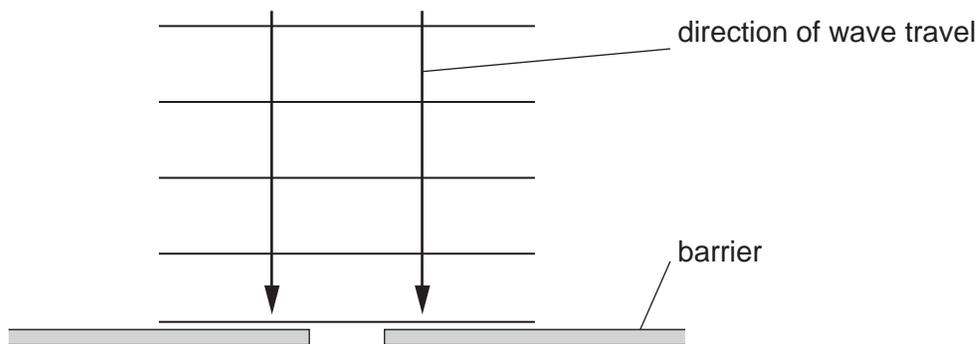


1 Fig. 6.1 shows a scale drawing of plane wavefronts approaching a gap in a barrier.



**Fig. 6.1**

(a) On Fig. 6.1, draw the pattern of the wavefronts after the wave has passed through the gap. [2]

(b) The wave approaching the barrier has a wavelength of 2.5 cm and a speed of 20 cm/s.  
Calculate the frequency of the wave.

frequency = ..... [2]

(c) State what happens, if anything, to the frequency of the wave as it passes through the gap.  
..... [1]

(d) Explain, in terms of diffraction, why a car radio may pick up low frequency radio signals but not pick up high frequency radio signals when the car is travelling behind a hill.

.....

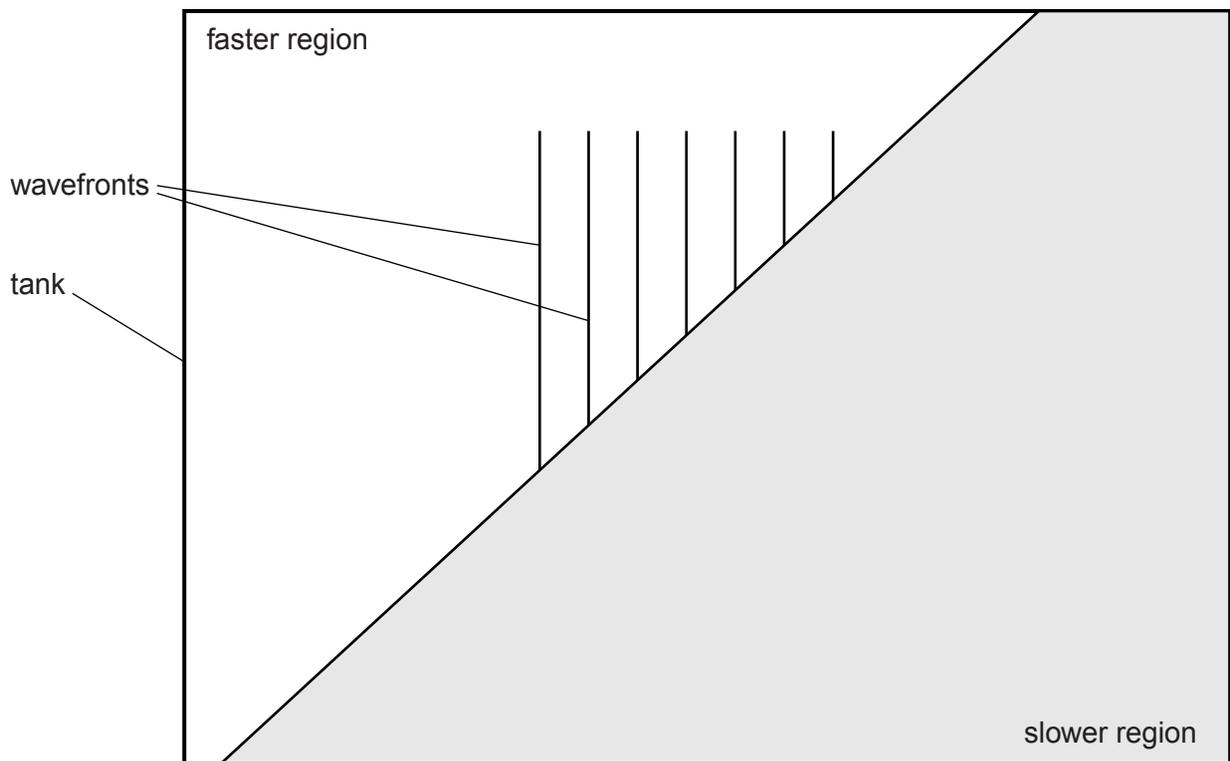
.....

