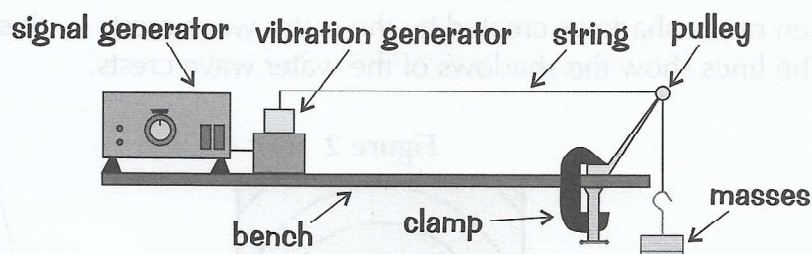


Investigating Waves and Refraction

Time to wave hello to some experiments, and the weird world of refraction...

Warm-Up

The set-up below can be used to measure the wave speed in a string.



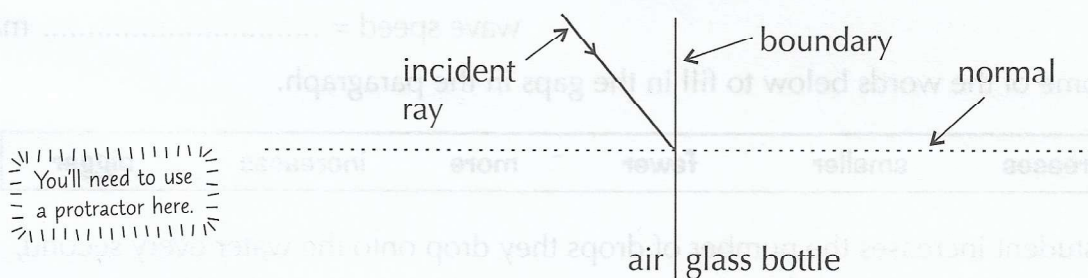
You start by turning on the signal generator and changing its frequency until there's a clear wave in the string.

Tick one advantage of using this set-up to find the wave speed in a string.

- ☐ A It's easy to see and measure the wavelength.
- ☐ B The wave speed in the string is always changing.
- ☐ C The number of waves on the string gives you the frequency.

- Q1** A ray of red light is shone at a glass bottle from the air. The light ray refracts when it crosses the boundary from the air to the glass bottle. The ray diagram for this is shown in **Figure 1**. The ray diagram is incomplete.

Figure 1



- a) What happens to the light ray when it hits the glass bottle?
- ☐ A It changes direction. ☐ B It spreads out. ☐ C It turns blue.
- b) Using **Figure 1**, find the angle of incidence of the light ray as it hits the glass bottle.

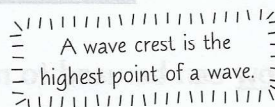
angle = ... °

- c) The angle of refraction is 30°. On **Figure 1**, draw the refracted light ray inside the glass bottle.

PRACTICAL

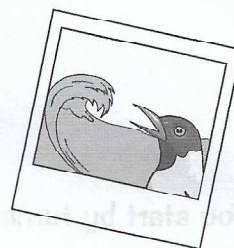
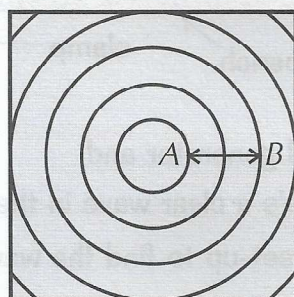
- Q2** A student experiments with a ripple tank. They drop one drop of water every half second onto the middle of the ripple tank. This creates circular water waves in the ripple tank.

A lamp is shone on the ripple tank. The water wave crests can be seen as shadows on a screen below.



A photo is taken of the shadows created by the water wave crests — this is shown in **Figure 2**. The lines show the shadows of the water wave crests.

Figure 2



- a) i) The distance from crest A to crest B is 16 cm.
Determine the wavelength of the water waves. Give your answer in cm.

wavelength = ... cm

- ii) Every second, two water waves reach the edge of the ripple tank.
Calculate the wave speed of the water waves.

wave speed = ... m/s

- b) Use some of the words below to fill in the gaps in the paragraph.

decreases

smaller

fewer

more

increases

bigger

If the student increases the number of drops they drop onto the water every second, the frequency of the water waves The speed of the water waves will remain the same, and their wavelength decreases. If a photo was taken in this case, there would be lines on the photo than on the one in **Figure 2**.

I hit my head on a ripple tank — the screen showed a brain wave...

It's worth learning how to measure the wave speed in a string and of a water wave. Thankfully, both experiments follow similar methods. You find the frequency and wavelength first, then calculate the speed using the wave equation.

