

CLASS 12 PHYSICS • CHAPTER 8.4.6

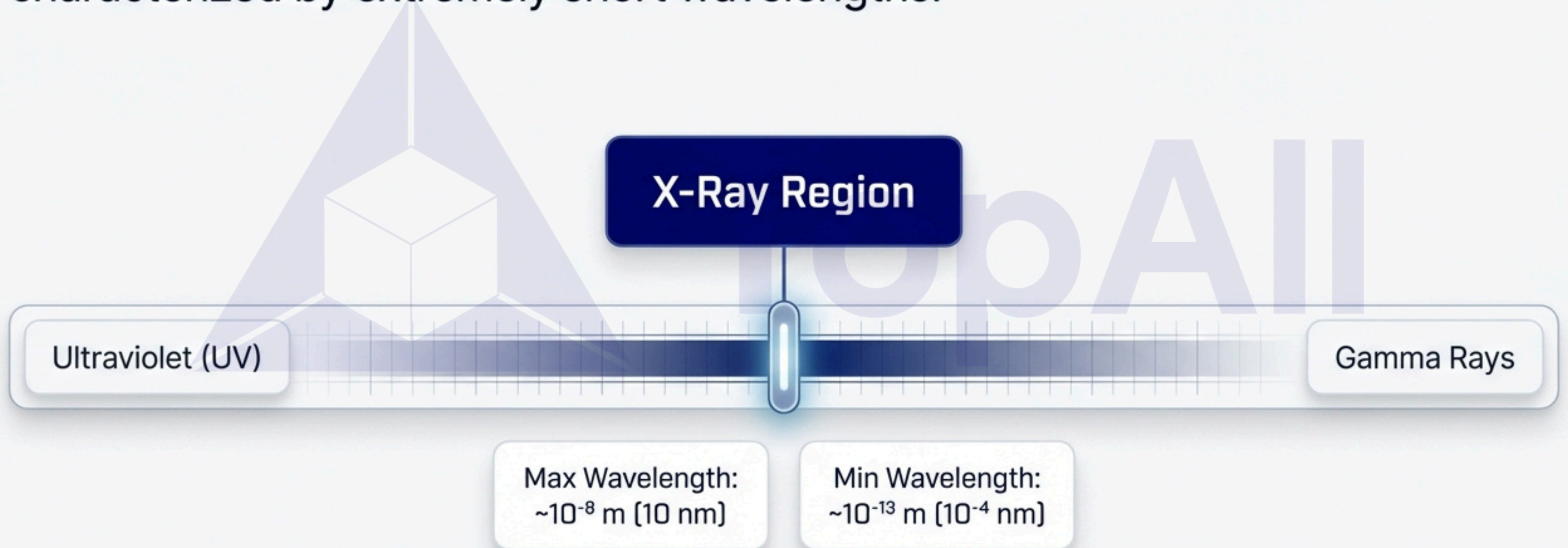
How X-Rays Let Us See Inside the Body

Exploring the physics of short-wavelength electromagnetic radiation, its production, and its clinical applications.



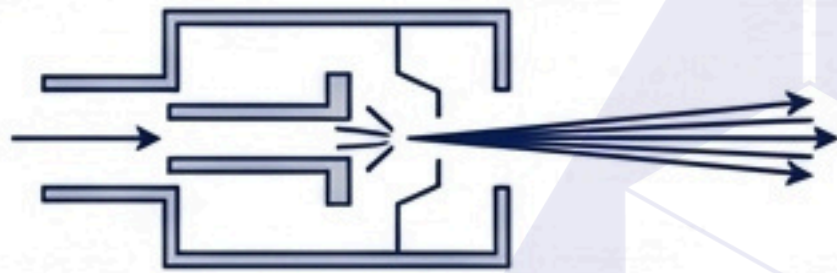
Positioned Beyond Ultraviolet

X-rays are a form of high-frequency electromagnetic radiation characterized by extremely short wavelengths.



The Production Mechanism

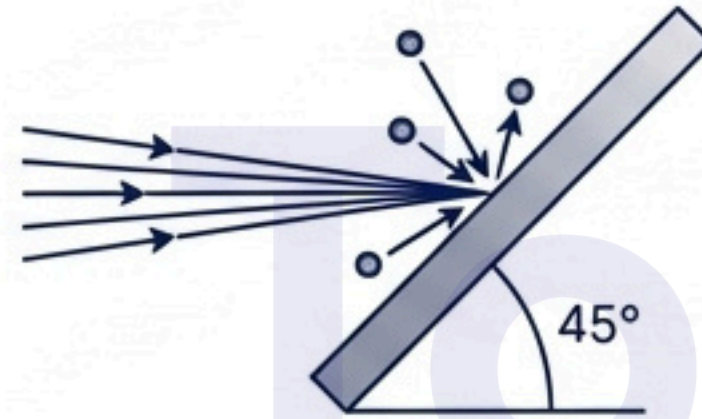
One common way to generate X-rays is to bombard a metal target by high energy electrons.



