

Waves in Air-Fluids-Solids

Question Paper

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.6 Waves
Sub-Topic	Waves in Air-Fluids-Solids
Difficulty Level	Silver Level
Booklet	Question Paper

Time Allowed: 53 minutes

Score: /52

Percentage: /100

Grade Boundaries:

Q1. A baby monitor has a sensor unit that transmits an image of the baby and the noises the baby makes to a monitor unit.

The monitor unit then displays an image of the baby and emits the noises the baby makes.

- (a) Compare the properties of the waves that transmit images and noises from the monitor unit.

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(4)

- (b) The sensor unit can detect infrared and visible light.

Suggest **one** advantage of being able to detect infrared.

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(1)

- (c) Write down the equation that links frequency, wave speed and wavelength.

Equation

(1)

- (d) The signals for the monitor unit are transmitted as electromagnetic waves with a wavelength of 0.125 m.

Wave speed of electromagnetic waves = 3×10^8 m / s

Calculate the frequency of the signal.

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Frequency = Hz

(3)
(Total 9 marks)

Q2.A note was played on an electric keyboard.

The frequency of the note was 440 Hz.

- (a) (i) What does a frequency of 440 Hz mean?

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(1)

- (ii) The sound waves produced by the keyboard travel at a speed of 340 m / s.

Calculate the wavelength of the note.

Give your answer to **three** significant figures.

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Wavelength = metres

(3)

- (b) **Figure 1** shows a microphone connected to a cathode ray oscilloscope (CRO) being used to detect the note produced by the keyboard.

Figure 1

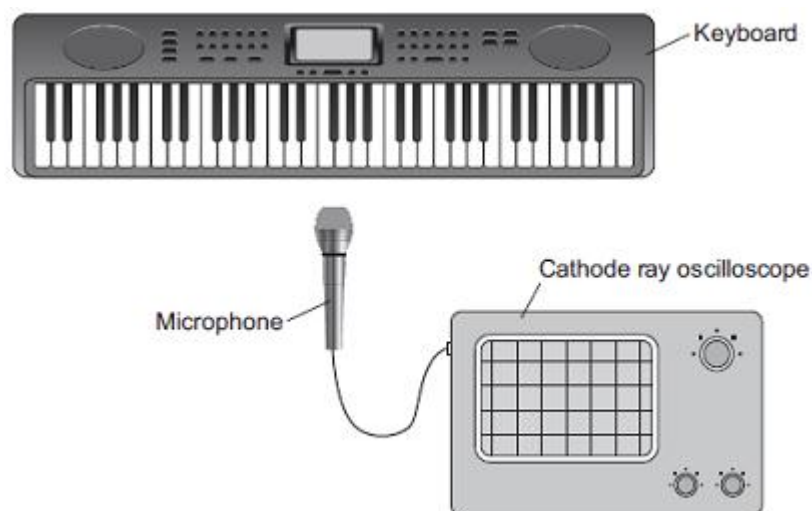
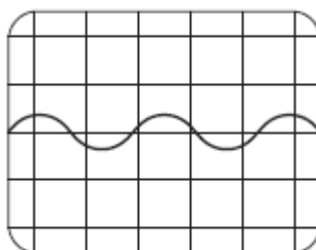


Figure 2 shows the trace produced by the sound wave on the CRO.

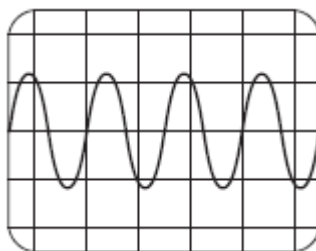
Figure 2



A second note, of different wavelength, was played on the keyboard.

Figure 3 shows the trace produced by the sound wave of the second note on the CRO.

Figure 3



The settings on the CRO were unchanged.

What **two** conclusions should be made about the **second** sound wave produced by the keyboard compared with the **first** sound wave?

Give a reason for each conclusion.

Conclusion 1

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Reason

.....

Conclusion 2

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Reason

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(4)
(Total 8 marks)

Q3.Waves may be longitudinal or transverse.

- (a) Describe the differences between longitudinal waves and transverse waves.

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(3)

- (b) Radio waves are electromagnetic waves.

Describe how radio waves are different from sound waves.

