

Sound

Question Paper 1

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	Properties of Waves including Light and Sound
Sub-Topic	Sound
Paper Type	(Extended) Theory Paper
Booklet	Question Paper 1

Time Allowed: 57 minutes

Score: /47

Percentage: /100

- 1 (a) Two students are measuring the speed of sound.

The students are provided with a starting pistol, a stopwatch and a long measuring tape. The starting pistol, when fired, produces a loud sound and a puff of smoke at the same instant.

Describe how the students use the apparatus and how they calculate the speed. You may draw a diagram.

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(b) A device at the bottom of the sea emits a sound wave of frequency 200 Hz.

(i) The speed of sound in sea-water is 1500 m/s.

Calculate the wavelength of the sound in sea-water.

wavelength = [2]

(ii) The sound wave passes from the sea-water into the air.

State what happens, if anything, to

- the frequency of the sound,
- the speed of the sound.

[2]

[Total: 8]

2 (a) Fig. 6.1 represents the waveform of a sound wave. The wave is travelling at constant speed.

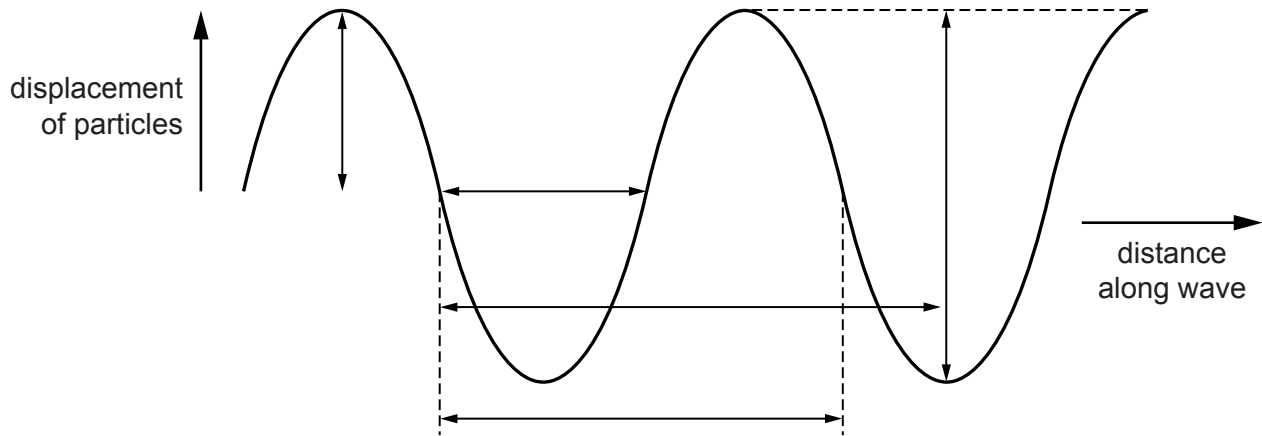


Fig. 6.1

(i) On Fig. 6.1,

1. label with the letter X the marked distance corresponding to the amplitude of the wave, [1]
2. label with the letter Y the marked distance corresponding to the wavelength of the wave. [1]

(ii) State what happens to the amplitude and the wavelength of the wave if

1. the loudness of the sound is increased at constant pitch,
 amplitude [1]
 wavelength
2. the pitch of the sound is increased at constant loudness.
 amplitude [1]
 wavelength

(b) A ship uses pulses of sound to measure the depth of the sea beneath the ship. A sound pulse is transmitted into the sea and the echo from the sea-bed is received after 54 ms. The speed of sound in seawater is 1500 m/s.

Calculate the depth of the sea beneath the ship.

depth = [3]

[Total: 7]

3 (a) A sound wave in air consists of alternate compressions and rarefactions along its path.

(i) Explain how a compression differs from a rarefaction.

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

(ii) Explain, in terms of compressions, what is meant by

1. the wavelength of the sound,

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

2. the frequency of the sound.

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

(b) At night, bats emit pulses of sound to detect obstacles and prey. The speed of sound in air is 340m/s.

(i) A bat emits a pulse of sound of wavelength 0.0085 m.

Calculate the frequency of the sound.

frequency =[2]

(ii) State why this sound cannot be heard by human beings.

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

(iii) The pulse of sound hits a stationary object and is reflected back to the bat. The pulse is received by the bat 0.12s after it was emitted.

Calculate the distance travelled by the pulse of sound during this time.

distance =[2]

[Total: 8]

- 4 A sound wave, travelling in air, approaches a solid barrier with a gap in the middle. Fig. 6.1 represents the compressions and rarefactions of the sound wave. The compressions are labelled A, B and C.

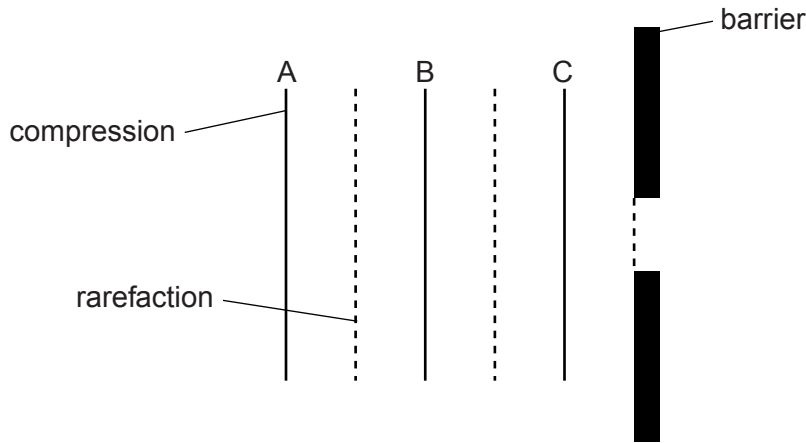


Fig. 6.1

- (a) State how a *compression* differs from a *rarefaction*.

