Chapter 3

Waves

3.1 General properties of waves

01. 0625_s23_qp_42 Q: 6

Two types of seismic waves are P-waves and S-waves.

(a) State the types of wave that P-waves and S-waves can be modelled as.

P-waves .....

S-waves .....

[2]

(b) The velocity of a P-wave in the Earth's solid crust is 7.2 km / s and its frequency is 4.5 Hz.

Calculate the wavelength of this P-wave.

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wavelength = ... [3]

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02. 0625_w23_qp_43 Q: 5

(a) Fig. 5.1 is a scale diagram of wavefronts of red light approaching a gap in a barrier.

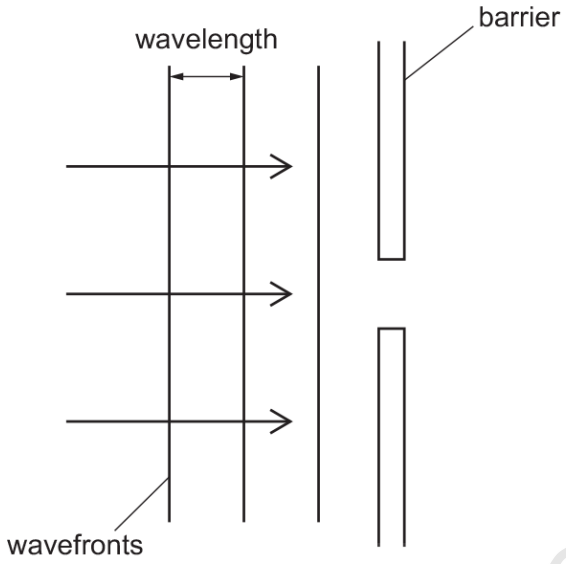

Fig. 5.1

On Fig. 5.1, draw **three** wavefronts after the wave has passed through the gap. [3]

(b) Fig. 5.2 shows the same barrier and gap. A wave of blue light approaches this barrier.

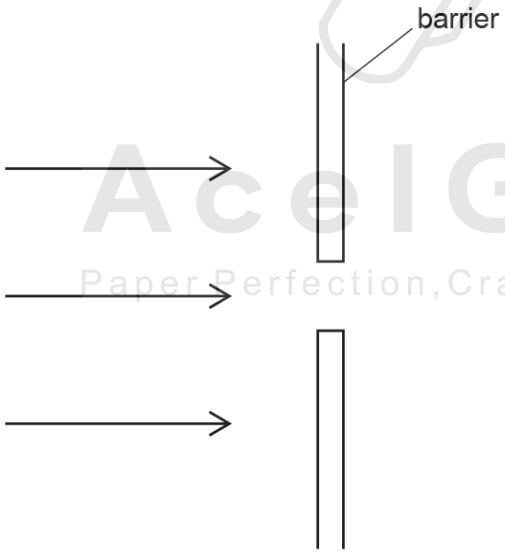

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Fig. 5.2

On Fig. 5.2:

- draw **three** wavefronts of this wave before it reaches the barrier
- draw **three** wavefronts after the wave passes through the gap.

[3]

03. 0625_w22_qp_43 Q: 6

Fig. 6.1 shows wave crests and the direction of travel for a water wave approaching a barrier in a large ripple tank.

