Additional Assessment Materials
Summer 2021

Pearson Edexcel GCSE in Physics (1PH0)
Higher

Resource Set Topic C – Test 1: Waves, Light and the Electromagnetic Spectrum

Questions

(Public release version)

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General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

1 Sonar is an example of a use of ultrasound.

(a) State **one** other example of a use of ultrasound.

(1)

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(b) State an example of a use of infrasound.

(1)

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(c) Figure 1 shows the depth of the sea, measured using sonar, at different distances from the shore.

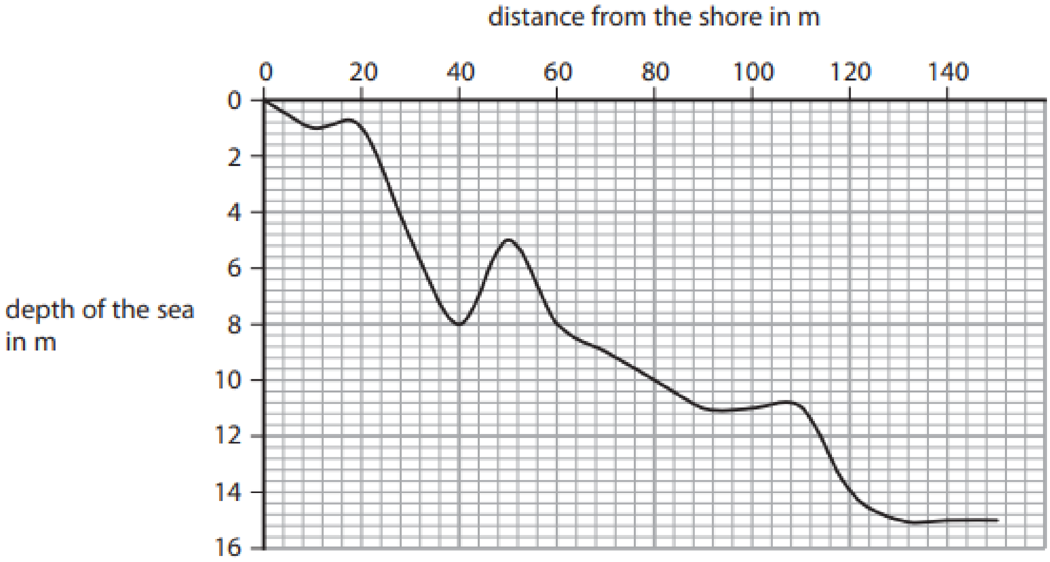

Figure 1

A technician on a boat uses sonar pulses to measure the depth of the sea when the boat is 120 m from the shore.

Calculate the **total** time of travel for the sonar pulse used to make this measurement.

The speed of the sonar pulse in seawater is 1600 m/s.

(4)

time of travel = ... s

6 (a) The diagram in Figure 7 shows two students, P and Q, trying to measure the speed of sound in air.

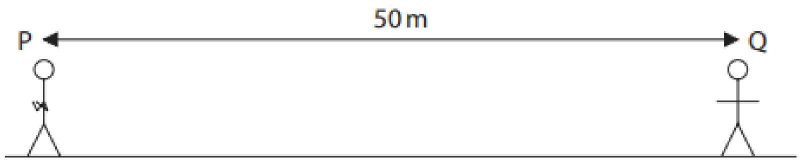

Figure 7

P will clap his hands together.

When Q sees P clap his hands, she will start a timer.

When Q hears the clap, she will stop the timer.

Explain **one** way the students could improve their method.

(2)

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(b) Figure 8 shows a long metal rod and a hammer.
The rod is hit at one end by the hammer.
This causes a sound wave to travel along the inside of the metal rod.

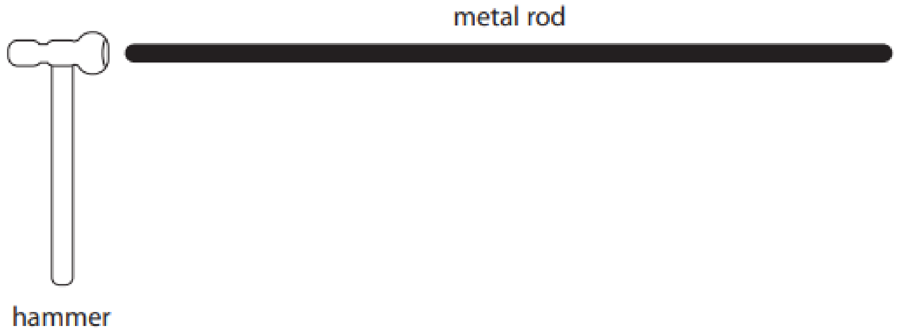

Figure 8

Describe how hitting the rod causes a sound wave to travel along the inside of the rod.