..... [2]

[Total: 7]

- 2 A water wave in a tank travels from a region where the speed of the wave is faster into a region where it is slower.

Fig. 6.1 is a one-quarter scale diagram that shows the wavefronts in the region where the speed is faster.



**Fig. 6.1** (scale: 1.0 cm represents 4.0 cm)

- (a) (i) Take measurements from the scale diagram in Fig. 6.1 to determine the wavelength of the water wave as it travels in the faster region.

wavelength = ..... [2]

- (ii) The speed of the wave in the faster region is 0.39 m/s.

Calculate the frequency of the wave.

frequency = ..... [2]

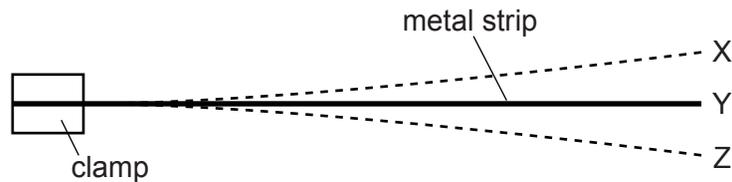
- (b) On Fig. 6.1, draw lines that indicate the positions of the wavefronts of the water wave in the slower region. [2]

(c) State what happens to the frequency of the water wave as it passes into the slower region.

.....  
..... [1]

[Total: 7]

3 (a) Fig. 5.1 shows a metal strip, held in a clamp.



**Fig. 5.1**

The end of the strip is pulled down and released, so that the strip vibrates. X and Z are the extreme positions of the end of the strip during this vibration. Y is the mid-position.

Explain what is meant by

(i) the *frequency* of vibration of the strip,

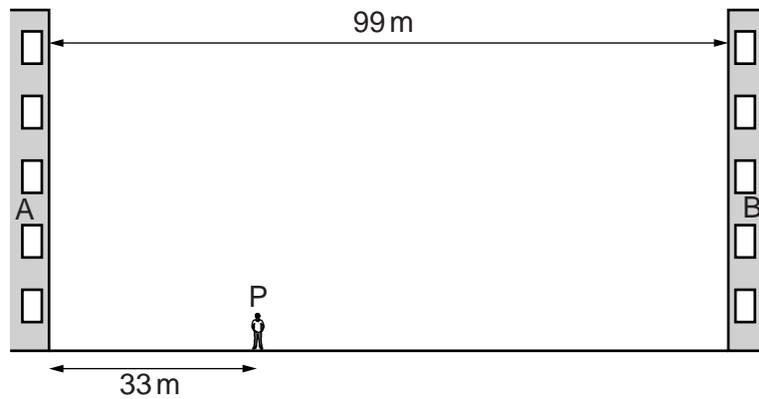
.....  
.....

(ii) the *amplitude* of vibration of the end of the strip.

.....  
.....

[2]

(b) Fig. 5.2 shows two tall buildings, A and B, that are 99 m apart.



**Fig. 5.2** (not to scale)

A student stands at P so that his distance from building A is 33 m. After clapping his hands once, he hears several echoes. The speed of sound in air is 330 m/s.

Calculate the time interval between clapping his hands and hearing

(i) the first echo,

time = .....[2]

(ii) the **third** echo.

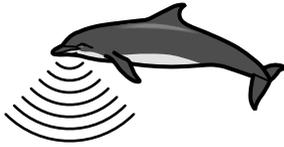
time = .....[1]

(c) Write down an approximate value for the speed of sound

(i) in water, speed = .....

(ii) in steel. speed = ..... [2]

(d) Fig. 5.3 shows a dolphin in water emitting a sound wave of frequency 95 kHz.



**Fig. 5.3** (not to scale)

Using your value from (c)(i), calculate the wavelength of this sound wave.

wavelength = .....[2]

[Total: 9]

4 Sound from a loudspeaker is travelling in air towards a solid wall.

Fig. 7.1 shows compressions of the incident sound wave and the direction of travel of the wave.

