

Medical imaging

Question Paper 3

Level	A Level
Subject	Physics
Exam Board	OCR
Topic	Particles and medical physics
Sub-Topic	Medical imaging
Booklet	Question Paper 3

Time Allowed: 54 minutes

Score: / 45

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 (a) State one reason for using non-invasive techniques in medical diagnosis.

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..... [1]

(b) Describe the use of medical tracers to diagnose the condition of organs.

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..... [2]

(c) Describe the principles of positron emission tomography (PET).

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..... [5]

[Total: 8]

4 (a) State and describe **one** way in which X-ray photons interact with matter.

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..... [2]

(b) The intensity of a collimated beam of X-rays is reduced to 10% of its initial value after passing through 3.0 mm of soft tissue. Calculate the thickness of soft tissue that reduces the intensity to 50% of its initial value.

thickness = mm [3]

(c) X-rays are used to image internal body structures.

(i) Explain how image intensifiers are used to improve the quality of the X-ray image.



In your answer, you should explain clearly the process involved which makes the image brighter.

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(ii) Explain how contrast media are used to improve the quality of the X-ray image.

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..... [2]

[Total: 10]

- 5 Fluorodeoxyglucose (FDG) is a radiopharmaceutical used for PET scans. It contains radioactive fluorine-18, which is a positron-emitter with a half-life of 6.6×10^3 s. A patient is injected with FDG which has an initial activity of 250 MBq.

(a) Calculate the decay constant of fluorine-18.

decay constant = s^{-1} [2]

(b) Show that the initial number of fluorine-18 nuclei in the FDG is about 2×10^{12} .

[1]

(c) About 9.9% of the mass of FDG is fluorine-18. Use your answer in (b) to determine the initial mass of FDG given to the patient. The molar mass of fluorine-18 is $0.018 \text{ kg mol}^{-1}$.

mass = kg [3]