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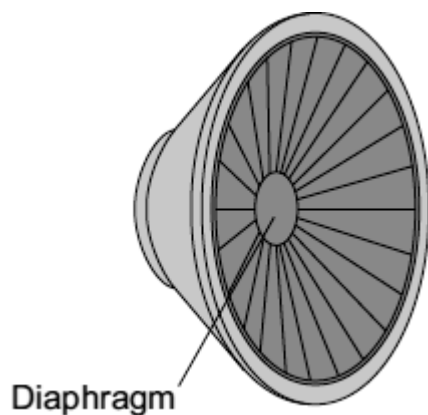
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(4)
(Total 7 marks)

Q4. The diaphragm of a loudspeaker moves in and out.

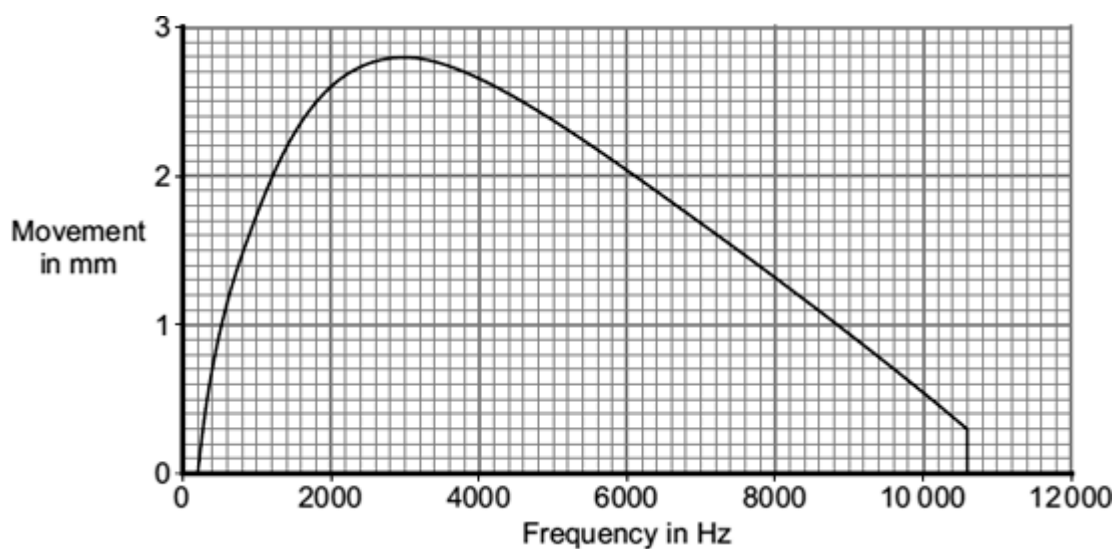


A team of scientists investigated loudspeakers.

The scientists measured the size of the movement of the diaphragm for signals of different frequencies.

They kept all the other variables constant.

The graph shows the average results for a large number of tests on one of the loudspeakers.



- (a) What is the frequency of the highest pitched sound which this loudspeaker produces?

Frequency = Hz

(1)

- (b) The greater the movement of the diaphragm, the greater the amplitude of the sound produced.

What is the frequency of the loudest sound which this loudspeaker produces?

Show clearly on the graph how you get to your answer and then complete this answer space.

Frequency = Hz

(2)

- (c) Can this loudspeaker produce the full range of sound which most people can hear?

Put a tick (✓) in the box next to your answer.

Yes ☐

No ☐

Explain the reason for your answer.

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(2)

- (d) Use **one** word to complete the sentence.

Repeating tests a large number of times and taking the average of the results improves the

(1)

- (e) Why did the scientists keep all the other variables constant?

