

Name:

Date:

P6 - Test 4  
Waves  
Intermediate

**GCSE**

**PHYSICS**

**AQA - Triple Science**

Mark

Grade

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### Materials

For this paper you must have:

- Ruler
- Pencil and Rubber
- Scientific calculator, which you are expected to use when appropriate

### Instructions

- Answer all questions
- Answer questions in the space provided
- All working must be shown

### Information

- The marks for the questions are shown in brackets

1.

P-waves and S-waves are two types of seismic wave caused by earthquakes.

(a) Which **one** of the statements about P-waves and S-waves is correct?

Tick **one** box.

P-waves and S-waves are transverse.

P-waves and S-waves are longitudinal.

P-waves are transverse and S-waves are longitudinal.

P-waves are longitudinal and S-waves are transverse.

(1)

Seismometers on the Earth's surface record the vibrations caused by seismic waves.

The diagram below shows the vibration recorded by a seismometer for one P-wave.



(b) Calculate the frequency of the P-wave shown in the diagram above.

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Frequency = \_\_\_\_\_ Hz

(1)

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

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(1)

(d) The P-wave shown in the diagram above is travelling at 7200 m/s.

Calculate the wavelength of the P-wave.

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Wavelength = \_\_\_\_\_ m

**(3)**

(e) Explain why the study of seismic waves provides evidence for the structure of the Earth's core.

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**(2)**

**(Total 8 marks)**



(ii) What is ultrasound?

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(1)

(iii) Ultrasound can be used to find the speed of blood flow in an artery.

State **one** other medical use of ultrasound.

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(1)

(b) The speed of an ultrasound wave in soft tissue in the human body is  $1.5 \times 10^3$  m / s and the frequency of the wave is  $2.0 \times 10^6$  Hz.

Calculate the wavelength of the ultrasound wave.

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Wavelength = \_\_\_\_\_ m

(2)

(c) When ultrasound is used to find the speed of blood flow in an artery:

- an ultrasound transducer is placed on a person's arm
- ultrasound is emitted by the transducer
- the ultrasound is reflected from blood cells moving **away** from the transducer
- the reflected ultrasound is detected at the transducer.

Describe the differences between the ultrasound waves emitted by the transducer and the reflected waves detected at the transducer.

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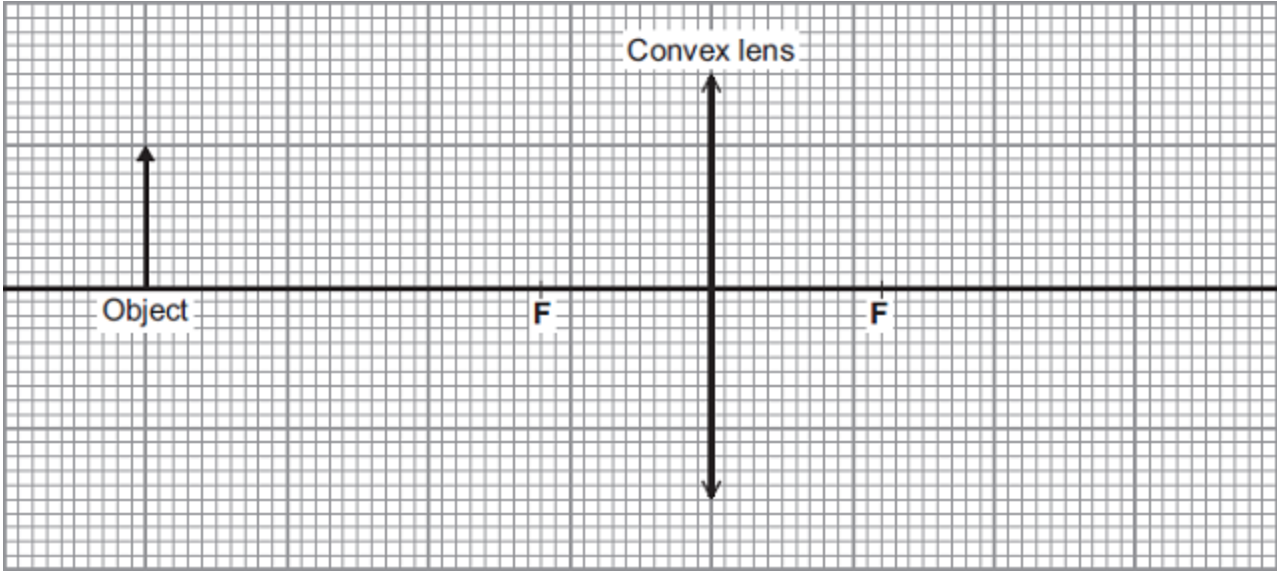
(2)

(Total 8 marks)

4.

