

# Light & Sound

## Question Paper

Level	GCSE
Subject	Physics
Exam Board	Edexcel IGCSE
Module	Single Award (Paper 2P)
Topic	Waves
Sub-Topic	Light & Sound
Booklet	Question Paper

**Time Allowed:**                      **minutes**

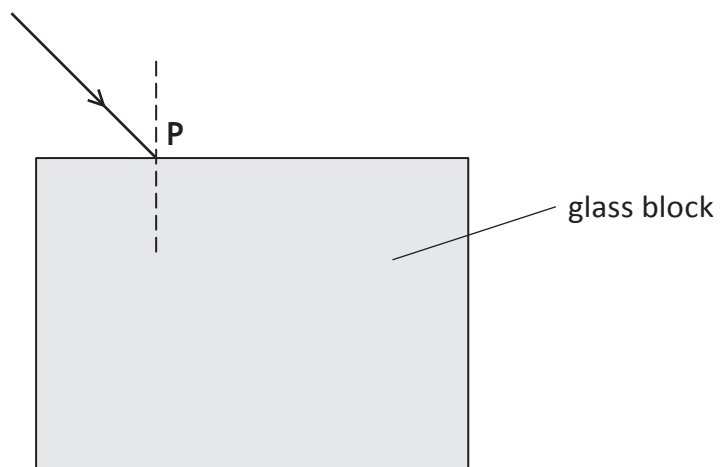
**Score:**                                      **/**

**Percentage:**                              **/100**

**Grade Boundaries:**

A*	A	B	C	D	E	U
>85%	75%	70%	60%	55%	50%	<50%

1. A student uses a rectangular glass block to determine the refractive index of glass. The diagram shows a ray of red light in air as it enters the glass block at **P**. The normal at **P** is shown as a dotted line.



(a) Complete the diagram by

- drawing the ray that continues inside the block
- labelling the angle of incidence ( $i$ ) and the angle of refraction ( $r$ )
- drawing the ray that leaves the block.

(4)

(b) The student measures values for the angle of incidence ( $i$ ) and the angle of refraction ( $r$ ).

$i$	$60^\circ$
$r$	$34^\circ$
$\sin i$	
$\sin r$	

(i) Complete the table by inserting values for  $\sin i$  and  $\sin r$ . (1)

(ii) State the equation that links refractive index, angle of incidence ( $i$ ) and angle of refraction ( $r$ ). (1)

(iii) Calculate the refractive index of the glass. (2)

Refractive index = .....

(c) How should the student continue the investigation to obtain a more accurate value for the refractive index of glass? (3)

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2. (a) A student wants to find the refractive index of a glass block.

(i) Draw a diagram to show how the student should set up the apparatus needed to find the refractive index of a glass block.

Label your diagram.

(2)

(ii) What measurements should the student take to find the refractive index of the glass block?

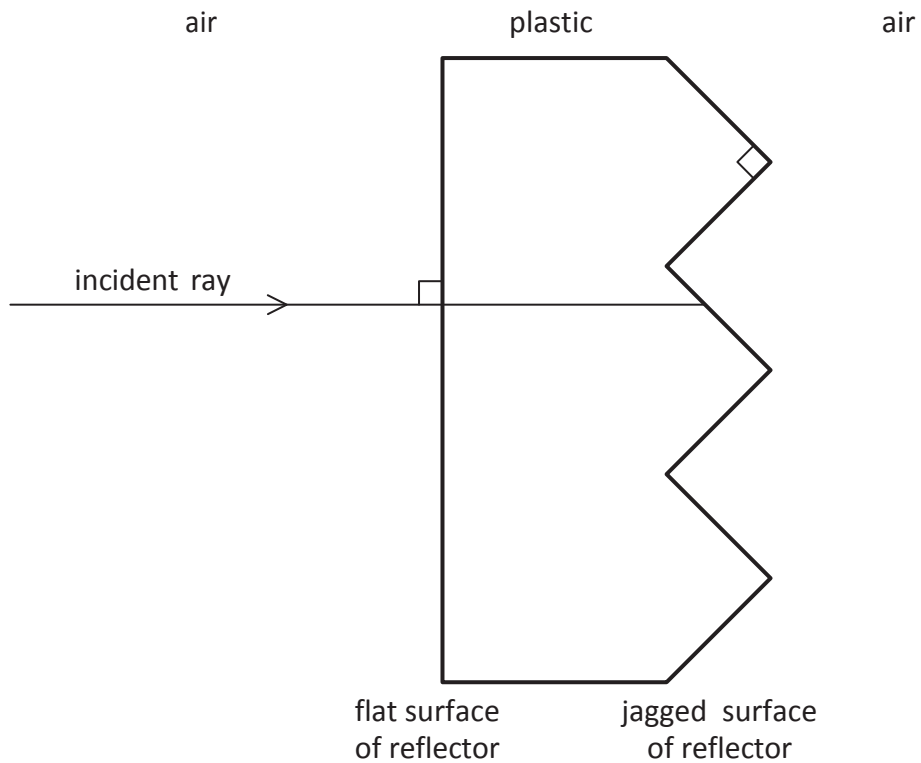
(2)