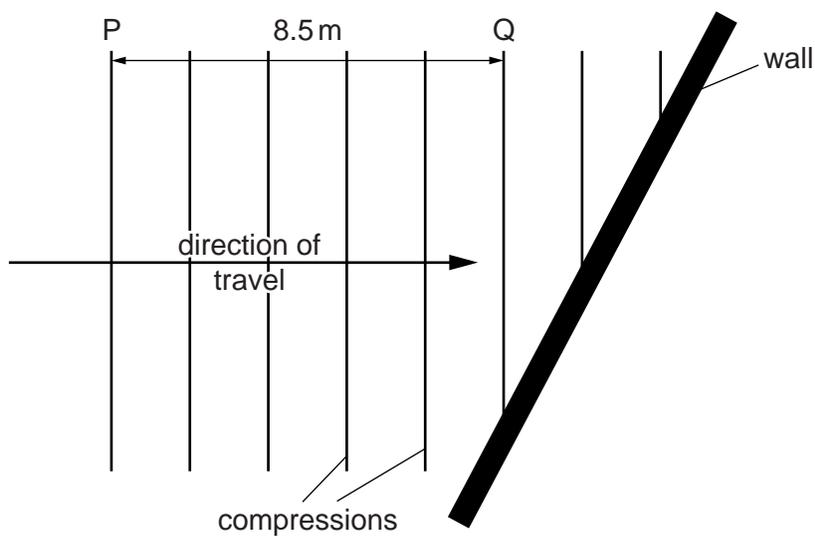


Fig. 7.1

(a) State what is meant by a *compression*.

.....  
.....[1]

(b) The distance from point P to point Q is 8.5m. It takes 25ms for the compression at P to reach Q.

For this sound wave, determine

(i) the wavelength,

wavelength = .....[1]

(ii) the frequency.

frequency = .....[2]

(c) As it strikes the wall, the sound reflects.

Complete Fig. 7.1 to show the positions of three compressions of the reflected sound wave. [2]

(d) The loudspeaker is immersed in water, where it continues to produce sound of the same frequency.

State and explain how the wavelength of the sound wave in water compares with the wavelength determined in (b)(i).

.....  
.....  
.....[2]

[Total: 8]

5 (a) State how a longitudinal wave differs from a transverse wave.

.....  
.....  
..... [2]

(b) A sound wave of frequency 7.5 kHz travels through a steel beam at a speed of 6100 m/s.

(i) Calculate the wavelength of this sound wave in the steel beam.

wavelength = ..... [2]

(ii) The sound wave passes from the end of the beam into air.

State

1. the effect on the speed of the sound,

..... [1]

2. the effect on the wavelength of the sound.

..... [1]

[Total: 6]

6 (a) Two types of seismic waves are produced by earthquakes. They are called P-waves and S-waves. P-waves are longitudinal and S-waves are transverse.

(i) Explain what is meant by the terms *longitudinal* and *transverse*.

longitudinal .....

.....

transverse .....

.....

[2]

(ii) State another example of

1. a longitudinal wave, .....

2. a transverse wave. ....

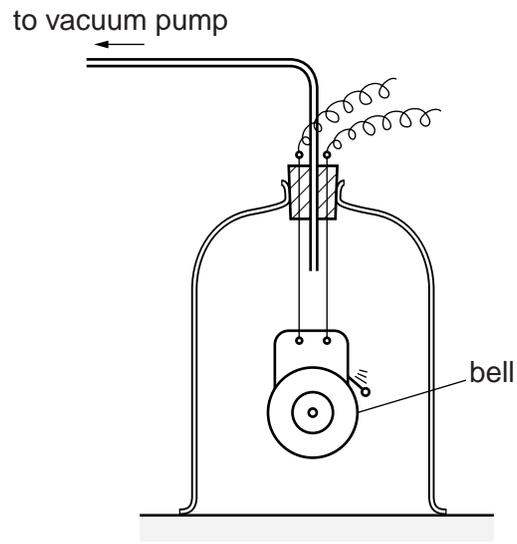
[2]

(iii) A seismic wave has a speed of 7.2 km/s and a frequency of 30 Hz.

Calculate its wavelength.

wavelength = .....[2]

(b) Fig. 5.1 shows an electric bell ringing in a sealed glass chamber containing air.