(a) A camera was used to take a photograph. The camera contains a convex (converging) lens.

Complete the ray diagram to show how the lens produces an image of the object.



F = Principal focus

(4)

(b) State **two** words to describe the nature of the image produced by the lens in the camera.

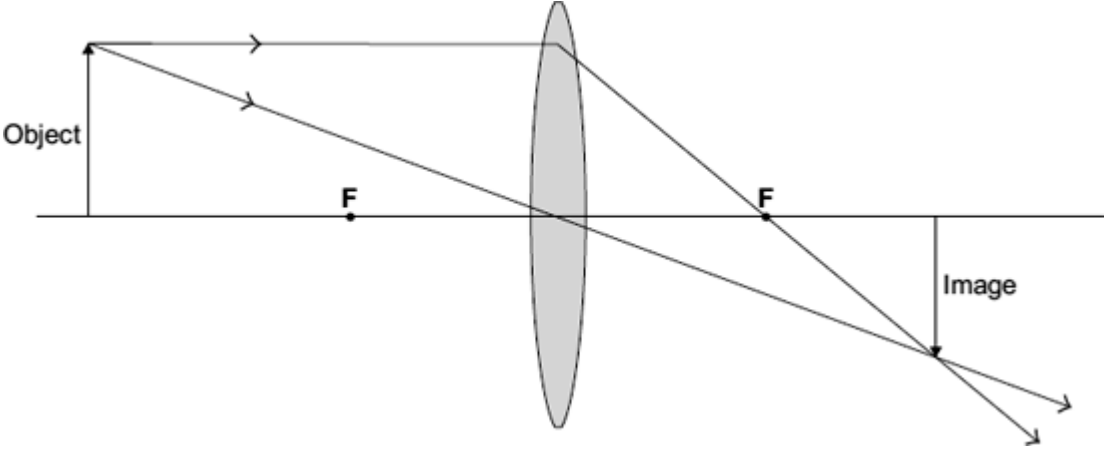
- 1. \_\_\_\_\_
- 2. \_\_\_\_\_

(2)

(Total 6 marks)

5.

The diagram shows a lens, the position of an object and the position of the image of the object.



(a) What type of lens is shown?

\_\_\_\_\_

(1)

(b) What is the name of the points, **F**, shown each side of the lens?

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(1)

(c) (i) The image is real and can be put on a screen.

How can you tell **from the diagram** that the image is real?

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(1)

(ii) Draw a ring around a word in the box which describes the image produced by the lens.

<b>inverted</b>	<b>larger</b>	<b>upright</b>
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(1)

