

Medical imaging

Question Paper 5

Level	A Level
Subject	Physics
Exam Board	OCR
Topic	Particles and medical physics
Sub-Topic	Medical imaging
Booklet	Question Paper 5

Time Allowed: 28 minutes

Score: / 23

Percentage: /100

Grade Boundaries:

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

1 (a) Describe the *piezoelectric effect*.

.....
 [1]

(b) Describe how ultrasound scanning is used to obtain diagnostic information about internal structures of a body. In your description include the differences between an A-scan and a B-scan.

.....

 [4]

(c) Fig. 7.1 shows the speed of ultrasound, density and acoustic impedance for muscle and bone.

material	speed of ultrasound / ms^{-1}	density / kg m^{-3}	acoustic impedance / $10^6 \text{kg m}^{-2} \text{s}^{-1}$
muscle	1590	1080	1.72
bone	4080	1750	7.14

Fig. 7.1

(i) Show that the unit for acoustic impedance is $\text{kg m}^{-2} \text{s}^{-1}$.

[1]

(ii) An ultrasound pulse is incident at right angles to the boundary between bone and muscle. Calculate the fraction of reflected intensity of the ultrasound.

fraction of reflected intensity = [2]

(iii) What is meant by *acoustic impedance matching*? Explain why a gel is used to produce an effective ultrasound image.

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.....
.....
..... [2]

(iv) The frequency of the ultrasound in the muscle is 1.2 MHz. Calculate the wavelength of the ultrasound in millimetres (mm).

wavelength = mm [2]

(v) Suggest why it is desirable to have ultrasound of short wavelength for a scan.

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..... [1]

[Total: 13]