**Fig. 5.1**

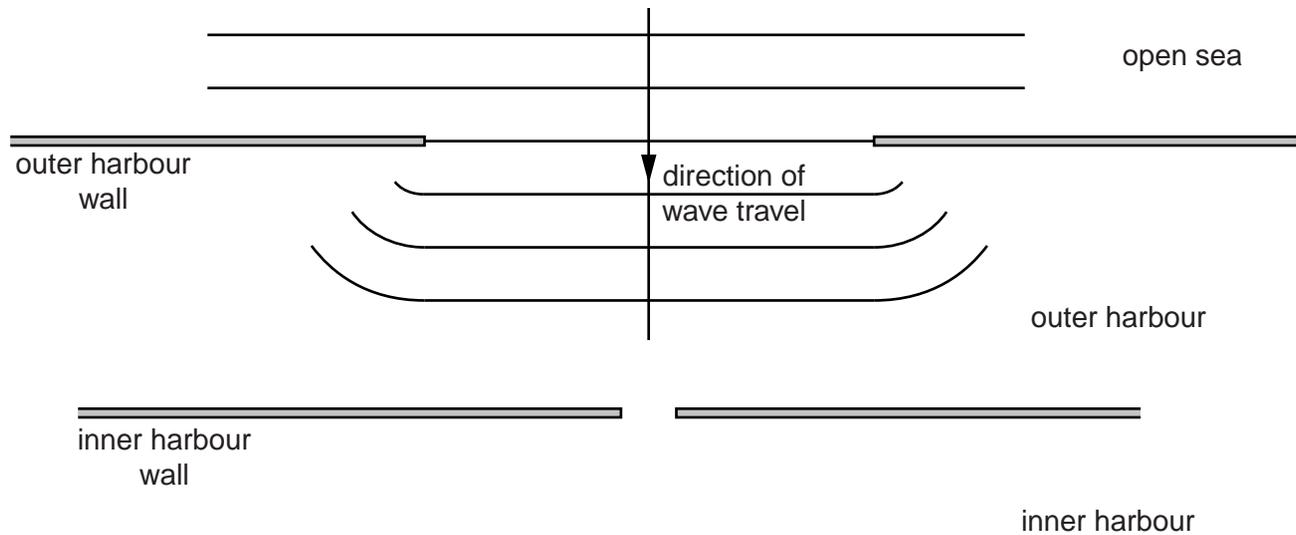
A student hears the bell ringing. The air is then removed from the chamber.

State and explain any change in the sound heard by the student.

.....  
.....  
.....  
.....[2]

[Total: 8]

- 7 (a) Fig. 5.1 shows an aerial view of wavefronts passing from the open sea into an outer harbour.



**Fig. 5.1**

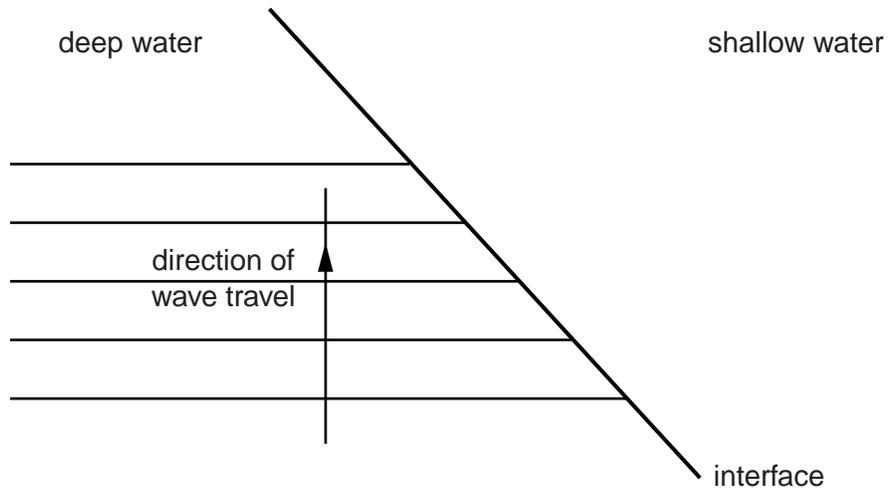
- (i) The wavefronts in the outer harbour are curving at their ends.

Name the process that is occurring at the entrance to the harbour.

..... [1]

- (ii) On Fig. 5.1, carefully complete the wave pattern as the wavefronts progress through the outer harbour and into the inner harbour. Show the rest of the wave pattern in the outer harbour and three wavefronts in the inner harbour. [3]

- (b) Fig. 5.2 shows an aerial view of wavefronts in deep water approaching a region of shallow water where they travel more slowly.



**Fig. 5.2**

- (i) Name the process that occurs as the wavefronts pass from deep to shallow water.  
..... [1]
- (ii) Complete Fig. 5.2 to show possible positions of the five wavefronts in the shallow water. [2]

[Total: 7]