an X-ray tube is generally a small coil of tungsten wire.

(a) Why is it a small coil?

(b) Why is the material tungsten?

How would the output of an X-ray tube operating at 80 kVp change if the tungsten anode ($Z = 74$) were replaced by a tin anode ($Z = 50$)?

Lecture 4

An X-ray tube output consists of a continuous spectrum determined by the operating kVp and, if the kVp is high enough, characteristic line spectra determined by the atomic number of the target material.

What is the physical meaning of this figure?

What is the source of electrons in an X-ray tube and how is the number of electrons controlled?

Discuss the factors that determine the shape of the x-ray spectrum

Explain the shape of the x-ray spectrum, and identify factors that influence it

What kinetic energy do electrons possess when they reach the target of an x-ray tube operated at 250 kVp? Calculate the minimum wavelength of x-ray photons generated at 250 kVp.

X-ray production efficiency is increased by

- Increased tube voltage
- Higher-Z target

How would the output of an X-ray tube operating at 80 kVp change if the tungsten anode ($Z = 74$) were replaced by a tin anode ($Z = 50$)?

Describe, with the aid of a diagram, the two physical processes that give rise to the production of X-rays from energetic electrons.