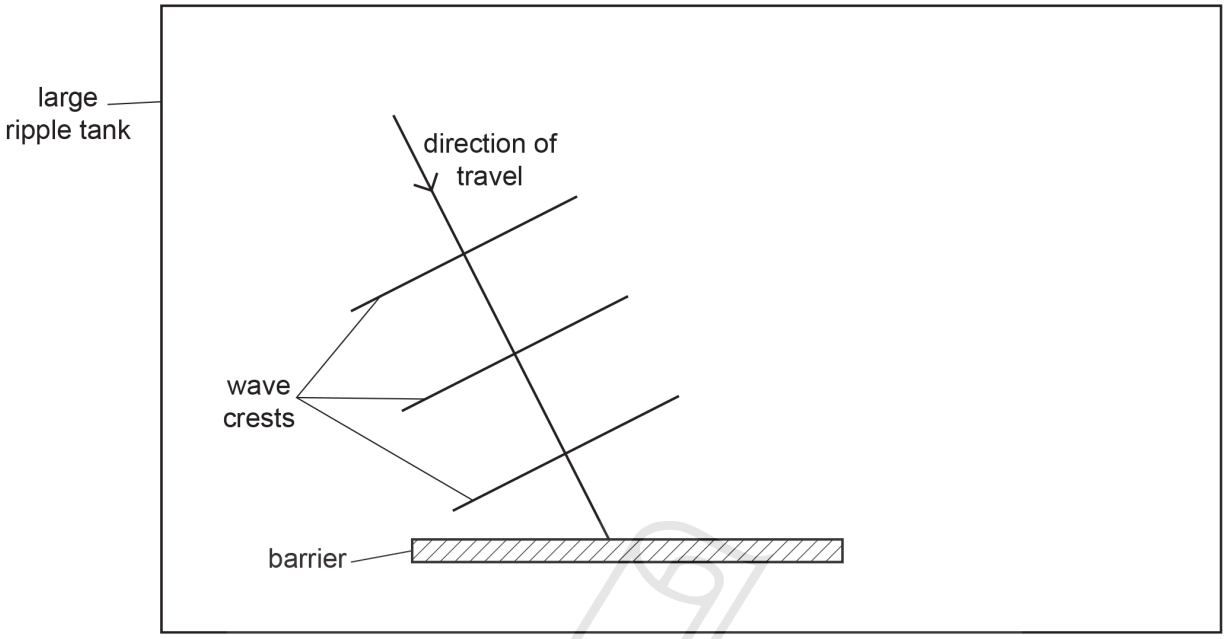

Fig. 6.1

The wavelength of the wave is 1.6 cm.

(a) On Fig. 6.1, draw:

(i) the direction of travel of the reflected wave [1]

(ii) **three** successive reflected wave crests. [2]

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(b) Fig. 6.2 shows an identical wave approaching a barrier with a gap of 1.3 cm.