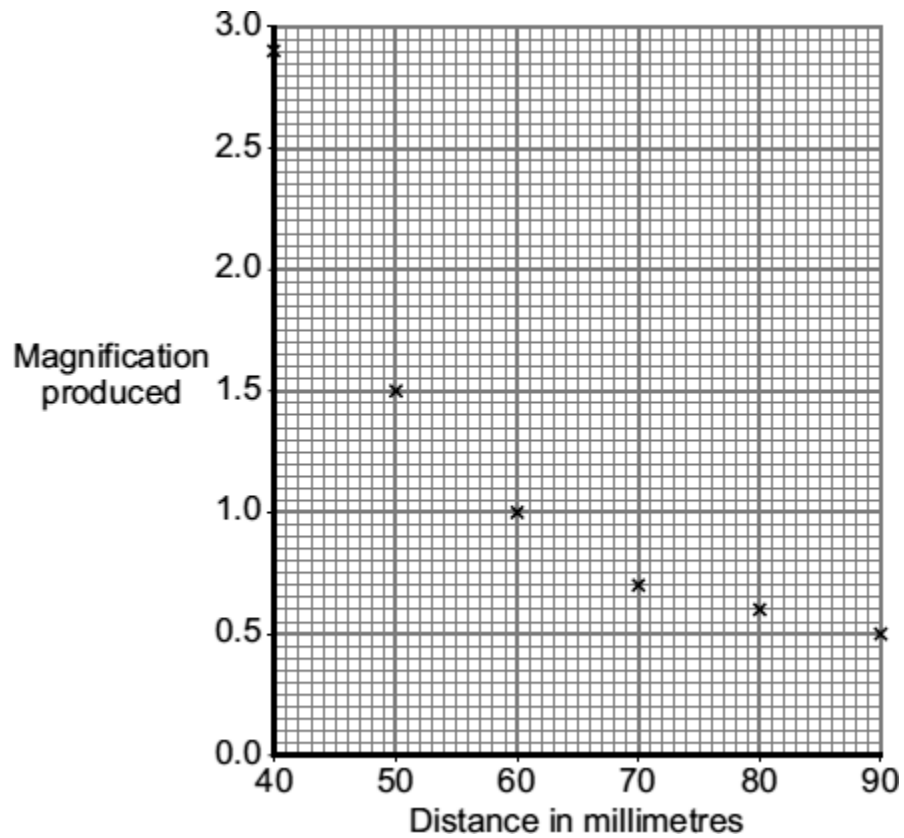
(d) A student investigates the relationship between the distance from the object to the lens and the magnification produced by the lens.

The student's results are given in the table.

The student did not repeat any measurements.

<b>Distance in millimetres</b>	<b>Height of object in millimetres</b>	<b>Height of image in millimetres</b>	<b>Magnification produced</b>
40	20	58	2.9
50	20	30	1.5
60	20	20	1.0
70	20	14	0.7
80	20	12	0.6
90	20	10	0.5

The student plots the points for a graph of *magnification produced* against *distance*.



(i) Draw a *line of best fit* for these points.

(1)

(ii) Complete the following sentence by drawing a ring around the correct word in the box.

A line graph has been drawn because both variables are

described as being

categoric.

continuous.

discrete.

(1)

(iii) Describe the relationship between *magnification produced* and *distance*.

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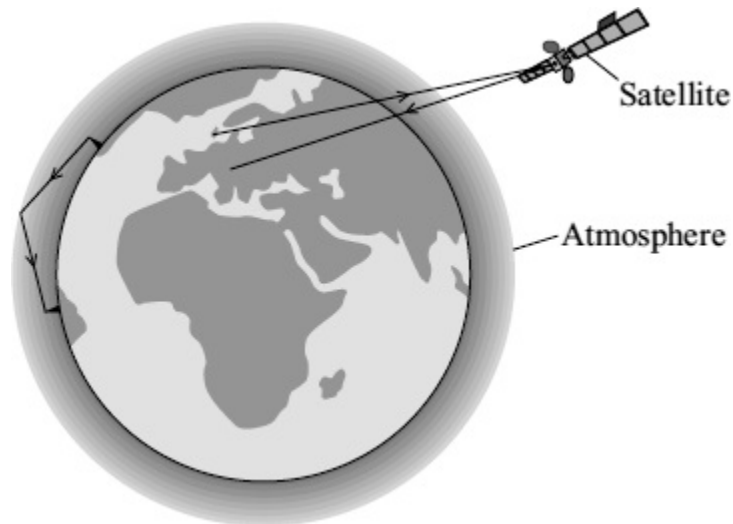
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(2)

(Total 8 marks)



6. (a) Electromagnetic waves have many uses. The diagram shows two ways of sending information using electromagnetic waves.



- (i) What type of wave is used to send information to and from satellites?

