Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Sound

Time allowed: 1 hour

Subject code **0625**

Physics

Questions from Paper 3 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.

Total marks

/ 64

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.

Information

- This paper has 10 questions worth 64 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1 A student strikes a tuning fork on a wooden block. The tuning fork is held close to the students' ear as shown in Fig. 8.1.



Fig. 8.1

(a) Describe how the tuning fork produces sound.

..... [1]

(b) State the normal frequency range of sounds that humans can hear. Give the unit.

from ..... to ..... [2]

(c) Two students determine a value for the speed of sound in air. Fig. 8.2 illustrates the method they use.

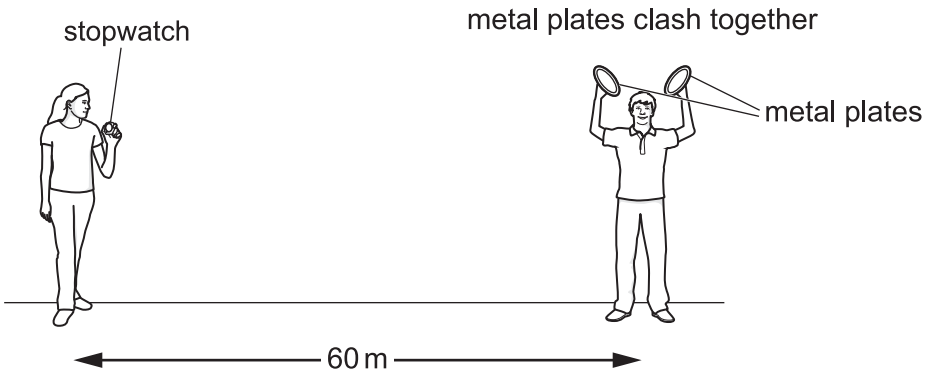


Fig. 8.2 (Not to scale)

The girl starts the stopwatch when she sees the metal plates clash together. She stops the stopwatch when she hears the sound of the clashing metal plates. The students use the time on the stopwatch to calculate the speed of sound.

The value for the speed of sound obtained by the students is different from the true value for the speed of sound in air.
Explain why the students' value is different.

.....

.....

..... [1]

[Total: 4]

Sound Click for more variations

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2 A stretched string is vibrating between two fixed ends. Fig. 8.1 shows how the string is vibrating.

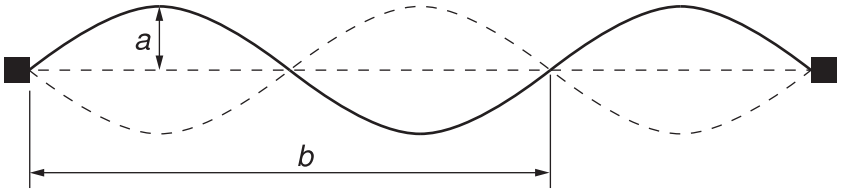


Fig. 8.1

(a) State the name of

(i) distance *a*, ... [1]

(ii) distance *b*. ..... [1]

(b) The string is causing a sound to be transmitted through the air.

(i) Describe how the string causes the sound.

.....

.....

.....

.....

..... [2]

(ii) State what happens to the sound as the distance *a* decreases.

.....

..... [1]

[Total: 5]

Properties of waves Click for more variations

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3 A sound wave is a longitudinal wave.

Fig. 7.1 shows a spring being used to demonstrate a longitudinal wave.

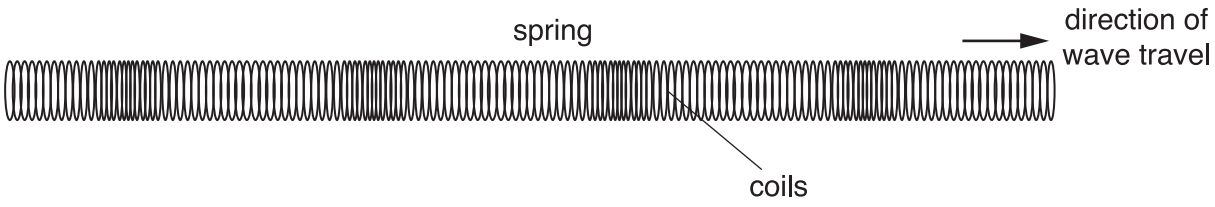


Fig. 7.1

(a) The coils of the spring vibrate.