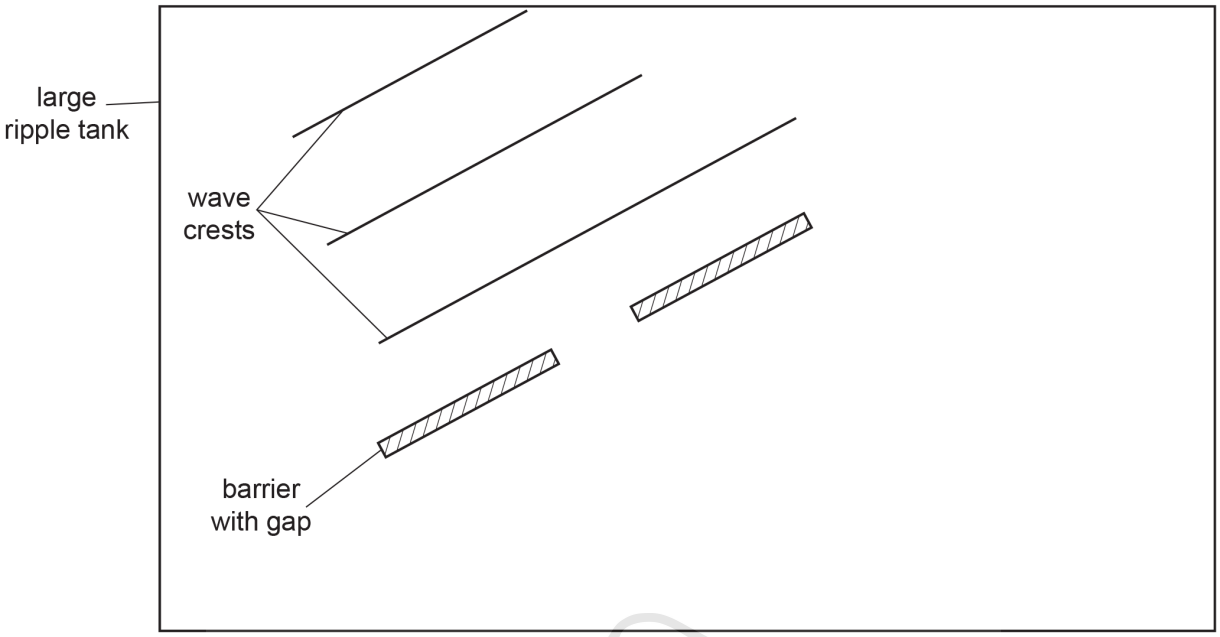

Fig. 6.2

On Fig. 6.2, draw **three** successive wave crests after they pass through the gap in the barrier. [3]

(c) The frequency of the wave is 4.0 Hz.

Calculate the speed of the wave.

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speed = ... [2]

04. 0625_m20_qp_42 Q: 6

(a) Fig. 6.1 shows crests of a water wave moving from left to right in a harbour.

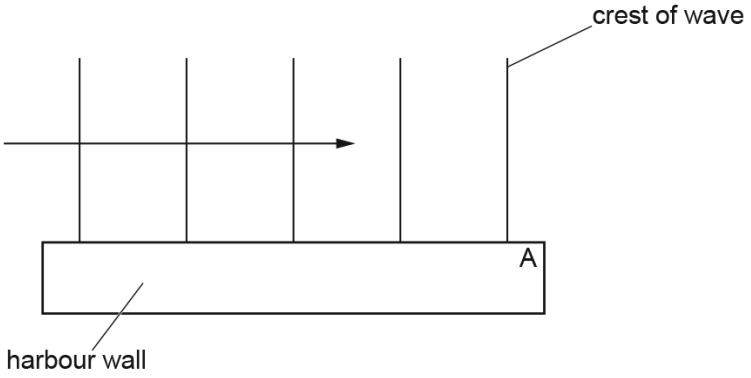

Fig. 6.1

(i) On Fig. 6.1, draw three more crests to the right of point A. [2]

(ii) State the name of the wave process that occurs as the wave passes point A.

..... [1]

(b) Fig. 6.2 shows the crests of another wave moving from left to right in a different part of the harbour. This wave moves from deep water to shallow water.

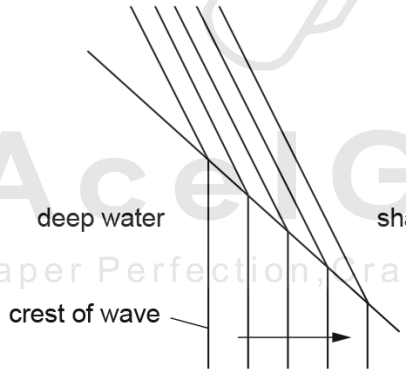

Fig. 6.2

(i) On Fig. 6.2, draw an arrow to show the direction of movement of the wave after it has passed into the shallow water. [1]

(ii) State the name of the process that occurs as the wave passes into the shallow water.

..... [1]

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(iii) Complete Table 6.1 to state whether each of the properties of the wave **increases**, **decreases** or **stays the same** as the wave passes into the shallow water.

Table 6.1

property	effect
wavelength	
frequency	
speed	

[3]

[Total: 8]

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05. 0625_w20_qp_42 Q: 6

Fig. 6.1 shows a transverse wave produced in a string.

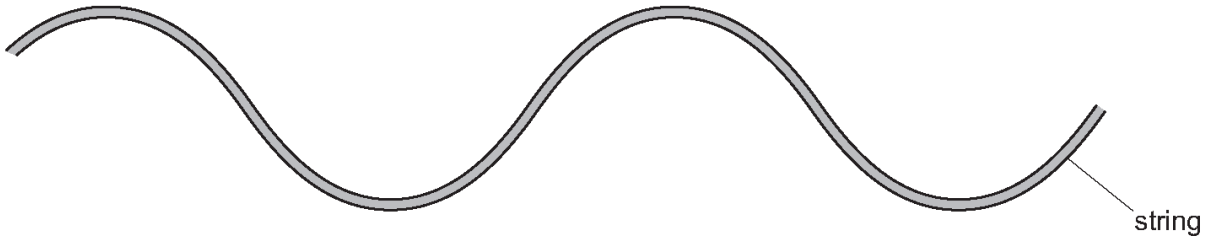

Fig. 6.1 (full size)

