Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Q1.

Three customers, **P**, **Q** and **R**, are sitting in a café listening to music from a loudspeaker. Customer **P** is 11 m from the loudspeaker. At the position of customer **P**, the sound intensity is 3.4×10^{-8} W m^{-2}.

(a) Customer **P** moves to a distance of 7.0 m from the loudspeaker.

Calculate the sound intensity at the new position of customer **P**.
Assume that the loudspeaker is a point source.

sound intensity = _____ W m^{-2}

(2)

(b) The sound intensity level is 65 dB at the position of customer **Q** and 42 dB at the position of customer **R**.

Calculate the ratio $\frac{\text{sound intensity at the position of } \mathbf{Q}}{\text{sound intensity at the position of } \mathbf{R}}$

ratio = _____

(2)

(c) Customer **Q** perceives the loudness of the sound differently to customer **R**.

Discuss whether the use of intensity level or intensity is more appropriate to compare the perceived loudness.

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(2)

(d) Customers **P**, **Q** and **R** move to the same distance from the loudspeaker.

Customer **P** is 80 years old and has hearing loss due to her age.

Customer **Q** is 35 years old and has hearing loss due to working in an extremely noisy environment.

Customer **R** is 35 years old and has no hearing loss.

The hearing defects of **P** and **Q** affect their perception of the music being played.

Describe how their perceptions are different from that of **R**.

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(3)

(Total 9 marks)

Q2.

Ultrasound is commonly used in medical procedures.

(a) An ultrasound A-scan is used to find the length l of an eye as shown in **Figure 1**.
Figure 2 shows the simplified A-scan for the eye. A short pulse of ultrasound is transmitted at time $t = 0$

The average speed of ultrasound in the eye = 1560 m s^{-1}.

Figure 1

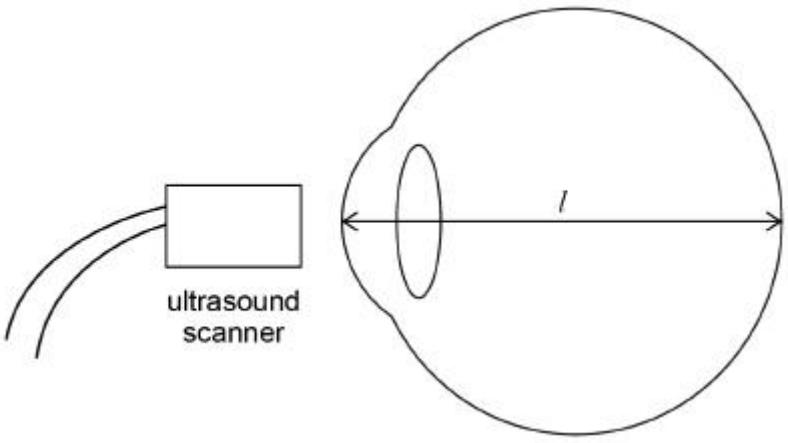
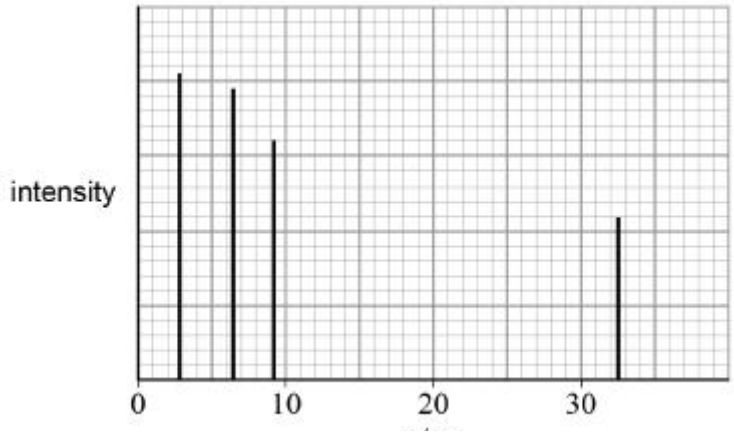


Figure 2



Calculate l.

l _____ m

(3)

(b) Amniocentesis is a procedure where a tube is inserted into a uterus to remove some cells and fluid from around a foetus. For the procedure to be carried out safely the positions of the needle, foetus and placenta must be determined accurately.

Discuss whether an A-scan or a B-scan should be used for amniocentesis.

In your answer, you should:

- outline the differences between an A-scan and a B-scan
- describe the advantages and disadvantages of each type of scan
- explain why your chosen scan should be used for this procedure.

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(6)
(Total 9 marks)