(2)

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(c) Sound travels slower in air than it does in water.

Figure 9 shows the direction of travel of a sound wave approaching a boundary between air and water.

The sound wave refracts at the boundary between air and water.

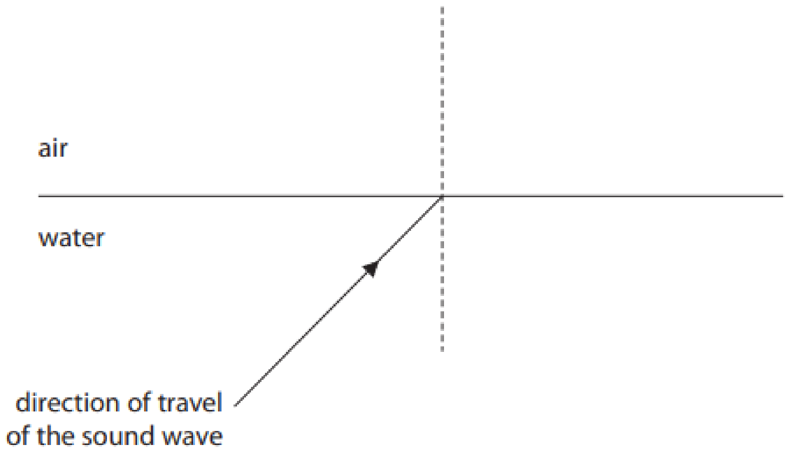

Figure 9

Complete the diagram in Figure 9 to show the direction the sound wave travels in the air.

(2)

(d) Sound travels slower in cold air than it does in warm air.

The equation relating the speed of sound in air to the density of the air is

$$\text{speed of sound} = \frac{K}{\sqrt{(\text{density})}} \qquad \text{where K is a constant.}$$

The table in Figure 10 gives some data about the speed of sound in air and the density of air.

	speed of sound in m/s	**density of air in kg / m³**
in cold air	331	1.29
in warm air		1.16

Figure 10

Use the equation and the data in the table in Figure 10 to calculate the speed of sound in warm air.

Give your answer to an appropriate number of significant figures.

(3)

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

5 (a) A radio station transmits on 97.4 MHz.

To receive the waves an aerial needs a length equal to half the wavelength of the radio waves being transmitted.

Calculate the length of the aerial needed.

The speed of the radio waves is 3.00×10^8 m / s.

(3)

length of aerial = ... m

(b) To investigate refraction in a rectangular glass block a student uses the apparatus shown in Figure 5.

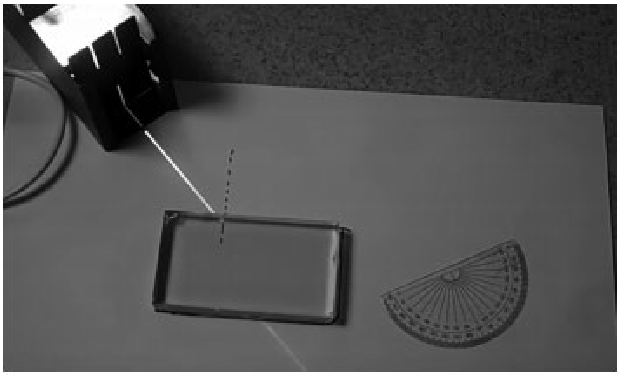

Figure 5

Describe how the student should measure the angle of refraction.

(2)

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(c) Figure 6 is a simplified diagram to show radio waves from a transmitter moving upwards, then meeting a boundary between lower and upper layers of the atmosphere.

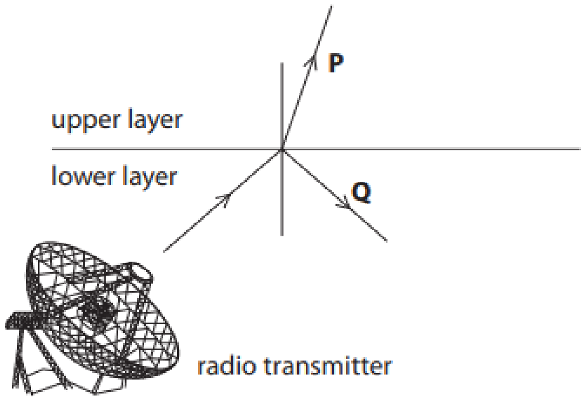

Figure 6

Explain what happens to the radio waves after they meet the boundary between the lower and upper layers as shown in Figure 6.

