OCR
Oxford Cambridge and RSA

GCSE Physics A (Gateway)

J249/04 Physics A P5-P8 and P9 (Higher Tier)

Question Set 14

1 (a) Some students try to measure the speed of sound, as shown in **Fig. 1.1**.

One student makes a loud sound by clapping her hands.

The sound of the clap reflects from the gym wall causing an echo.

Another student measures the time between hearing the clap and hearing the echo.

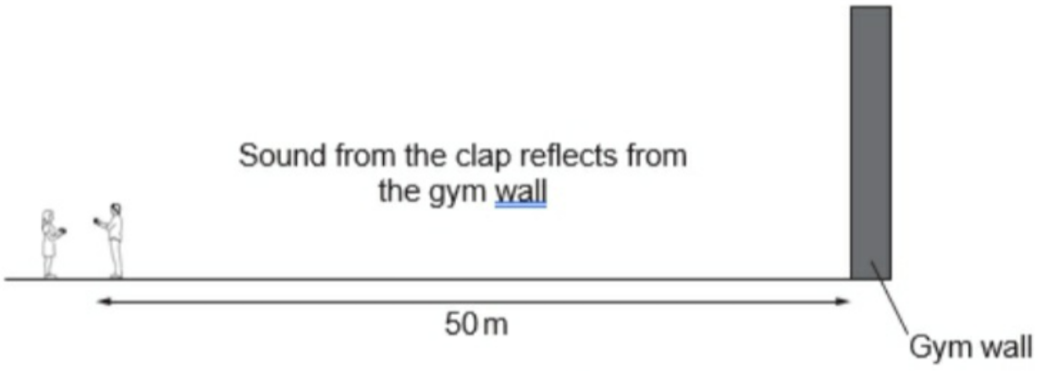

Fig. 1.1

They repeat the experiment three times and record their results in the table below.

Distance to wall (m)	Time 1 (s)	Time 2 (s)	Time 3 (s)	Mean time (s)
50	0.28	0.32	0.54	

anomaly – do not use.

(i) The student did not pay attention when recording **time 3**.

Calculate the **mean** time taken for the sound of the clap to return, using suitable values from the table.

$\frac{0.28 + 0.32}{2} = 0.30$ (2sf)

Mean time taken = 0.30 s

[1]

(ii) Calculate the speed of sound for the clap.

Use your answer to **(a)(i)** and the equation: distance travelled = speed × time

Give your answer to **3** significant figures.

Speed of sound = ... 333 ..... m/s

[4]

$$\frac{\text{distance travelled}}{\text{time}} = \text{speed}$$

$$\frac{50 \times 2}{0.30} = 333.33\dot{3} \text{ m/s}$$

$$= 333 \text{ (3sf) m/s}$$

(iii) Describe **two** ways to improve and develop their method.

- Use a microphone and a datalogger to pick up the echo. This is to avoid human error / reaction time when stopping the timer when echo is heard.
- Increase distance from wall to reduce percentage error.

[2]

(b) Ultrasound wave pulses are used by vets to scan inner tissues inside animals.

The ultrasound pulses partially reflect from different layers of tissue. These reflected wave pulses (echoes) are collected by the detector as shown in **Fig. 1.2**.

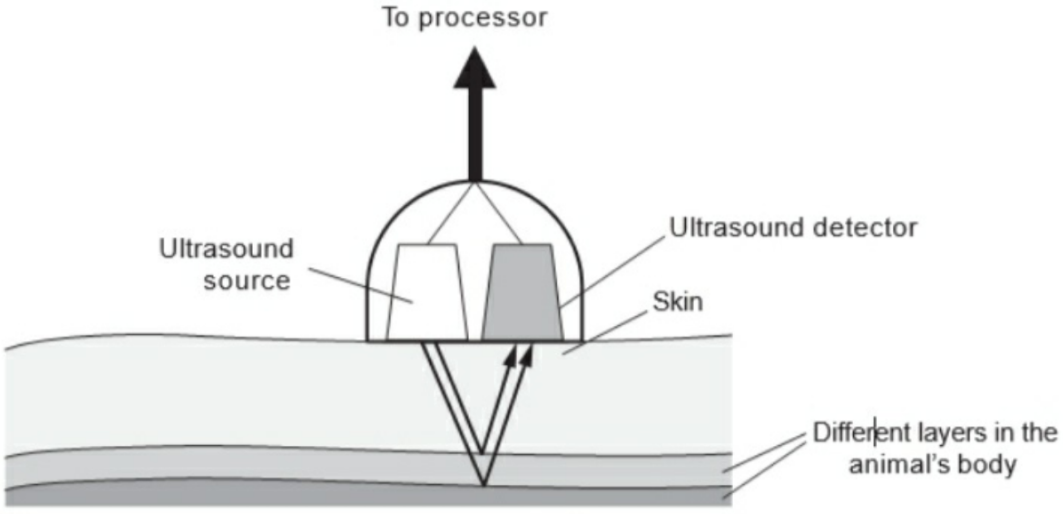

Fig. 1.2.

In a scan using ultrasound pulses, three layers of tissue are detected, with each layer having a different thickness.

Describe and explain how the results from the detector can show:

- that there are three layers
- that each layer has a different thickness.

The detector can time for when the signal [3]
echo to return. The detector will notice that there are 3 different times the signal returns indicating that there are 3 layers reflecting back the ultrasound pulses. The detector will also realise that each layer has different thickness. this is because there is irregular time differences between each layer, indicating that the ultrasound pulses will have to travel different distances to be reflected back ∴ showing that each layer has different distances.

Total Marks for Question Set 14: 10