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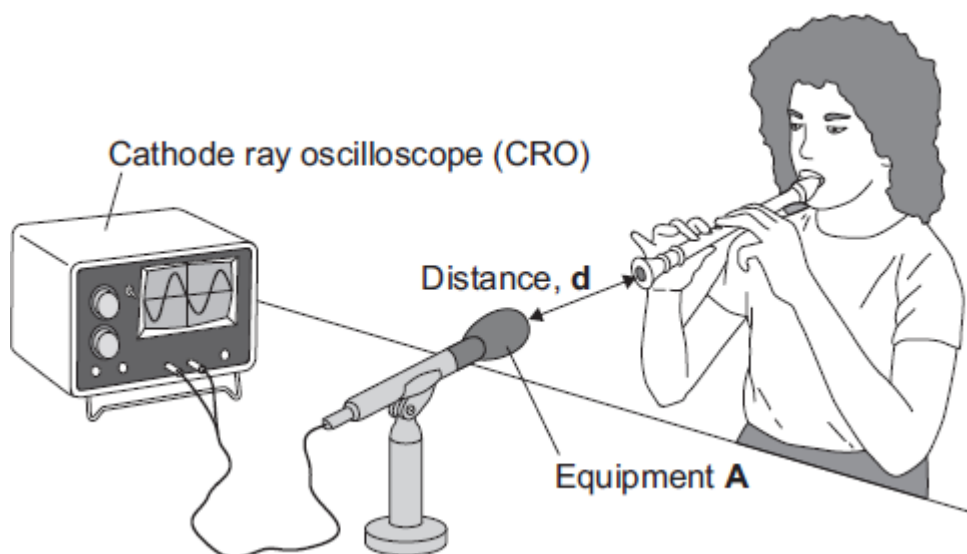
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(1)

(Total 7 marks)

Q5. A group of students investigates sound waves.

The diagram shows part of their investigation.



- (a) Identify the equipment labelled **A**.

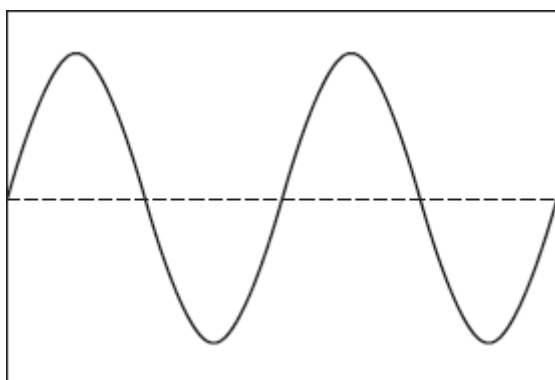
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(1)

- (b) The student plays the same note in the same way at different distances from equipment **A**.

Another student records the amplitude of the wave shown on the cathode ray oscilloscope (CRO).

- (i) Label this wave to show its amplitude.



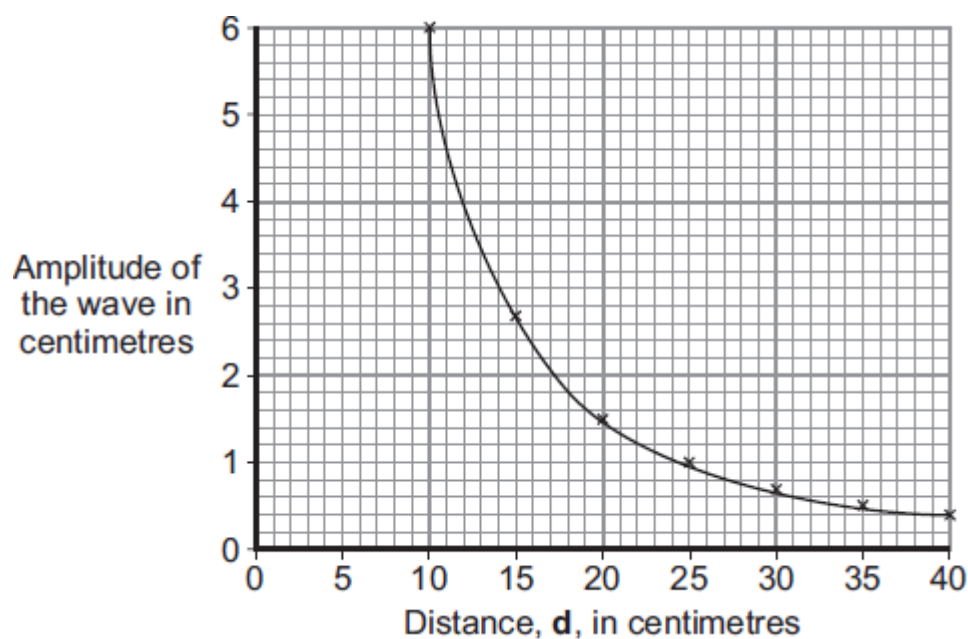
(1)

- (ii) Complete the sentence.

Increasing the amplitude of a sound wave will increase the
of the sound.

