1 **(a)** Fig. 7.1 shows the surface of water in a tank.

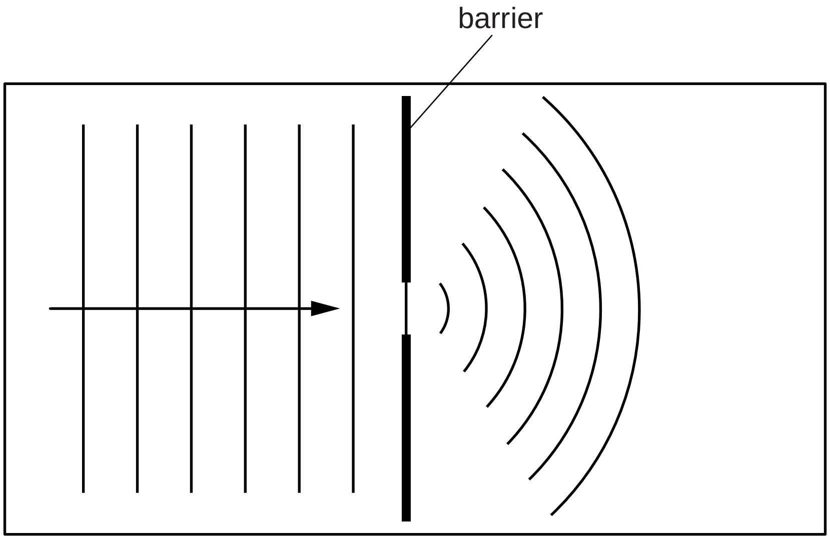

Fig. 7.1

Straight wavefronts are produced at the left-hand end of the tank and travel towards a gap in a barrier. Curved wavefronts travel away from the gap.

(i) Name the process that causes the wavefronts to spread out at the gap.

.... [1]

(ii) Suggest a cause of the reduced spacing of the wavefronts to the right of the barrier.

.... [1]

(iii) State how the pattern of wavefronts to the right of the barrier changes when the gap is made narrower.

.... [1]

(b) Fig. 7.2 shows a wave travelling, in the direction of the arrow, along a rope.

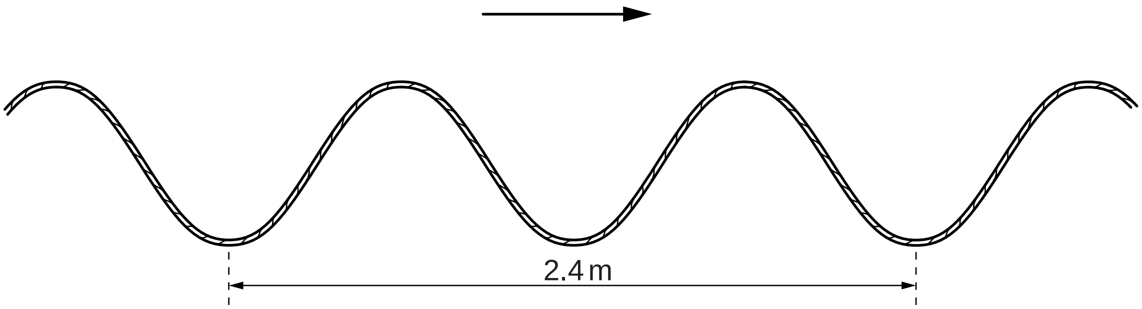

Fig. 7.2

(i) Explain why the wave shown in Fig. 7.2 is described as a *transverse* wave.

....

.... [1]

(ii) The speed of the wave along the rope is 3.2 m / s.

Calculate the frequency of the wave.

frequency = ... [3]

[Total: 7]

2 **(a)** Draw a straight line from each wave to the most appropriate speed on the right.

wave	speed
	15 m/s (1.5×10 m/s)
	300 m/s (3×10^2 m/s)
light in air	1500 m/s (1.5×10^3 m/s)
sound in air	1 500 000 m/s (1.5×10^6 m/s)
sound in water	300 000 000 m/s (3×10^8 m/s)
	1 500 000 000 m/s (1.5×10^9 m/s)

[3]

(b) Fig. 6.1 shows a railway-line testing-team checking a continuous rail of length 120 m. The diagram is not to scale.