(a) On Fig. 6.1:

(i) draw labelled lines to show

1. the amplitude of the wave

2. the wavelength of the wave

[2]

(ii) label a trough with the letter T. [1]

(b) A person vibrates one end of the string vertically to produce the wave. He makes 15 complete oscillations in 60 s.

Show that the speed of the wave is 2.0 cm / s.

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[3]

(c) State the difference between transverse waves and longitudinal waves. Use your ideas about the direction of oscillations.

transverse waves .....

.....

longitudinal waves .....

.....

[2]

06. 0625_s18_qp_41 Q: 6

(a) Fig. 6.1 shows wavefronts approaching a gap in a barrier.

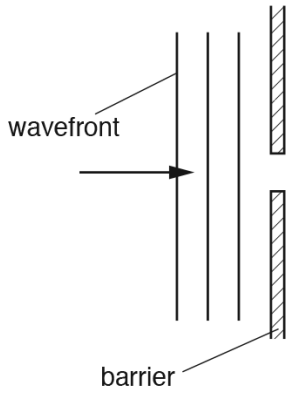

Fig. 6.1

(i) On Fig. 6.1, draw **three** wavefronts to the right of the barrier. [2]

(ii) Fig. 6.2 shows the gap in the barrier increased to five times the gap in Fig. 6.1.

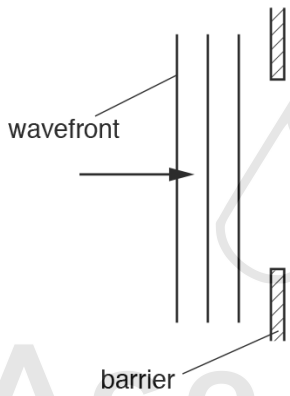

Fig. 6.2

On Fig. 6.2, draw **three** wavefronts to the right of the barrier. [2]

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(b) Describe, with a labelled diagram, an experiment using water waves that shows the reflection of wavefronts that occur at a straight barrier.

.....

.....

.....

.....

.....

.....[4]

[Total: 8]

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07. 0625_w18_qp_43 Q: 4

A wave is travelling across the surface of water in a tank at a speed of 0.15 m/s.

(a) The wavelength of the wave is 0.030 m.

Calculate the frequency of the wave.

frequency = ...[2]

(b) This water wave is a transverse wave.

(i) Explain what is meant by the term *transverse wave motion*.

.....

.....

.....

.....[3]

(ii) Draw a diagram that represents a transverse wave travelling from left to right across the page. On your diagram, label:

- the wavelength
- the amplitude.

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[3]

[Total: 8]

08. 0625_s17_qp_42 Q: 6

(a) The graph in Fig. 6.1 represents a wave on a rope.