(1)

- (c) The graph shows the students' average results from several sets of measurements.



Use the graph to find the distance, d , in centimetres, at which the average amplitude is likely to be 2 centimetres.

Distance = cm.

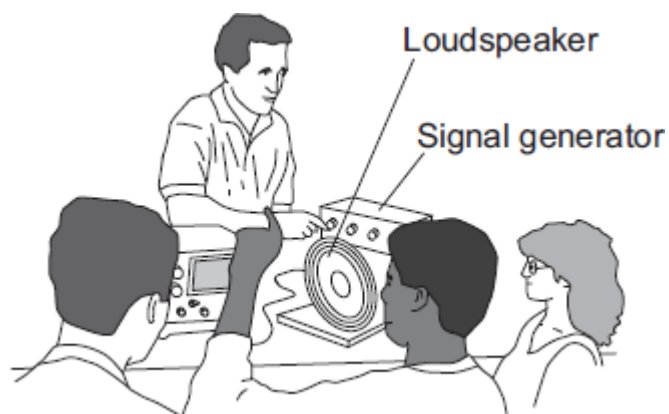
(1)

- (d) Write a conclusion for this investigation.

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(1)

- (e) A physics teacher uses a signal generator and a loudspeaker to demonstrate the range of hearing of a group of students.



What is the range of frequencies most humans can hear?

Most humans can hear from Hz to Hz.

(2)
(Total 7 marks)

Q6. When sound waves reach a material, some of the energy of the sound is reflected and some is transmitted through the material.

(a) Complete the sentence.

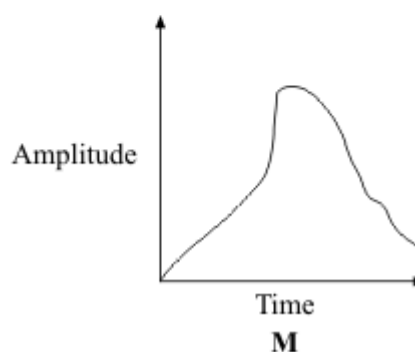
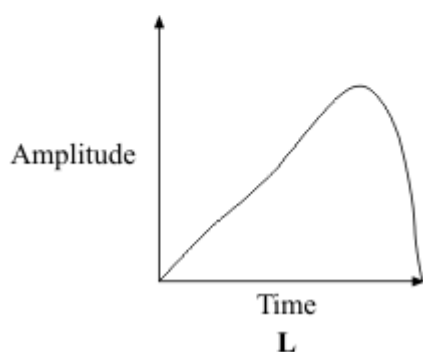
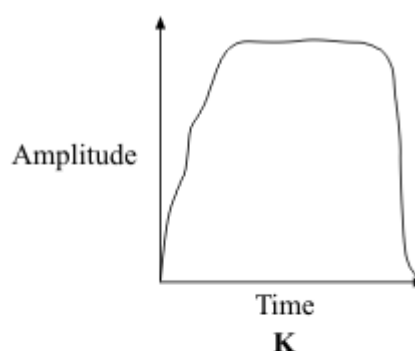
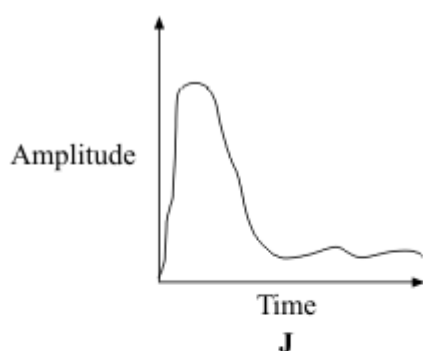
Sound waves are caused by

(1)

(b) The graphs **J**, **K**, **L** and **M** represent the sound energy reflected from a surface.

The graphs are all drawn to the same scale.

Which graph shows the greatest total sound energy output from the surface?