Source

Step 1: Acceleration

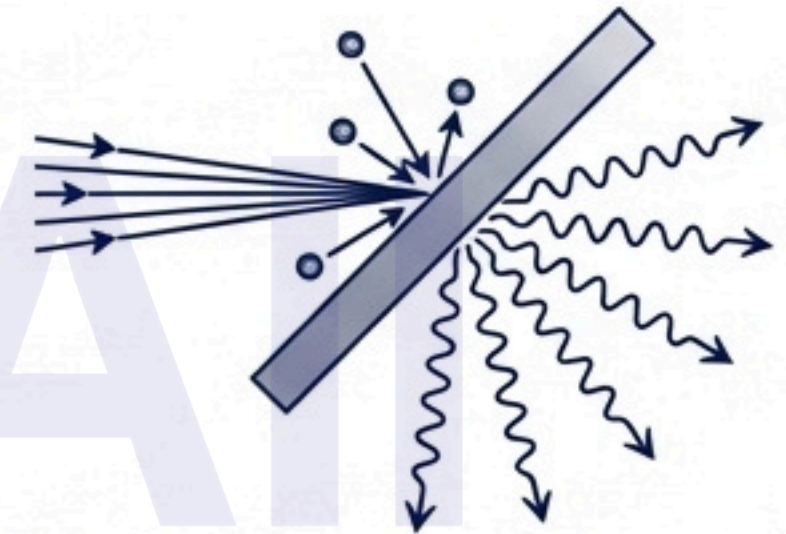
High-energy electrons are fired at extreme velocities.



Impact

Step 2: Bombardment

These electrons violently strike a solid metal target.



Output

Step 3: Emission

The rapid deceleration and atomic interaction release X-ray photons.



You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



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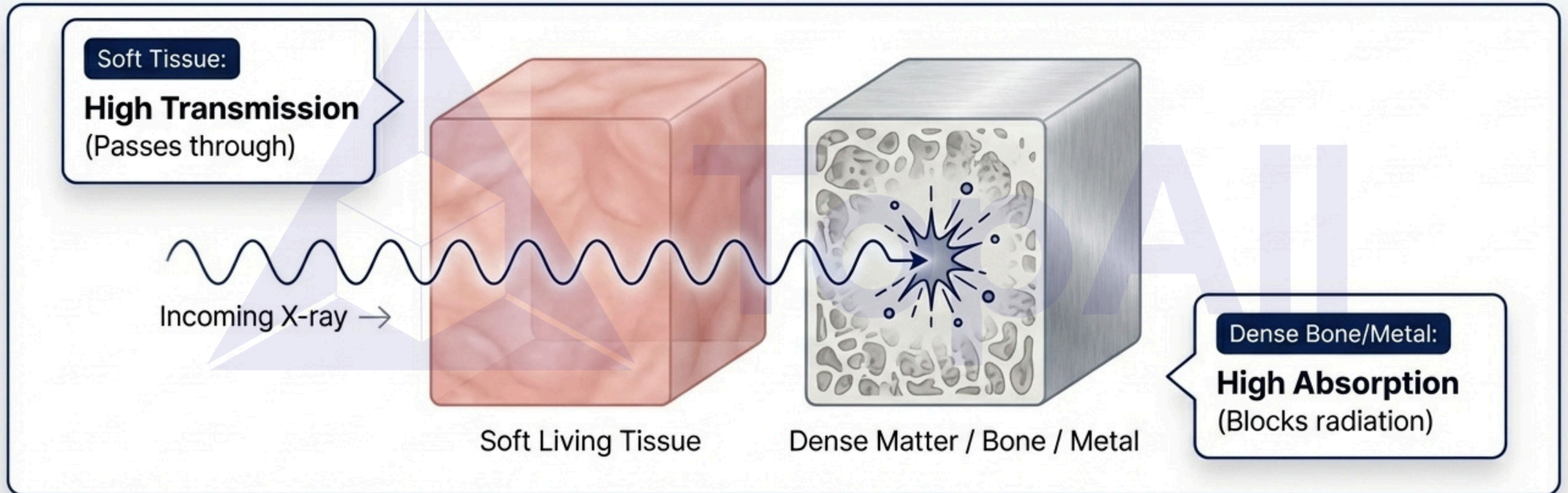
Key Highlights

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The Physics of Penetration

Because X-rays have extraordinarily short wavelengths, they can easily bypass the atomic structures of less dense materials.



This differential absorption is what creates the contrasting shadows in medical imaging.



Application 1: Diagnostic Medicine



X-rays serve as a vital diagnostic tool in modern medicine, allowing physicians to see inside the body without surgery.



Fracture Detection — Instantly reveals breaks or cracks in dense bone structures.



Anomaly Scanning — Identifies foreign metal objects or abnormal dense growths.



Non-Invasive — Provides critical internal data without breaking the skin.

Application 2: Treatment vs. Tissue Risk



Medical Treatment

Used carefully to target and destroy certain forms of cancer, malignancies, and specific skin diseases.



Overexposure Hazard

Because X-rays carry high energy, unnecessary exposure can severely damage or destroy healthy living tissues and organisms.

High-Yield Concepts Mastered

- ✓ **Spectrum:** Located beyond UV, spanning 10^{-8} m to 10^{-13} m.
- ✓ **Production:** Generated by bombarding a metal target with high-energy electrons.
- ✓ **Diagnostics:** Primary use as a non-invasive medical imaging tool.
- ✓ **Therapeutics:** Capable of treating certain malignancies and skin diseases.
- ✓ **Safety:** Strict exposure limits required to prevent damage to living tissue.



You've Learned the Theory.

Now Let's Test It.

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