

Definitions and Concepts for WJEC (Wales) Physics A-level

Unit 4 - Option B: Medical Physics

A-Scans: A method of scanning tissue that involves placing an ultrasound emitting transducer on the surface of the body, and then measuring reflections of emitted pulses. A-Scans are used to measure the foetal head size during pregnancy.

Absorbed Dose: The energy that a body absorbs per kilogram, through the absorption of ionising radiation.

Acoustic Impedance: The product of the speed of sound through a given medium, and the density of the medium.

Attenuation of X-Rays: The reduction of the intensity of X-rays when they pass through matter. This decay of intensity is exponential.

B-Scans: A method of scanning tissue, used for more complex structures than A-scans. Instead of the echo signals controlling the y-gain (as in A-scans), they control the brightness of the oscilloscope spot. B-scans are used to determine the placenta's position during pregnancy.

Beam Intensity: The power (energy transfer per unit time) per unit area transferred by a beam of radiation.

Collimator: A device used to produce parallel beams of radiation. Gamma cameras contain a collimator.

CT Scans: A scanning method that produces a cross section of the body by rotating a monochromatic x-ray beam around it, in combination with a series of detectors. Whilst it produces higher resolution images than ultrasound and is non-invasive, it is highly ionising and costly.

Digital Image Receptors: A device that changes an x-ray beam into a visible image.

Doppler Equation: An equation used to calculate the change in the observed wavelength when a source is moving relative to an observer. It can be applied in the analysis of blood flow.

Effective Dose: The product of an equivalent dose with a tissue weighting factor.

Equivalent Dose: The product of an absorbed dose with a corresponding radiation weighting factor.

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Fluoroscopy: A form of medical imaging that involves using X-rays to form a moving image of within a patient's body.

Gamma Camera: A type of detector used in PET scanners, consisting of photomultiplier tubes that convert gamma photons into electrical pulses.

Gray: The unit of absorbed dosage.

Lamor Frequency: The frequency of precession of the magnetic moment of a proton in a magnetic field.

Linear Attenuation Coefficient: The linear attenuation coefficient is the ratio of the fractional reduction of intensity over the thickness of the layer causing the attenuation.

Magnetic Resonance Imaging: A scanning method that involves the patient lying in a very strong cylindrical magnet. Electromagnetic radiation is emitted that causes a reorientation of hydrogen nuclei. When they return to their original positions radiofrequency radiation is emitted and detected.

MRI Scans: A scanning method that involves the patient lying in a very strong cylindrical magnet. Electromagnetic radiation is emitted that causes a reorientation of hydrogen nuclei. When they return to their original positions radiofrequency radiation is emitted and detected.

PET Scan: A scanning technique that produces cross-sectional and 3D images. It involves a radionuclide being injected into the body, which then releases gamma photons that are detected by the scanning machine. It is used for the detection of tumours.

Photomultiplier: A device used to amplify low intensity light signals through the use of photoelectric cells. They are found in gamma cameras.

Piezoelectric Transducers: A device that mechanically deforms when a potential difference is applied to it. Conversely, if the device itself is deformed, it will induce a potential difference. They are used in medical sensing.

Precession Nuclei: When nuclei precess about an external magnetic field. Precession is when the axis of the top of the nuclei is tipped at an angle less than being perpendicular to the surface the top is on, and the axis rotates about that angle.

Radioactive Tracers: Radionuclides that enter a patient's body and target a specific area. They emit radiation that can be detected from outside the body, allowing images of body parts to be formed.

Radiography: The use of ionizing radiation to form medical images.

Relaxation Time: The time taken for a spin to release the energy received by a radiofrequency pulse.



Scintillation Counter: A device used to detect radiation through the detection of light photons produced by a scintillator. The device is used within gamma cameras.

Scintillator: A device that converts photons from ionizing radiation into light photons.

Sievert: The unit of effective and equivalent dosages.

Technetium-99m: A radionuclide commonly used as a radioactive tracer for medical purposes.

Ultrasound Imaging: A non-invasive form of medical imaging that involves the emission, reflection and detection of ultrasound waves to form an image of within a patient's body.

X-Ray Diagnosis: The use of X-rays for medical imaging.

X-Ray Therapy: The use of X-rays for medical treatment.

X-Rays: High energy, ionizing radiation that is used in both medical detection and medical treatment.

