

1 (a) Describe the *piezoelectric effect*.

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 [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.

(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 1.2MHz. 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]