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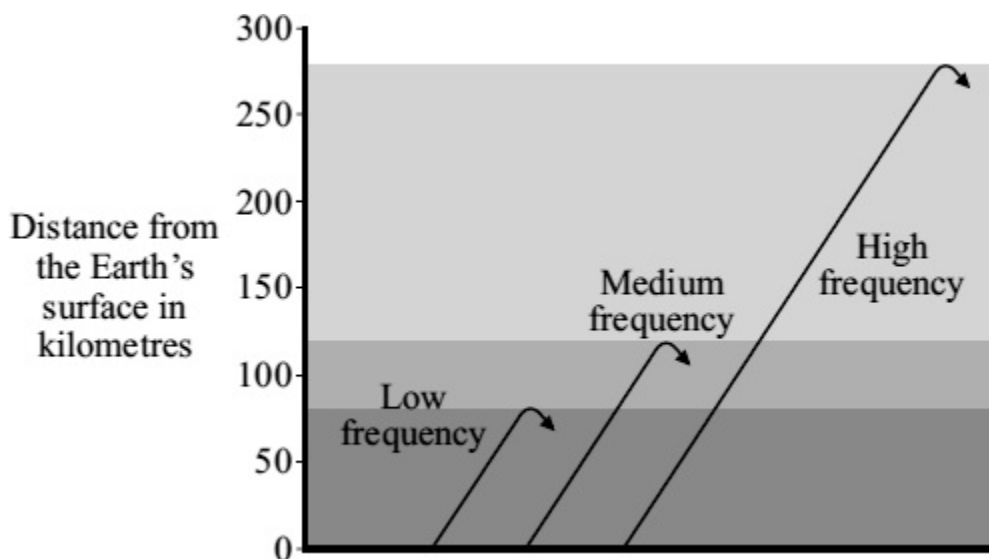
(1)

- (ii) What property of this type of wave makes it suitable for satellite communications?

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(1)

- (b) Different frequency radio waves travel different distances through the atmosphere before being reflected.



Use the information in the diagram to describe the connection between the frequency of a radio wave and the distance the radio wave travels through the atmosphere before it is reflected.

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(1)

- (c) Electromagnetic waves travel at a speed of 300 000 000 m/s.

A radio station transmits waves with a wavelength of 20 metres.

Calculate the frequency, in kilohertz (kHz), of these waves.

Show clearly how you work out your answer.

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Frequency = \_\_\_\_\_ kHz

(2)

(Total 5 marks)

7.

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.

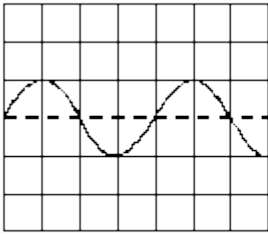


Diagram X

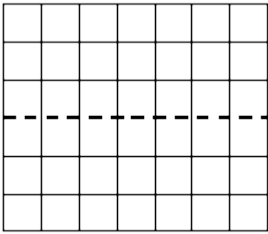


Diagram Y

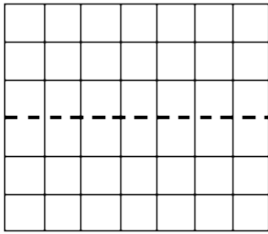


Diagram Z

- (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**

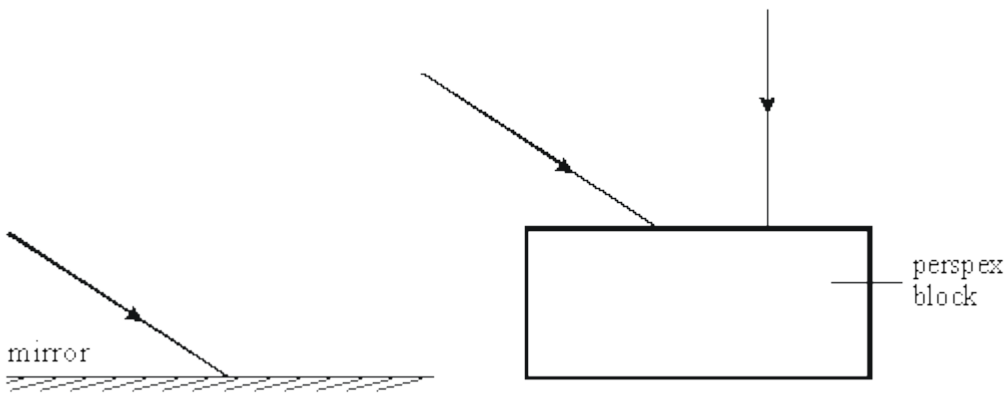
- (i) A musical note with a high frequency sounds \_\_\_\_\_ than one with a low frequency.
- (ii) A noise of small amplitude sounds \_\_\_\_\_ than one with large amplitude.