(iii) Describe how the student should use these measurements to find the refractive index of the glass block.

(2)

(b) The diagram shows a section through a bicycle reflector.

A ray of light is incident on the flat surface of the reflector.



(i) The critical angle for the plastic of the reflector is less than  $45^\circ$ .

Continue the incident ray on the diagram to show the path of the ray until it emerges from the plastic.

(2)

(ii) What happens to the incident ray as it enters the plastic?

(1)

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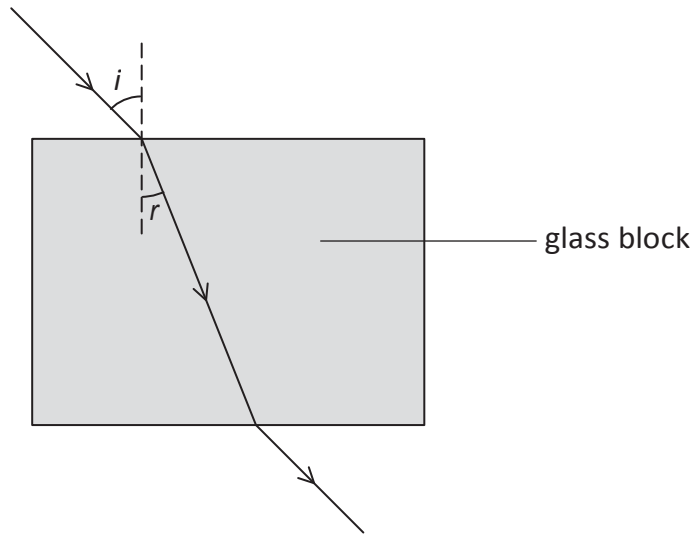
(Total for Question 2= 9 marks)

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3. A student investigates refraction using a glass block.

She wants to find the refractive index of the glass.

She sends rays of light into the block at different angles and measures the angle of incidence and the angle of refraction.



The table shows her results.

