7 A stone is dropped on a still pond at $t = 0$. The wave reaches a leaf floating on the pond a distance of 3.00 m away. The leaf then begins to oscillate according to the graph shown in Figure 2.21.

(a) Find the speed of the water waves.

(b) Find the period and frequency of the wave.

(c) Find the wavelength and amplitude of the wave.

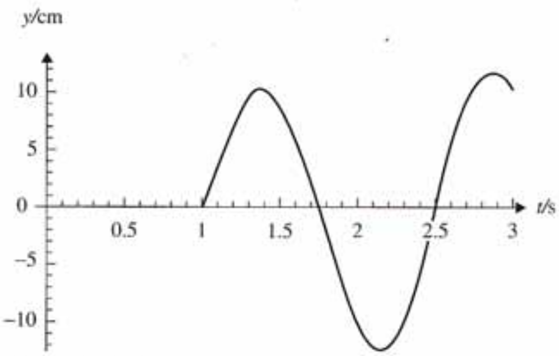

Figure 2.21 For question 7.

8 A sound wave of frequency 500 Hz travels from air into water. The speed of sound in air is 330 m s^{-1} and in water 1490 m s^{-1}. What is the wavelength of the wave in:

(a) air;

(b) water?

9 The speed of ocean waves approaching the shore is given by the formula $v = \sqrt{gh}$, where h is the depth of the water. It is assumed here that the wavelength of the waves is much larger than the depth (otherwise a different expression gives the wave speed). What is the speed of water waves near the shore where the depth is 1.0 m? Assuming that the depth of the water decreases uniformly, make a graph of the water wave speed as a function of depth from a depth of 1.0 m to a depth of 0.30 m.

10 (a) Explain, in the context of wave motion, what you understand by the term *displacement*.

(b) Using your answer in (a), explain the difference between longitudinal and transverse waves.

(c) A rock thrown onto the still surface of a pond creates circular ripples moving away from the point of impact. Why is more than one ripple created?

(d) Why does the amplitude decrease as the ripple moves away from the centre?

11 A ship sends a sonar pulse of frequency 30 kHz and duration 1.0 ms towards a submarine and receives a reflection of the pulse 3.2 s later. The speed of sound in water is 1500 m s^{-1}. Find the distance of the submarine from the ship, the wavelength of the pulse and the number of full waves emitted in the pulse.

12 Figure 2.22 shows three points on a string on which a transverse wave propagates to the right. Indicate how these three points will move in the next instant of time.

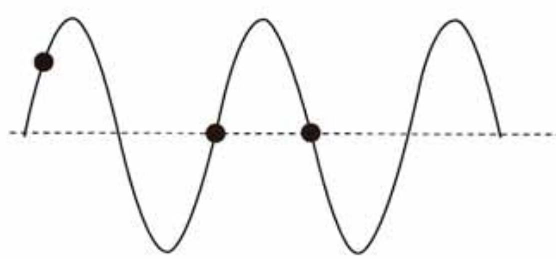

Figure 2.22 For question 12.

13 How would your answers change if the wave in question 12 were moving to the left?

14 Figure 2.23 shows a piece of cork floating on the surface of water when a wave travels through the water. On the same diagram draw the position of the cork half a wave period later.

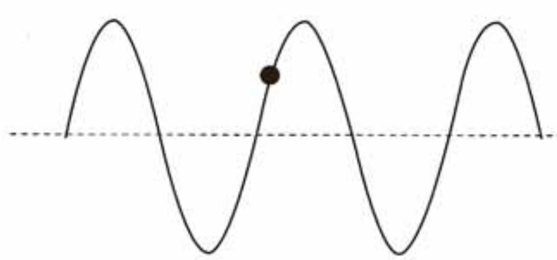

Figure 2.23 For question 14.

15 Figure 2.24 shows the same wave at two different times. The wave travels to the right and the bottom diagram represents the wave 0.2 s after the time illustrated in the top diagram. For this wave determine:

(a) the amplitude;
(b) the wavelength;
(c) the speed;
(d) the frequency.
(e) Can the graph be used to determine whether the wave is transverse or longitudinal?

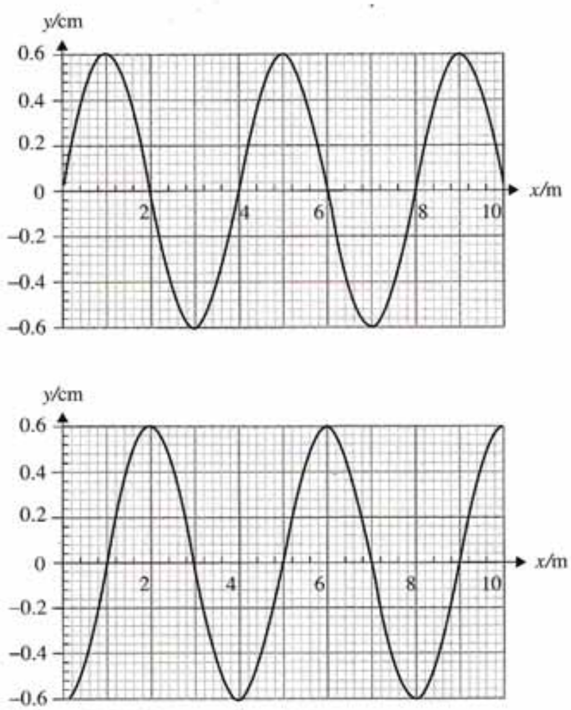

Figure 2.24 For question 15.

16 Figure 2.25 is a picture of a longitudinal wave travelling towards the right taken at a specific time. The density of the lines is proportional to the density in the medium the wave travels through.

(a) Draw this wave a very small interval of time later.
(b) Indicate on the diagram the wavelength of this wave.

Figure 2.25 For question 16.

17 Indicate on Figure 2.26 a compression, a rarefaction and the wavelength. Draw the picture of this wave half a period later.

Figure 2.26 For question 17.

18 By drawing suitable diagrams, explain the difference between transverse and longitudinal waves.

19 In the context of wave motion explain, with the aid of a diagram, the terms:

(a) wavefront;
(b) ray.

20 An earthquake creates waves that travel in the earth's crust; these can be detected by seismic stations. Explain why three seismic stations must be used to determine the position of the earthquake. Describe *two* differences in the signals recorded by three seismic stations, assuming they are at different distances from the centre of the earthquake.