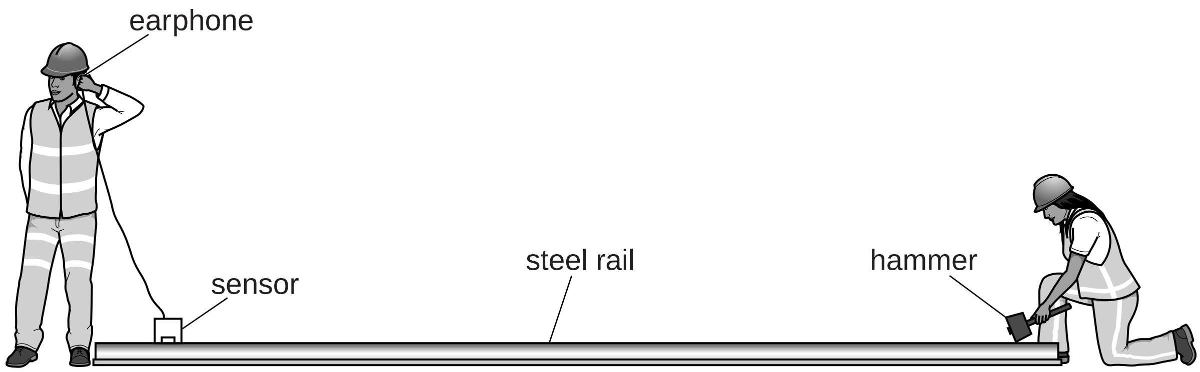

Fig. 6.1 (not to scale)

One tester strikes one end of the rail with a hammer. The other tester hears the sound transmitted through the air and transmitted through the rail. He hears the two sounds at different times.

The speed of sound in steel is 5000 m / s.

Calculate the time difference, using your value from **(a)** for the speed of sound in air.

time difference = ... [4]

[Total: 7]

3 **(a)** A wave passes along the surface of the water in a ripple tank. Describe the motion of a molecule on the surface as the wave passes.

....

.... [1]

(b) Fig. 7.1 shows a view from above of water waves approaching a narrow gap in a barrier. The water on both sides of the barrier has the same depth.

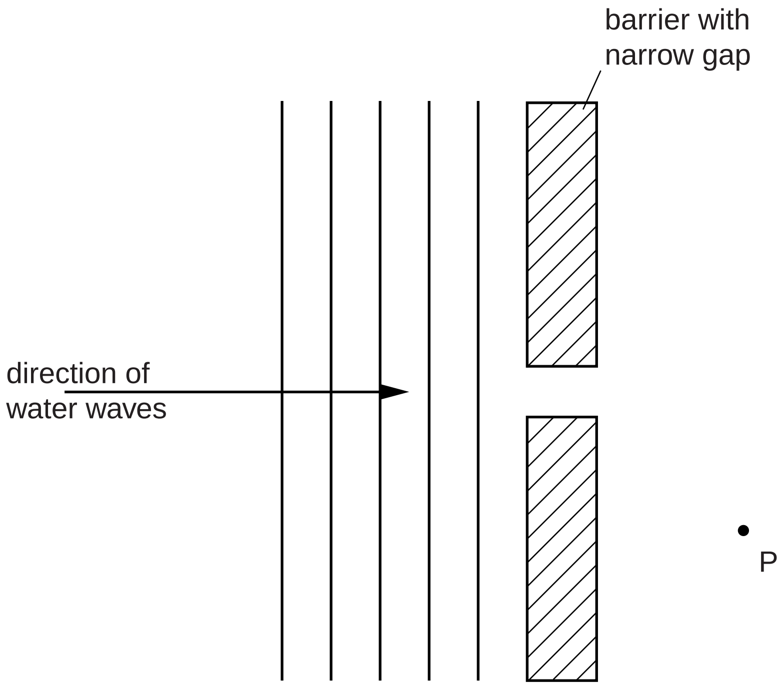

Fig. 7.1

(i) On Fig. 7.1, sketch the pattern of waves in the region to the right of the barrier. [2]

(ii) State the process by which waves arrive at point P to the right of the barrier.

.... [1]

(c) The waves approaching the barrier in Fig. 7.1 have a wavelength of 1.4 cm and travel at a speed of 12 cm / s.