Draw **two** arrows on Fig. 7.1 to show the directions of the vibrations. [2]

(b) Through which of these is sound **not** able to travel? Tick **one** box.

- ☐ air
- ☐ steel
- ☐ vacuum
- ☐ water

[1]

(c) **(i)** Very old people cannot hear the highest frequencies of sound that can be heard by young people.

Suggest the highest frequency that very old people can hear.

.....[2]

(ii) State the meaning of the term *ultrasound*.

.....[1]

[Total: 6]

Properties of waves Click for more variations

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4 A metal rail is 330 m long. Sound travels at 5000 m/s in the metal.

(a) Calculate the time taken for a sound to travel the length of the rail.

time taken = ... s [3]

(b) Sound in air takes 1.0 s to travel 330 m.

As shown in Fig. 6.1, a man puts his right ear against one end of the rail. Another man strikes the other end of the rail with a hammer.

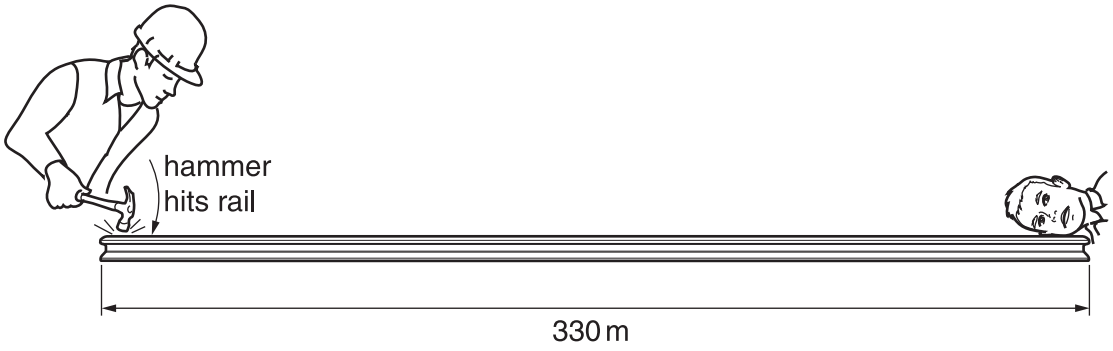


Fig. 6.1 (not to scale)

Describe and explain what each man hears.

man with hammer .....

.....

man with one ear against rail.....

.....

.....

[3]

[Total: 6]

Motion Click for more variations

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5 A boat is using echo-sounding equipment to measure the depth of the water underneath it, as illustrated in Fig. 6.1.

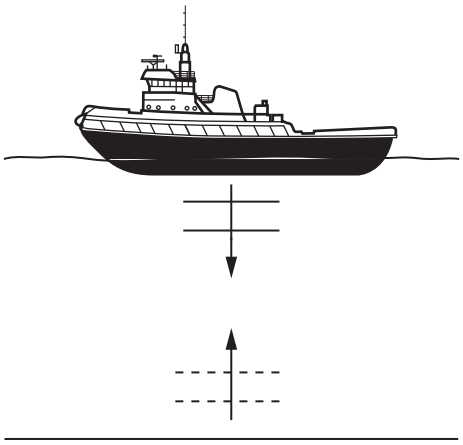


Fig. 6.1

(a) The equipment in the boat sends a short pulse of sound downwards and detects the echo after a time interval of 0.80 s.

(i) Describe how an echo is caused.

.....

.....

.....[2]

(ii) The speed of sound in water is 1500 m/s.
Calculate the distance travelled by the sound in 0.80 s.

distance travelled = ... m [3]

(iii) State the depth of water under the boat.

depth = ...m [1]

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(b) The boat is sailing away from the shore. The depth of water increases uniformly with distance from the shore.

On Fig. 6.2, sketch a graph that shows how the time interval to hear the echo might change as the distance from the shore changes.