(2)

(Total 5 marks)

8.

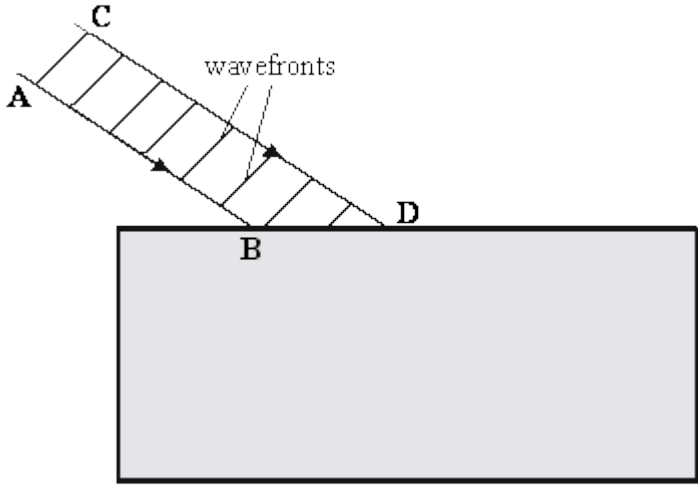
(a) The diagrams below show rays of light striking a mirror and a perspex block.



Complete the paths of the three rays of light on the diagrams to show the rays leaving the mirror and the perspex block.

(4)

(b) The diagram below shows a beam of light striking a perspex block.



- (i) Continue the paths of the rays AB and CD inside the perspex block.
- (ii) Draw the wavefronts of the beam of light in the perspex.
- (iii) Explain why the beam behaves in the way you have shown.

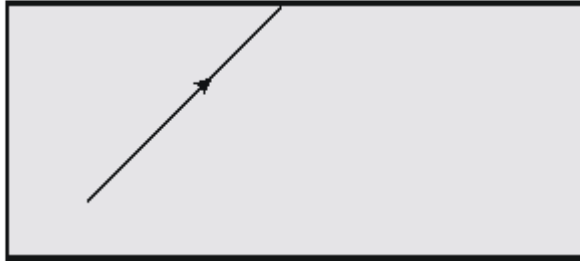
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(7)

- (c) The diagram below shows a ray of light striking a perspex-air surface from inside the perspex. The critical angle is  $45^\circ$ .

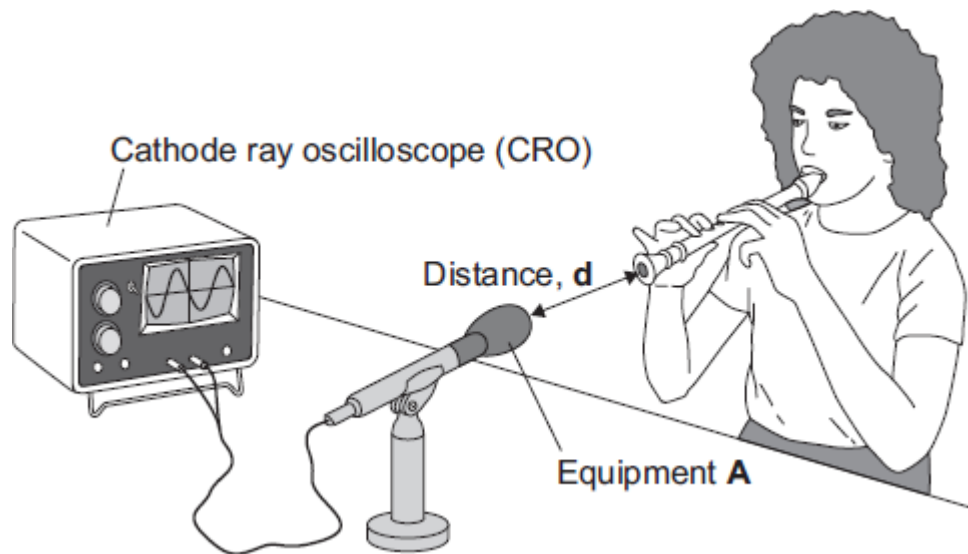


Draw the path of the ray after it reaches the perspex-air boundary.