.....
 [1]

- (b) The speed of sound in air is 340 m/s. The frequency of the sound is 850 Hz.

For this wave, determine

- (i) the wavelength,

wavelength = [2]

- (ii) the time that elapses before compression A reaches the barrier.

time = [2]

- (c) On Fig. 6.1, draw the shape and positions of compressions B and C as compression A reaches the barrier. [2]

- (d) Sound waves can also travel in water.

State how the speed of sound in water compares with the speed of sound in air.

..... [1]

5 A dolphin produces a sound wave in water of frequency 7800 Hz.

Fig. 6.1 represents rarefactions of the sound wave travelling in the water and hitting the side of a wooden ship at an angle.

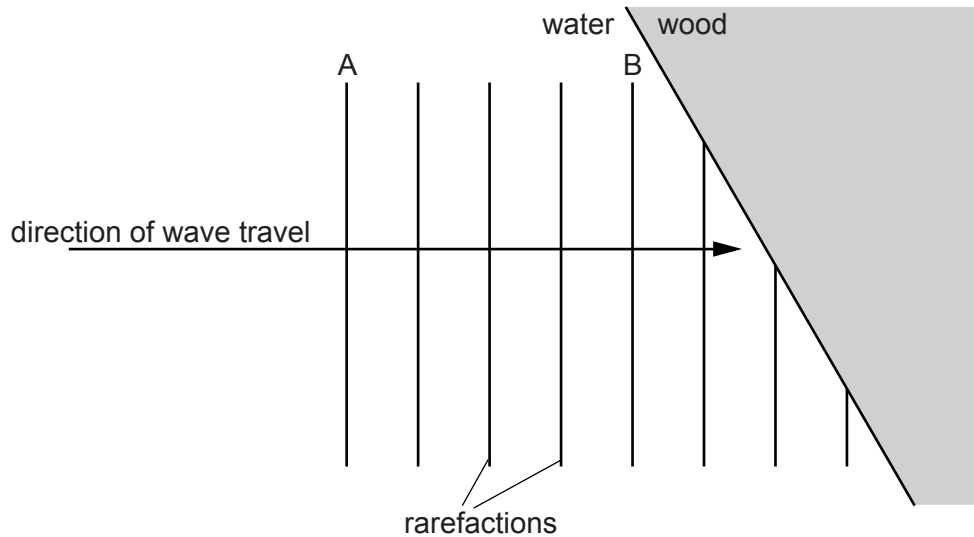


Fig. 6.1

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

.....
 [1]

(b) On Fig. 6.1, two rarefactions A and B are labelled. The distance between rarefaction A and rarefaction B is 0.76 m.

Determine

(i) the wavelength in water of the sound wave,

wavelength = [1]

(ii) the time taken for the rarefaction at A to reach the point where rarefaction B is now positioned.

time = [2]

(c) The sound wave passes from the water into the wood where the speed of sound is greater.

State what happens to

(i) the frequency,

.....[1]

(ii) the wavelength.

.....[1]

(d) On Fig. 6.1, sketch the positions in the wood of the three incomplete rarefactions. [2]

[Total: 8]

- 6 (a) Draw a straight line from each quantity on the left-hand side to a speed on the right-hand side which is typical for that quantity.

	30 m/s
speed of sound in gas	300 m/s
	3000 m/s
speed of sound in solid	30 000 m/s
	300 000 m/s

[2]

- (b) Explain why sound waves are described as *longitudinal*.

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

- (c) Fig. 8.1 shows how the displacement of air molecules, at an instant of time, varies with distance along the path of a sound wave.

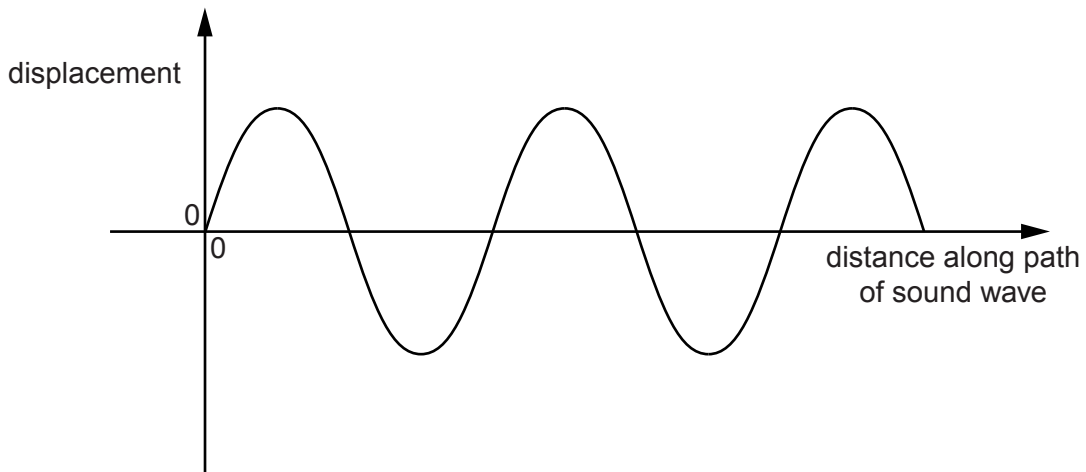


Fig. 8.1

(i) On Fig. 8.1, sketch two cycles of a sound wave that has a shorter wavelength **and** a greater amplitude. [2]

(ii) State **two** changes in the sound heard from this wave compared with the original wave.

1.

2.

[2]

[Total: 8]