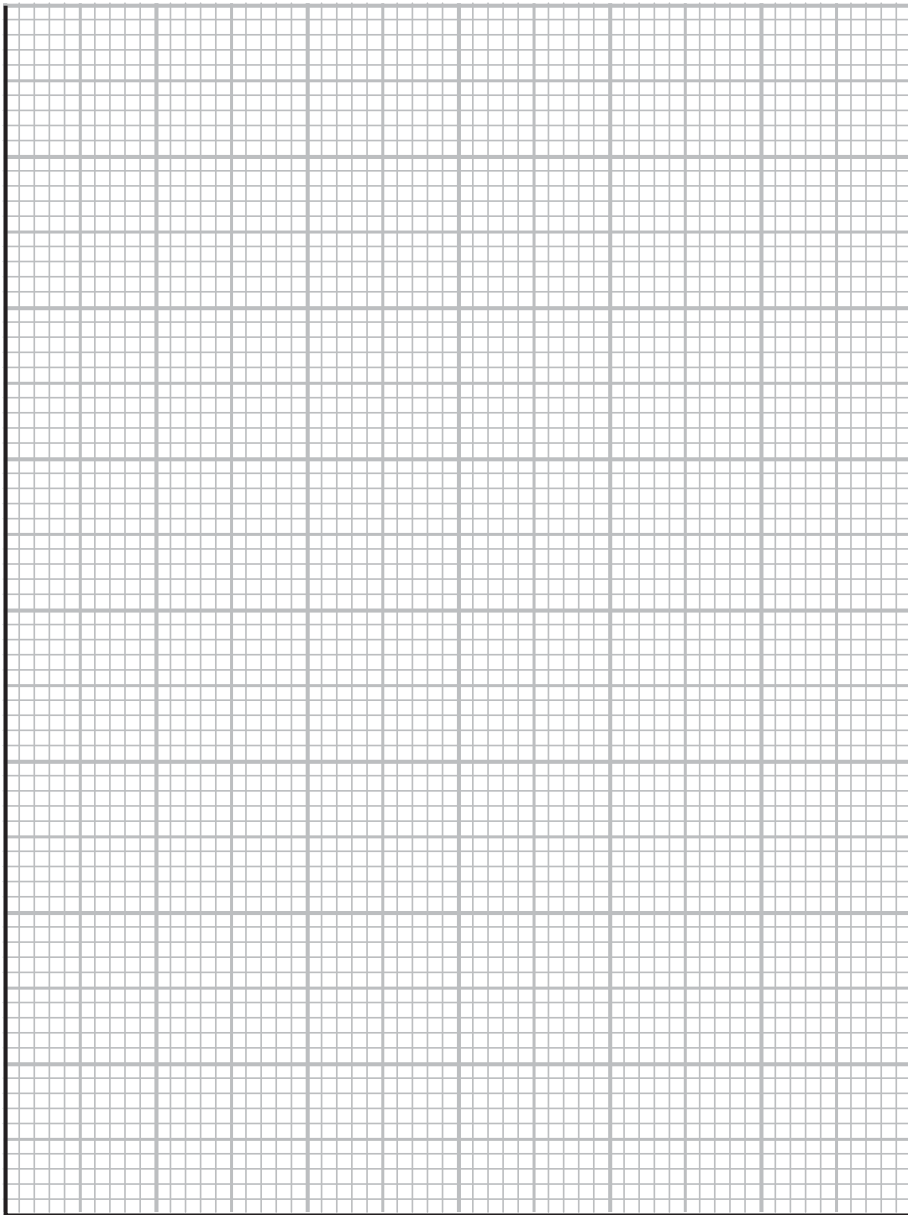
Angle of incidence, $i$	Angle of refraction, $r$	$\sin i$	$\sin r$
$0^\circ$	$0^\circ$	0.00	0.00
$15^\circ$	$10^\circ$	0.26	0.17
$25^\circ$	$16^\circ$	0.42	
$35^\circ$	$22^\circ$	0.57	
$45^\circ$	$28^\circ$	0.71	0.47

(a) (i) Complete the table by calculating the missing values of  $\sin r$ .

(1)

(ii) Draw a graph of  $\sin i$  ( $y$ -axis) against  $\sin r$  ( $x$ -axis).

(5)



(iii) Use your graph to find the refractive index of the glass.

(2)

refractive index = .....

(b) Suggest two reasons why using a graph to find the refractive index is a better method than simply calculating it using a pair of angles from the table.

(2)

1 .....

.....

2 .....

.....

**(Total for Question 3= 10 marks)**

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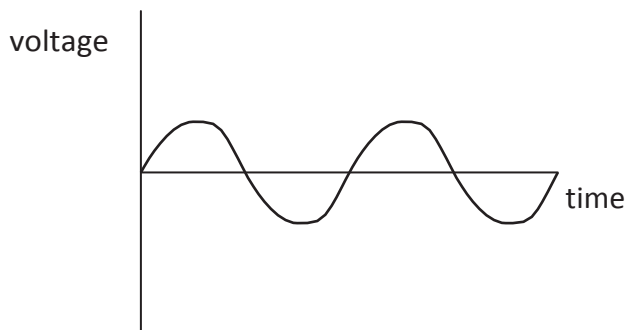


4. (a) The graphs show oscilloscope traces produced by four different sounds. The oscilloscope settings are the same for each trace.

