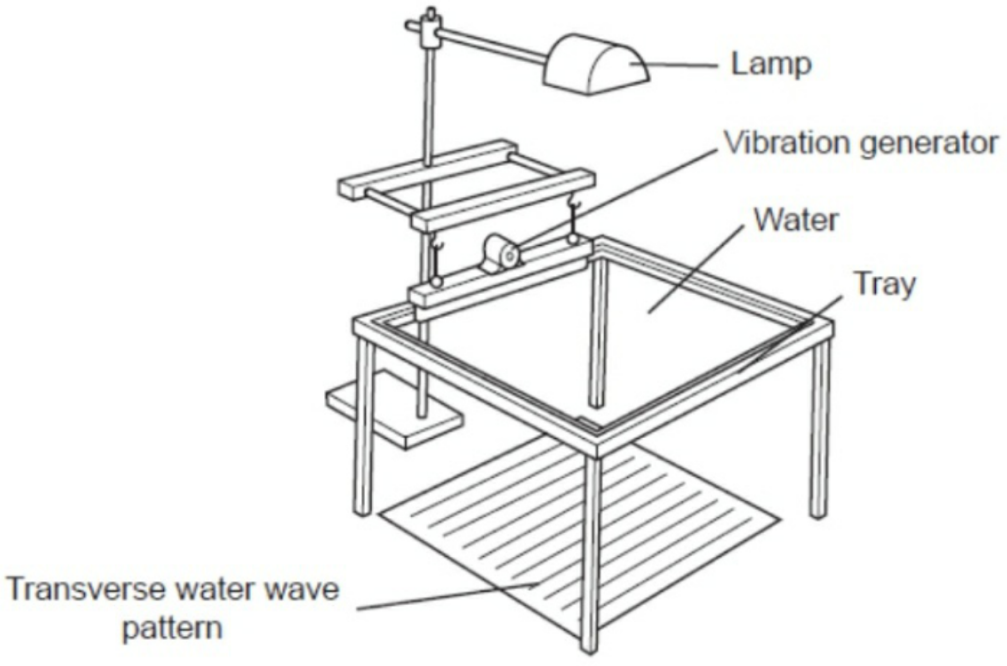
OCR
Oxford Cambridge and RSA

GCSE Physics A (Gateway)

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

Question Set 2

1 A teacher uses water waves in a ripple tank to demonstrate **transverse** waves.



She makes measurements of the water waves.

(a) The frequency of the water waves is 0.5 Hz

(i) Calculate the number of water waves produced in 5 seconds.

$0.5 \times 5 = 2.5$

Answer = 2.5

[1]

(ii) The teacher **increases** the frequency of the water waves.

Describe what happens to the speed **and** the wavelength of the water waves.

If the frequency increases, then the wavelength will be shorter because there are more waves closer together. However changing the frequency of the waves will not change the wave speed.

[2]

(ii) A student tries to describe water waves in the sea.

'The water waves move up and down. The water particles move all the way across the surface of the sea. This means that water moves in the direction of the waves.'

Part of his explanation is **incorrect**.

Write an improved and correct description about water waves in the sea.

The waves move with a transverse motion (up and down motion). This means the waves oscillations are at 90° (perpendicular) to the direction of travel. **[2]**

* not in the direction of the waves as the student describes *.

(b) A student watches a ball game on the school field.

The student sees the ball being hit with a bat but he hears the sound a short time after. This is because the speed of light is much greater than the speed of sound.

Describe an experiment which measures the speed of **sound** in air.

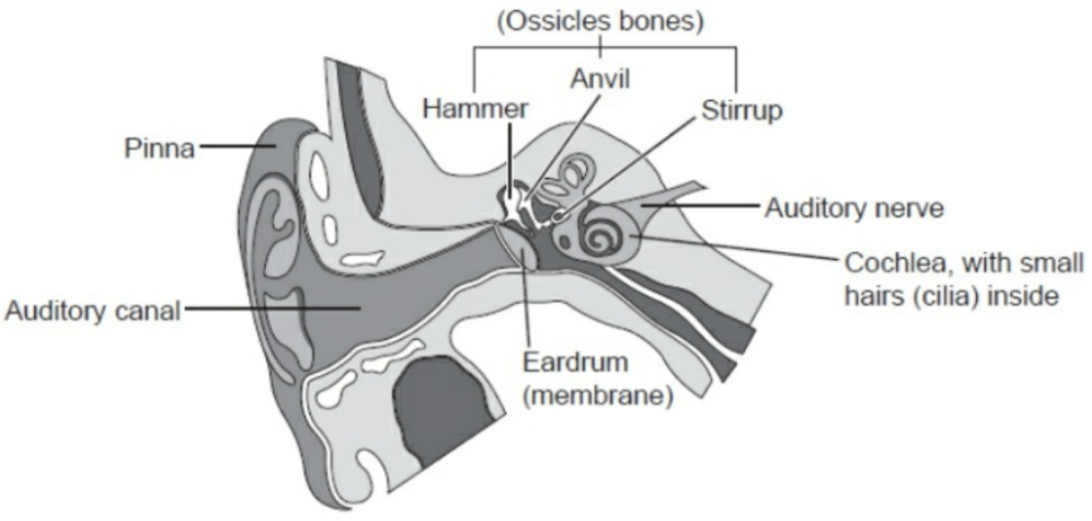
In your answer describe the measurements, calculations and procedures needed to gather **accurate** and **reliable** results.

You may draw a diagram as part of your answer.

Using two microphones which are at a certain distance apart (eg 10m). Attach a data logger to the two microphones so it can measure and record the time taken for the sound to reach the 2 microphones. **[5]**
With the distance apart (between 2 microphones) and the time delay between the 2 microphones (measured by the data loggers), use the equation: speed = $\frac{\text{distance}}{\text{time}}$ = $\frac{\text{distance between microphones}}{\text{time delay between microphones}}$
To gain accurate and reliable results, do the experiment multiple times to gain an average of the speed of sound.

Remove any outliers to also make the results more accurate.

(c) Look at the diagram of a human ear.



Sound wave disturbances, outside the ear, transfer energy to the small hairs (cilia) inside the cochlea.

The cochlea then sends nerve impulses along the auditory nerve to the brain.

Explain how sound wave disturbances in the air outside the ear transfer to the small hairs (cilia) inside the cochlea.

Air particles vibrate left to right, colliding with other air particles. this transfers the sound wave through the air. The vibrations in the air make the eardrum vibrate, and these vibrations are passed through the ossicles (the 3 small bones in the ear). The vibrations then travel to a spiral structure called the cochlea (which then passes the signal to the brain, via the auditory nerve). **[3]**

Total Marks for Question Set 2: 13