(2)  
(Total 13 marks)

9.

A group of students investigates sound waves.  
The diagram shows part of their investigation.



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

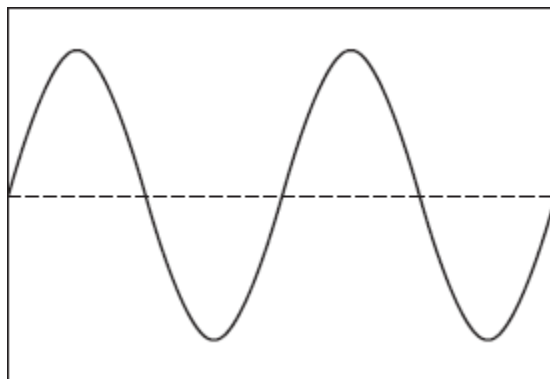
\_\_\_\_\_

(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.



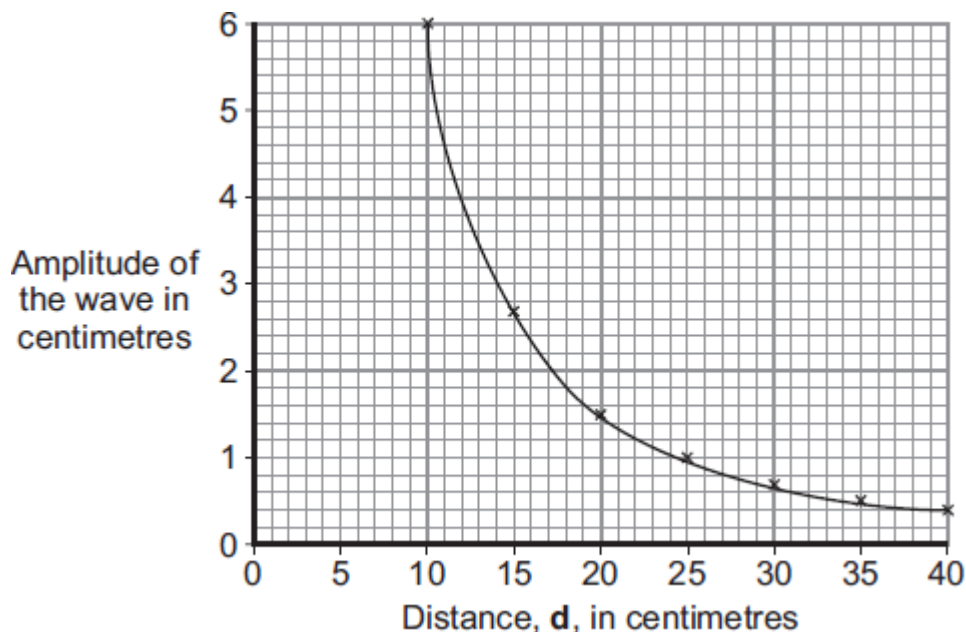
(1)

(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)

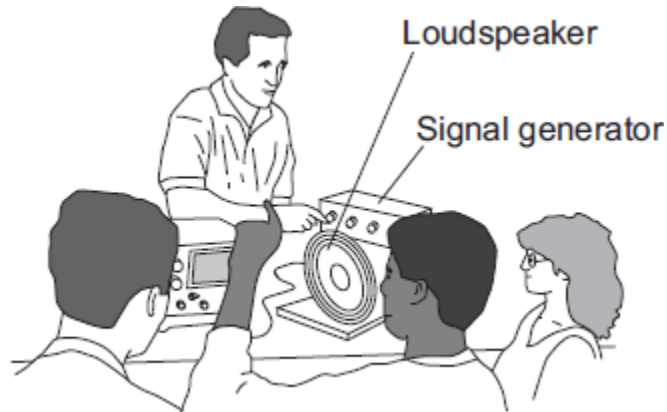
(d) Write a conclusion for this investigation.

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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)