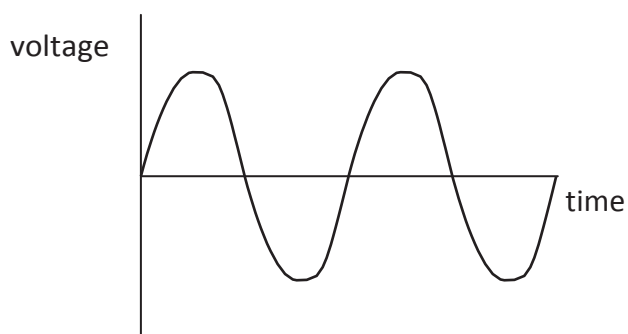
Which graph shows the trace for the loudest sound at the lowest frequency?

(1)

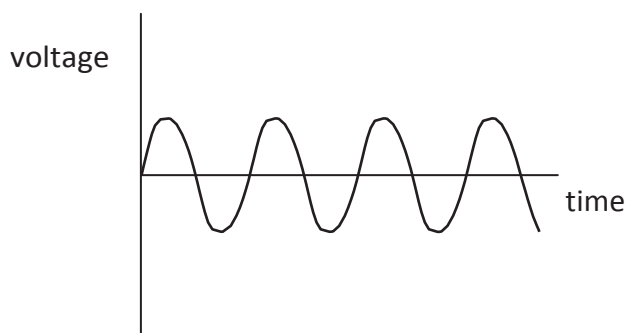
A



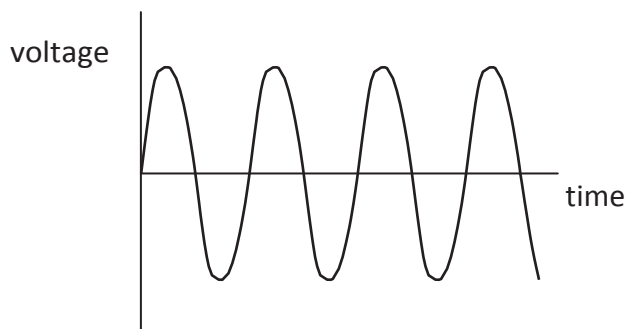
B



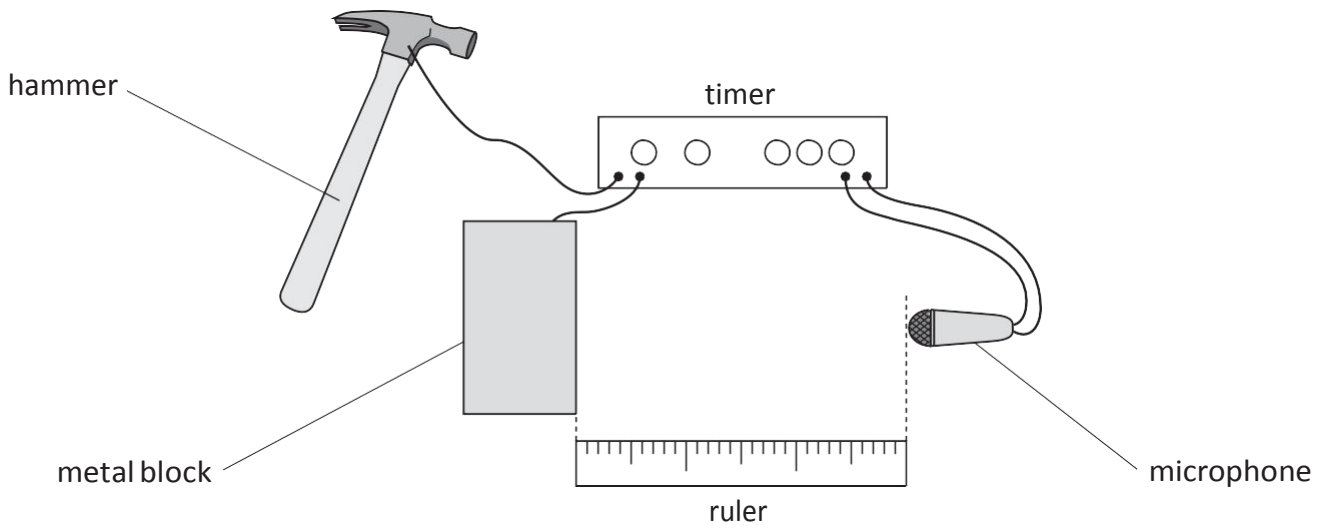
C



D



(b) The diagram shows the equipment used by a student to measure the speed of sound in air.