Graph

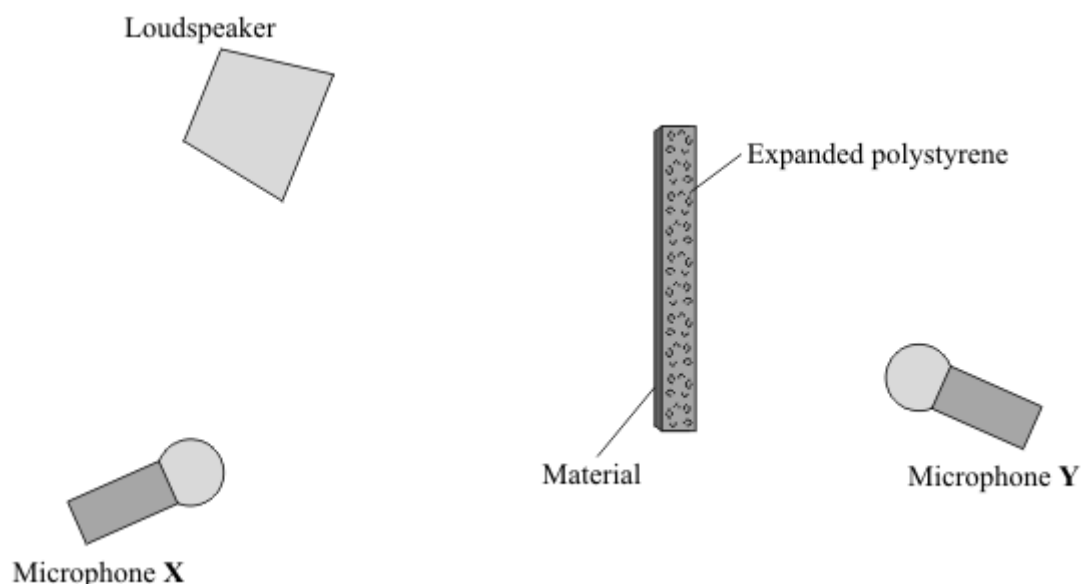
(1)

- (c) The proportion of the sound energy which is reflected or transmitted depends on the material which receives the sound.

A student investigates different materials.

The diagram shows how a student sets up her equipment.

- (i) Using a pencil and ruler to draw on the diagram, show how microphone **X** receives reflected sound.



(2)

- (ii) The student tests four materials. Each sheet of material is 1 mm thick. This has been glued onto a block of expanded polystyrene.

Why does the student use the same size of expanded polystyrene block and the same sound level for each test?

.....

(1)

- (iii) The table shows the readings for the sound level transmitted to microphone Y.

Soundlevel from loudspeaker in arbitrary units	Surface material	Soundlevel transmitted to microphone Y in arbitrary units
60	paper	39
60	plaster	18
60	cloth	31
60	wood	15

- [A] Which surface material transmits the smallest proportion of the sound?

.....

(1)

- [B] What proportion is this?

.....

(1)

- (d) People living in a flat have very noisy neighbours who are always playing loud music.

Suggest **one** practical idea to reduce the amount of noise transmitted into the flat through the walls and explain how your idea will work.

.....

(2)

(Total 9 marks)

Q7. Most young people can hear sounds in the frequency range 20 Hz to 20 000 Hz.

(a) Tick the box beside the statement which best describes frequency.

the maximum disturbance caused by a wave

☐

the number of complete vibrations per second

☐

the distance between one crest of a wave and the next one

☐

the distance travelled by a wave in 1 second

☐

(1)

(b) Diagram **X** shows a trace on an oscilloscope screen.

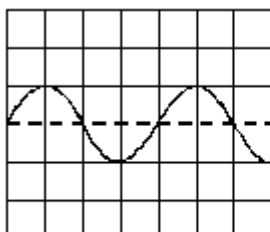


Diagram **X**

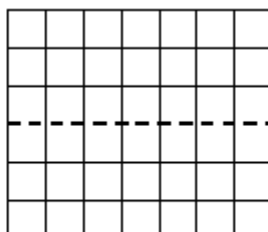


Diagram **Y**

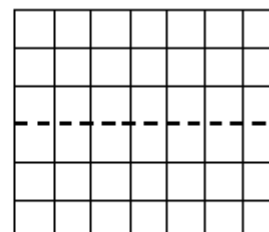


Diagram **Z**

(i) Draw a trace on diagram **Y** which has a higher frequency than that shown in diagram **X**.

(ii) Draw a trace on diagram **Z** which has a larger amplitude than that shown in diagram **X**.

(2)

(c) Choose words from the list below to complete the following sentences.

higher

louder

lower

quieter

- (i) A musical note with a high frequency sounds than one with a low frequency.
- (ii) A noise of small amplitude sounds than one with large amplitude.

(2)
(Total 5 marks)