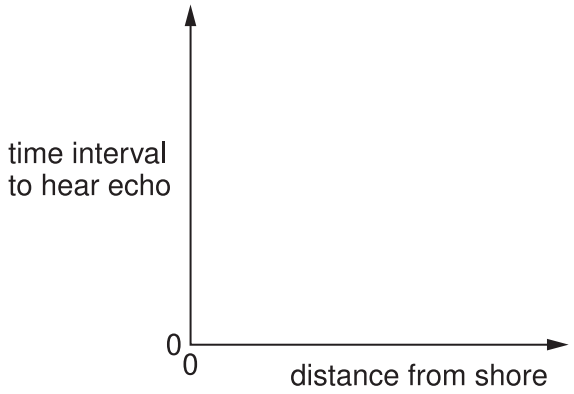


Fig. 6.2

[2]

[Total: 8]

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6 Ultrasound is an example of a longitudinal wave.

(a) Define the term ultrasound.

..... [1]

(b) Describe what is meant by a longitudinal wave.

.....

..... [1]

(c) Ultrasound is used to locate objects below the surface of the sea.

(i) Describe how ultrasound is used to locate an object below the surface of the sea.

You may draw a labelled diagram as part of your answer.

.....

.....

.....

.....

[3]

(ii) State **one** other use of ultrasound.

.....

..... [1]

[Total: 6]

Sound Click for more variations

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7 A fisherman uses high frequency sound waves to locate fish in the sea. Fig. 8.1 shows the sound waves emitted from the boat.

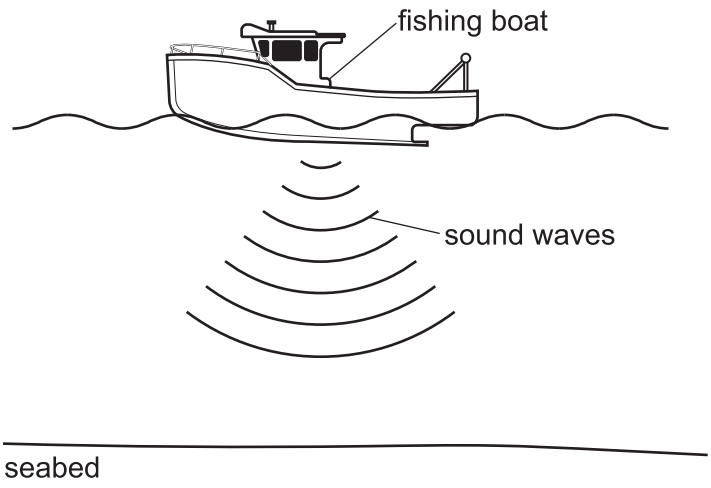


Fig. 8.1 (not to scale)

(a) State the name of sound waves which have a frequency greater than 20 kHz.

..... [1]

(b) High frequency sound waves travel from the boat through the sea water.
The speed of sound in water is 1500 m / s. The seabed is 22 m below the boat.

Calculate the time taken for the boat to receive the reflected wave from the seabed after the sound is emitted.

time = ... [3]

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(c) Fig. 8.2 shows a fish below the boat.

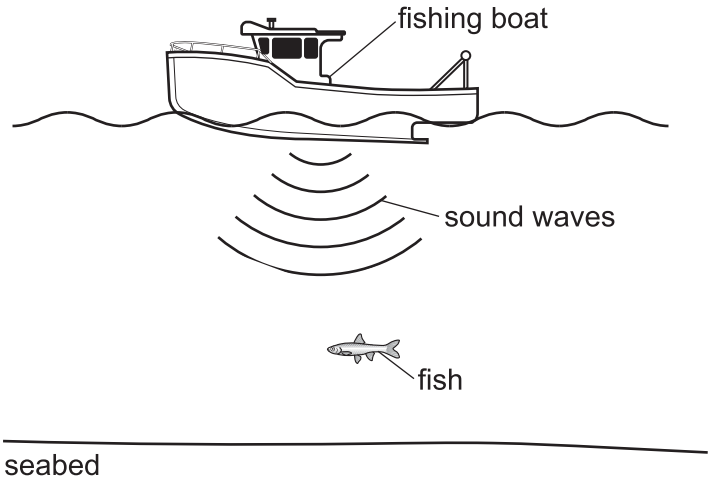


Fig. 8.2 (not to scale)

Describe and explain how the reflected sound wave received by the boat from the fish differs from the reflected sound wave received from the seabed.