Calculate the frequency of the waves.

frequency = ... [2]

[Total: 6]

4 Fig. 5.1 shows a view from above of waves on the surface of water in a water tank.

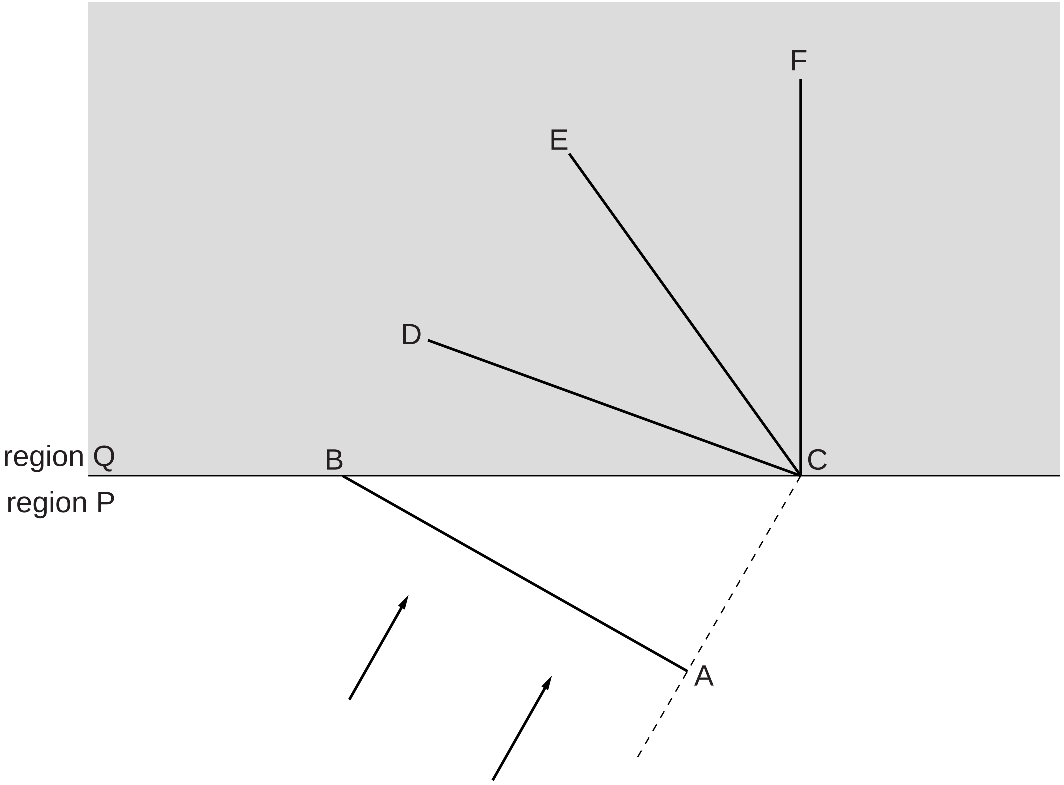

Fig. 5.1

The wavefront AB is travelling in region P towards region Q, where the water is shallower and the waves travel more slowly.

(a) Some time later, the wavefront has moved into region Q.

CD, CE and CF are suggested positions of the new wavefront.

(i) State which is the correct position of the new wavefront.

....

(ii) Explain your answer to **(i)**.

....

....

....

....

[4]

(b) Fig. 5.2 shows the waves after a change is made to the way the tank is set up, and the experiment is repeated.