Your explanation should refer to changes in direction and speed of the waves.

(4)

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6 (a) Four students and their teacher do an experiment to measure the speed of sound in air.

The teacher stands at a distance and fires a starting pistol into the air.
The students see the flash when the pistol is fired.
They measure the time from when they see the flash to when they hear the bang.

A student drew a diagram of the arrangement as shown in Figure 7.

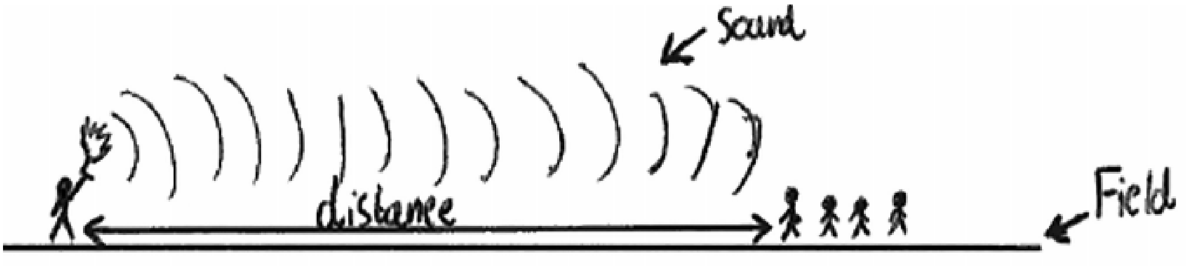

Figure 7

The students obtained a value of 240 m/s for the speed of sound.

The accepted value, in a science data book, is 343 m/s.

(i) Calculate the difference between the students' value and the accepted value as a percentage of the accepted value.

(2)

percentage difference = ... %

(ii) When the distance was 100 m, the students measured the following times:

0.43 s   0.35 s   0.50 s   0.38 s

Explain why their times vary so much.

(2)

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(iii) Explain **one** way the students might improve this experiment.

(2)

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(b) Figure 8 represents a sound wave coming from a loudspeaker and shows the effects on particles of the air at one instant in time.

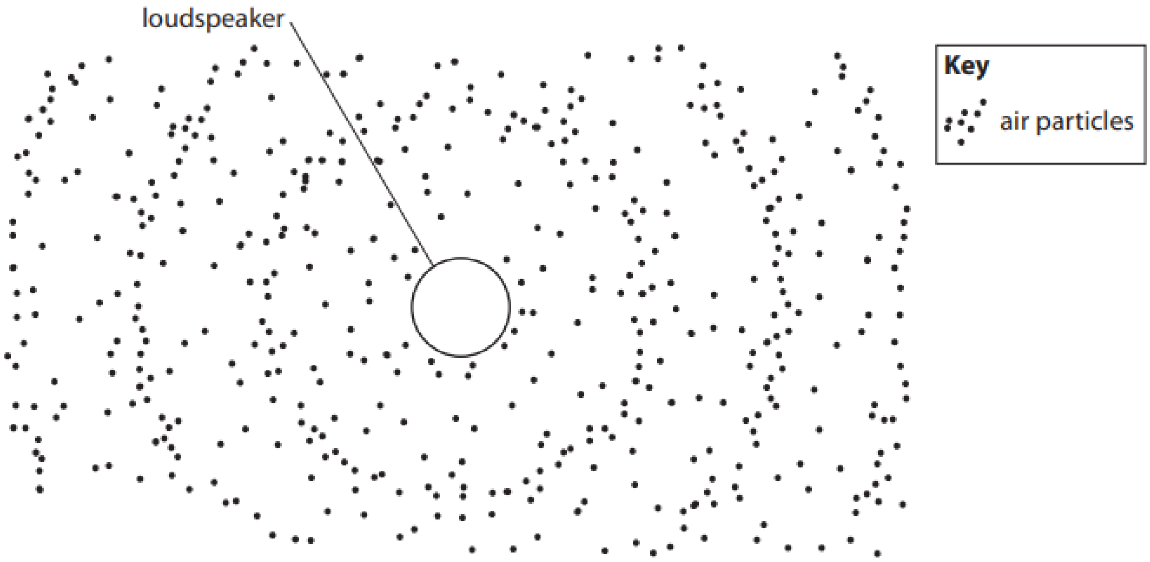

Figure 8

(i) Draw and label a distance of one wavelength in Figure 8.