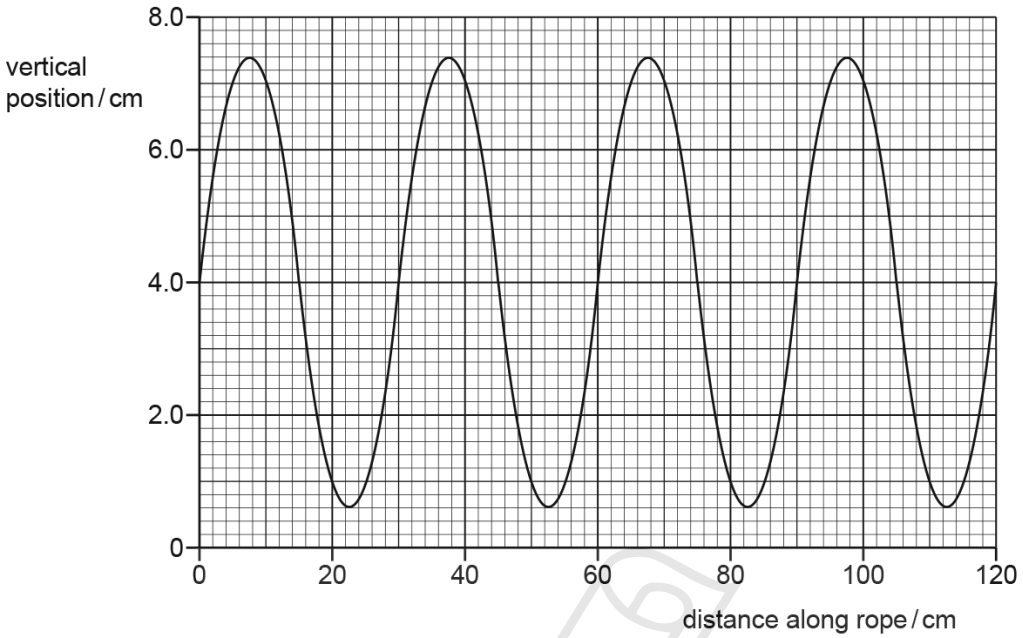

Fig. 6.1

Using Fig. 6.1, determine

(i) the amplitude of the wave,

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amplitude = ...[1]

(ii) the wavelength of the wave.

wavelength = ...[1]

(b) A wave travelling on the surface of water has a wavelength of 2.5 cm and a speed of 8.0 cm / s.

Calculate the frequency of the wave.

frequency = ...[2]

(c) The wave in **(b)** approaches a barrier that has a large gap in its centre.

Fig. 6.2 shows the crests of the wave viewed from above.

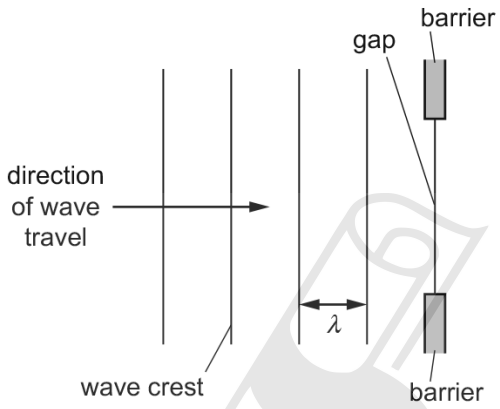

Fig. 6.2

The gap in the barrier is larger than the wavelength λ.

(i) On Fig. 6.2, draw the pattern formed by three crests after the wave passes through the gap in the barrier. [2]

(ii) Water is added to the tank and the speed of a wave in the deeper water is greater than that in the shallower water. The frequency of the wave remains constant but its wavelength is different.

1. State and explain how the wavelength in the deeper water has changed.

.....

.....[1]

2. Apart from the change in wavelength, describe **one** other difference in the pattern formed by the crests after the wave passes through the gap.

.....

.....[1]

[Total: 8]

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09. 0625_w17_qp_41 Q: 5

(a) A wave passes through a gap in a barrier. The wavelength of the wave is the same magnitude as the width of the gap in the barrier.

Tick **one** box to indicate what happens to the wave.

diffraction and dispersion	
diffraction only	
dispersion only	
refraction and diffraction	
refraction and dispersion	
refraction only	

[1]

(b) Fig. 5.1 shows six wavefronts of a wave travelling on the surface of deep water. The wave is incident on a boundary with a region where the water is shallow.