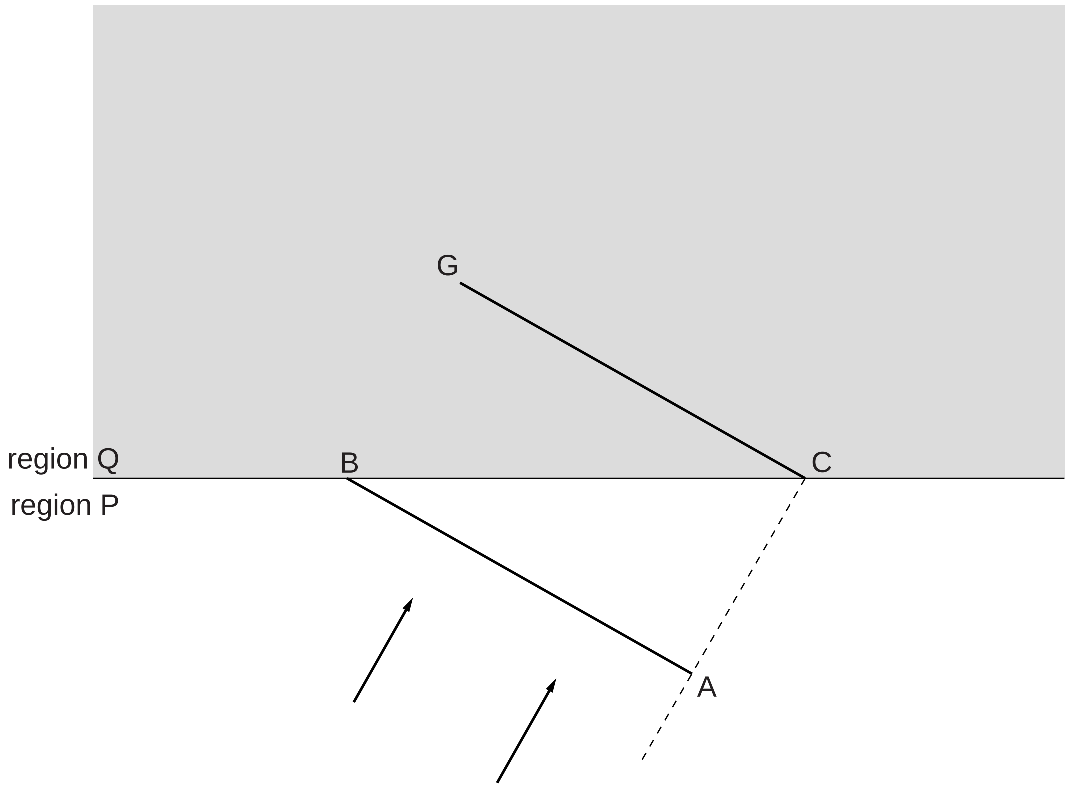

Fig. 5.2

The wave from position AB in region P now moves to position CG in region Q.

State the change that has been made and explain your reasoning.

change ....

explanation ....

....

.... [2]

[Total: 6]

5 **(a)** The speed of light in air is known to be 3.0×10^8 m/s.

Outline how you would use a refraction experiment to deduce the speed of light in glass. You may draw a diagram if it helps to clarify your answer.

....

....

....

....

....

....[4]

(b) A tsunami is a giant water wave. It may be caused by an earthquake below the ocean.

Waves from a certain tsunami have a wavelength of 1.9×10^5 m and a speed of 240 m/s.

(i) Calculate the frequency of the tsunami waves.

frequency = ...[2]

(ii) The shock wave from the earthquake travels at 2.5×10^3 m/s.

The centre of the earthquake is 6.0×10^5 m from the coast of a country.

Calculate how much warning of the arrival of the tsunami at the coast is given by the earth tremor felt at the coast.

warning time = ...[4]

[Total: 10]

6 **(a)** **(i)** A long rope, fixed at one end, is being used by a student to demonstrate transverse waves.
State what the student does to the rope to produce the transverse wave.

....

....[1]

(ii) Fig. 6.1 shows a section of the rope when the transverse wave is present.

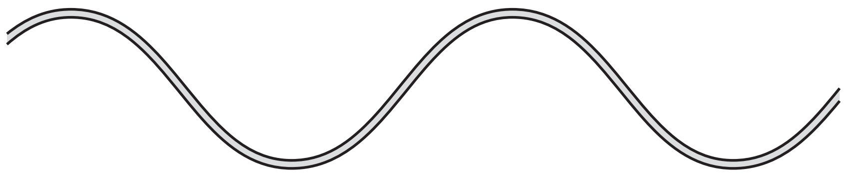

Fig. 6.1

On Fig. 6.1, show

1. a distance, labelled λ, corresponding to the wavelength of the wave,

2. a distance, labelled *A*, corresponding to the amplitude of the wave. [2]

(iii) Suggest what the student could do to reduce the wavelength of the wave.

....

....[1]

(b) The diagram in Fig. 6.2 represents waves on the surface of water in a ripple tank. The waves are travelling from deep water across a boundary into shallow water.

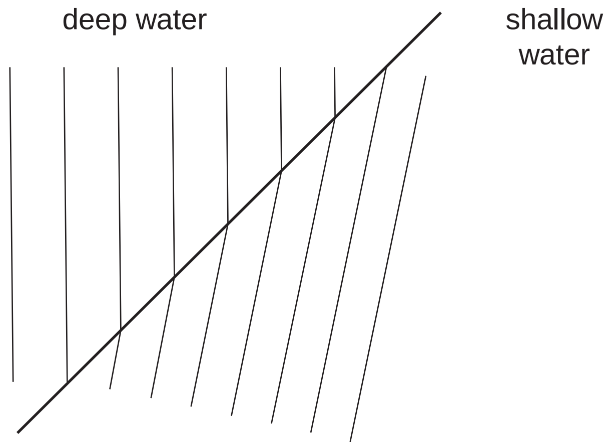

Fig. 6.2

Explain how the diagram shows that water waves travel more slowly in shallow water than in deep water.

....

....

....

.... [3]

[Total: 7]