(1)

(ii) Describe the motion of the particles as the wave travels through the air.

(2)

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10 Figure 14 shows the hearing responses of a human, a mouse and a bird over a range of frequencies of sound.

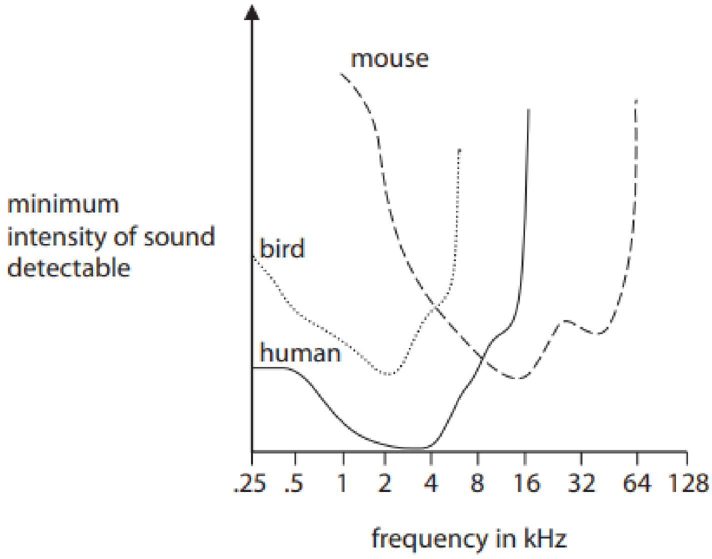

Figure 14

(a) (i) Describe **two** differences between the hearing responses of the human and the mouse.

(2)

1 ....

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2 ....

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(ii) A farmer wants to use an alarm to scare away these birds.

State which frequency would be most effective.
Give the appropriate units.

(1)

frequency ....

(iii) State the reason for your choice of frequency in (ii).

(1)

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(b) Describe the difference between 'infrasound' and 'ultrasound'.

(2)

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(c) A transducer can transmit and detect ultrasonic waves.

Figure 15 shows ultrasonic waves transmitted by the transducer on the bottom of a ship.

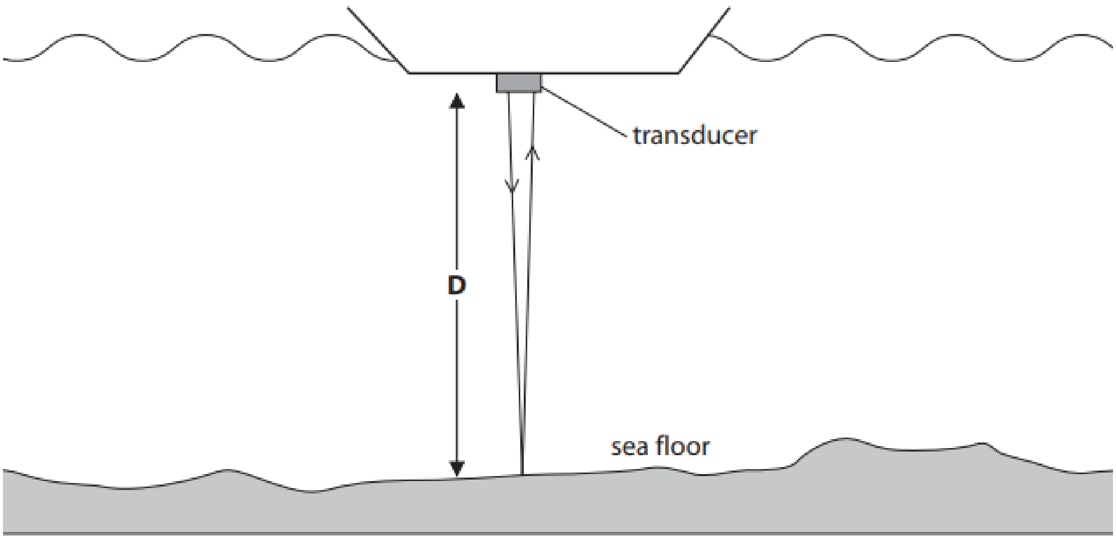

Figure 15

The waves reflect off the sea floor and are received back at the transducer.

The waves travel at 1500 m / s.

The time between transmission and reception is 48 milliseconds.

Calculate the depth of water, D, shown in Figure 15.

(2)

depth of water, D = ... m

(d) Explain how vibrations from earthquakes may be used to study the core of the Earth.

(4)

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TOTAL FOR PAPER IS 45 MARKS