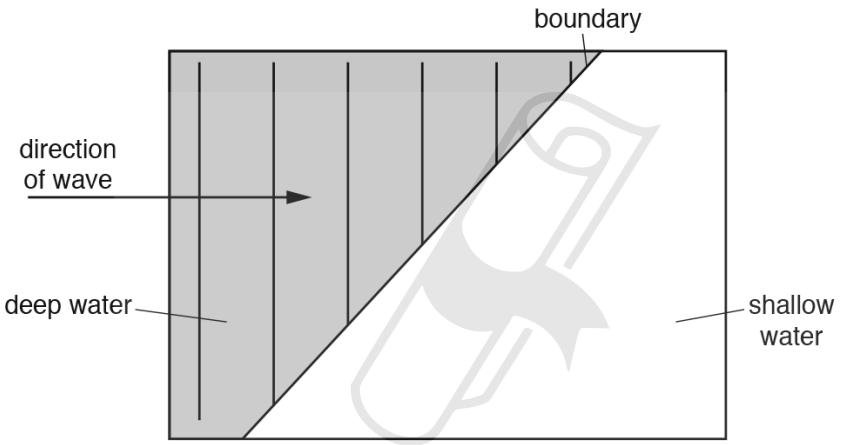

Fig. 5.1

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(i) On Fig. 5.1, draw the wavefronts of the wave in the shallow water where the wave travels more slowly. [2]

(ii) The depth of the shallow water is now changed so that the speed of the wave in the shallow water is 0.60 m/s. The speed of the wave in the deep water is 0.80 m/s.
The distance between successive wavefronts in the deep water is 1.4 cm.

Calculate the wavelength of the wave in the shallow water.

wavelength = ...[4]

[Total: 7]

10. 0625_w17_qp_42 Q: 6

Fig. 6.1 represents wavefronts of a water wave on the surface of water approaching a gap in a barrier.

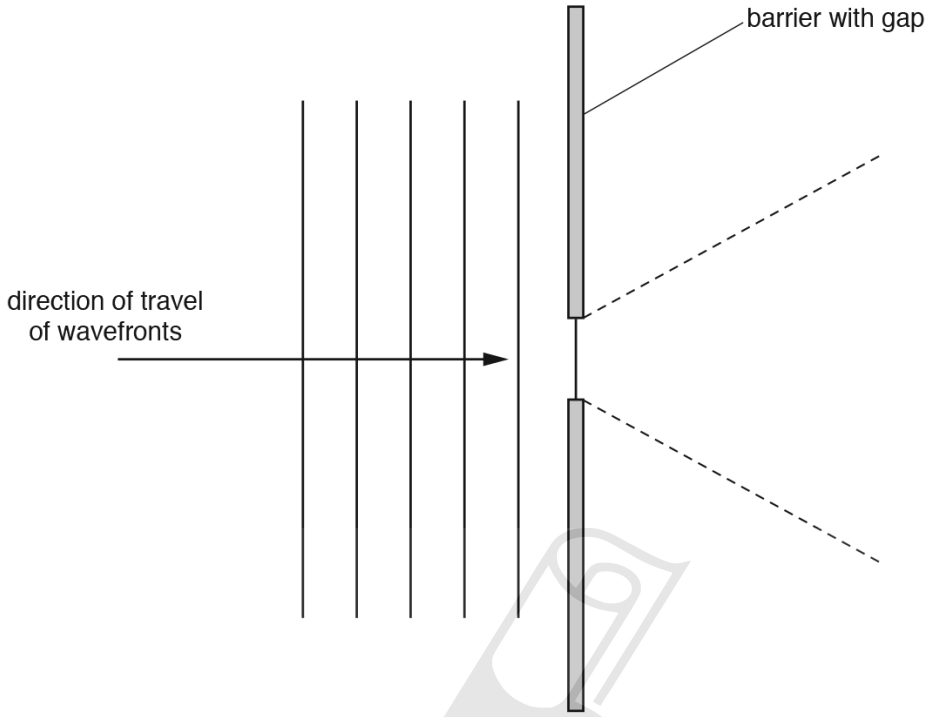

Fig. 6.1

(a) The wavefronts to the right of the barrier spread out as far as the dashed lines in Fig. 6.1.

(i) State the name of the process of spreading out.

.....[1]

(ii) Draw **four** wavefronts to the right of the barrier. [2]

(b) **(i)** State the effect of increasing the width of the gap in the barrier.

.....

.....[1]

(ii) State and explain the effect of decreasing the frequency of the water wave.

.....

.....

.....[2]

[Total: 6]

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