



QUESTION WORKBOOK

Radionuclide imaging and PET

Medical physics · Year 13

AQA 3.10.6 · CIE 24.3 · OCR A 6.5.2

12 questions · 32 marks

NAVY SCREEN EDITION

SECTION A · Warm-up

A1 State what is meant by a medical tracer. [2]

A2 Explain why a tracer nuclide should be a gamma emitter, and why its half-life must be chosen with care. [3]

A3 An X-ray image and a tracer image answer different questions about a patient. State the difference. [2]

SECTION B · Standard

B1 Describe the roles of the collimator and the scintillator crystal in a gamma camera. [3]

- B2** Technetium-99m has a half-life of 6.0 hours. Calculate the fraction of a dose's activity remaining 24 hours after preparation. [3]

- B3** Describe what happens when a positron emitted by a PET tracer meets an electron, and state the energy of each photon produced. [3]

- B4** Show that the rest energy of an electron is about 8×10^{-14} J, and convert it to keV. [3]

- B5** Explain why the two annihilation photons travel in opposite directions. [2]

SECTION C · Stretch

C1 Explain how a PET scanner uses coincidence detection to locate the tracer. [4]

C2 Calculate the frequency of a 511 keV annihilation photon. [2]

C3 Fluorine-18, used in PET, has a half-life of 110 minutes. A hospital needs at least one eighth of the delivered activity remaining at scan time. Calculate the maximum delay between delivery and scanning. [2]

C4 A patient asks whether a PET scan means being irradiated by the machine. Explain what the scanner actually does, and where the dose really comes from. [3]