.....

.....

..... [2]

[Total: 6]

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8 **(a)** **(i)** State a typical value for the speed of sound in air.

speed = ...[1]

(ii) State the range of frequencies that can be heard by a healthy human ear.

.....[1]

(b) A sound wave in air has a wavelength of 22 mm.

Fig. 6.1 represents wavefronts of this sound. These wavefronts are successive compressions.

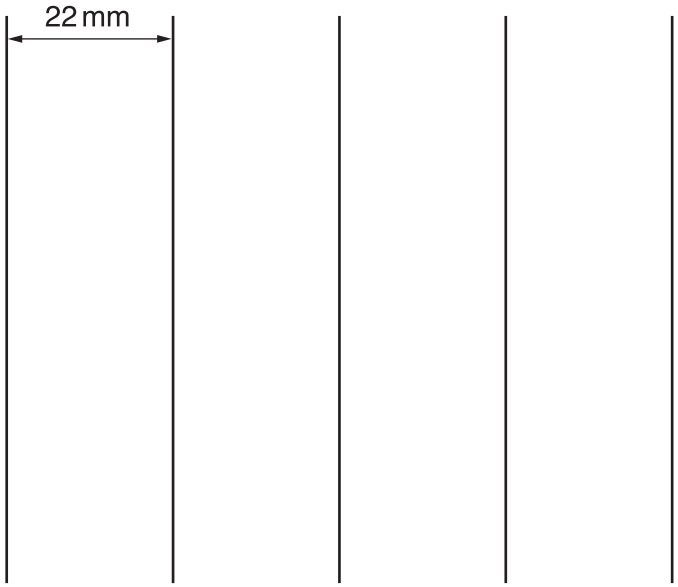


Fig. 6.1

(i) Using your value for the speed of sound in **(a)(i)**, calculate the frequency of the sound wave.

frequency = ...[2]

(ii) On Fig. 6.1, draw dotted lines to represent **three** different rarefactions. [1]

(iii) State, in terms of both molecules and pressure, what is meant by a *rarefaction*.

.....

.....

.....

.....[2]

[Total: 7]

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9 **(a)** State the range of frequencies of sound which can be heard by a healthy human ear.

.....[1]

(b) Compressions and rarefactions occur along the path of sound waves.

State, in terms of the behaviour of molecules, what is meant by

(i) a *compression*,

.....

.....

(ii) a *rarefaction*.

.....

.....

[2]

(c) State the effect on what is heard by a listener when there is

(i) an increase in the amplitude of a sound,

.....[1]

(ii) a decrease in the wavelength of a sound.

.....[1]

(d) A student carries out an experiment to find the speed of sound in air.

He stands facing a high cliff and shouts. He hears the echo 1.9 s later.

He then walks 250 m further away from the cliff and shouts again, hearing the echo 3.5 s later.

Calculate the speed of sound given by this experiment.

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speed = ...[3]

[Total: 8]

Sound Click for more variations

10 A dolphin communicates with other dolphins underwater by emitting sounds in the range 7–15 kHz.

(a) State the value of the speed of sound in air and state how the speed of sound in water differs from the speed of sound in air.

speed of sound in air ..... m/s

speed of sound in water .....

[1]

(b) State and explain if humans with normal hearing can hear all the sounds emitted by the dolphin.

statement .....

explanation .....

.....

[2]

(c) Complete Table 5.1 to describe differences in loudness and pitch of two different dolphin sounds.

Table 5.1

Frequency /kHz	amplitude	loudness	pitch
14	large		
8	small		

[2]

(d) Complete the sentences to describe how sound is transmitted through water.

Sound waves are made of vibrating ..... which produce compressions and rarefactions. A compression is a region of ..... and a rarefaction is a region of ..... . The sound waves travel ..... to the direction of the vibrations.

[3]

[Total: 8]

Sound Click for more variations

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