The student measures the distance between the front of the metal block and the microphone.

She then uses this method to measure the time taken for sound to travel from the metal block to the microphone.

start the timer by hitting the metal block with the hammer

stop the timer when the sound produced reaches the microphone

record the time taken for sound to reach the microphone in milliseconds

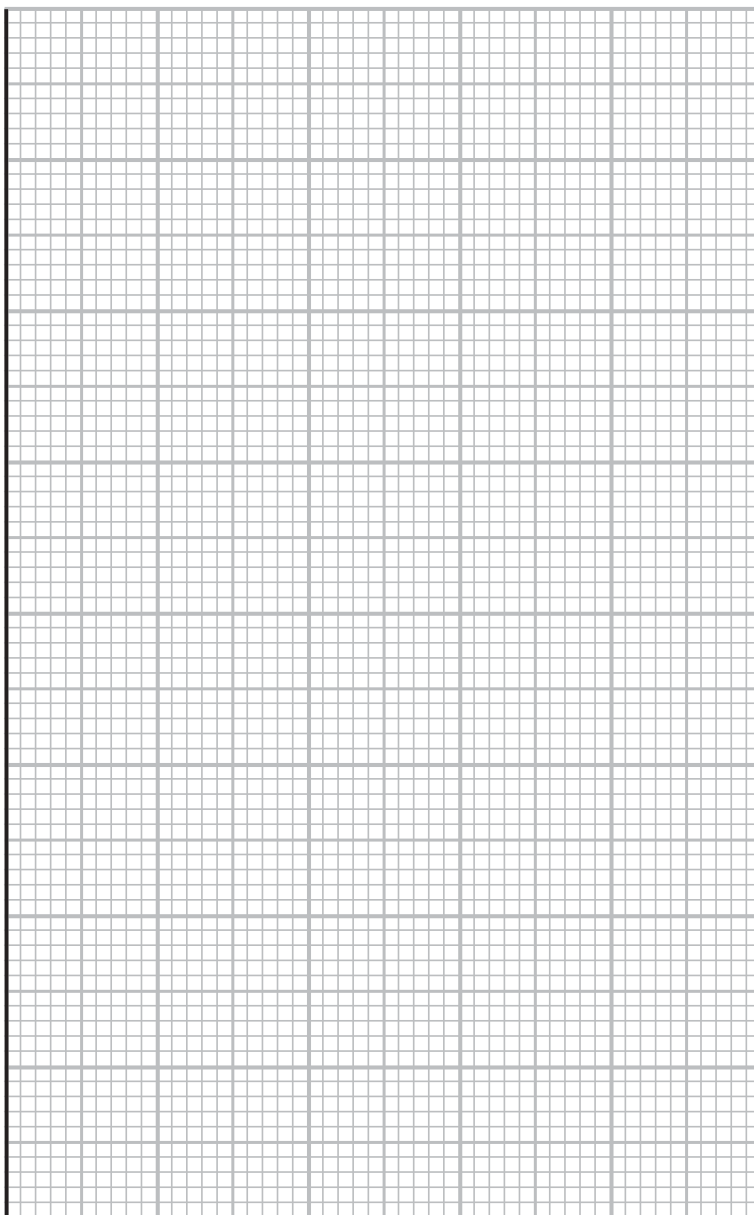
The student repeats the experiment six times, changing the distance between the metal block and the microphone for each experiment.

The table shows her results.

Distance in m	Time in ms
0.62	1.8
0.80	2.4
1.00	3.0
1.20	3.8
1.38	4.2

(i) Use the student's results to plot a graph of distance against time and draw the straight line of best fit.

(5)



(ii) Use your graph to find the speed of sound in air and give the unit.

(3)

speed = ..... unit .....

(iii) Suggest how the student could make this experiment valid (a fair test).

(1)

(iv) Suggest two ways that the student could improve the quality of her data.

(2)

1

2

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**(Total for Question 4 = 12 marks)**