



Rewarding Learning

ADVANCED

General Certificate of Education

Centre Number

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Candidate Number

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Life and Health Sciences

Assessment Unit A2 4

assessing

Sound and Light

[AZ041]

Assessment



AZ041

TIME

1 hour 45 minutes.

Assessment Level of Control:

Tick the relevant box (✓)

Controlled Conditions	
Other	

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Answer **all seven** questions.

Write your answers in the spaces provided.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question, or part question.

You may use an electronic calculator.

Quality of written communication will be assessed in question **3(a)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	

Total Marks	
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Examiner Only	
Marks	Remark

1 (a) A tuning fork is sounded and creates a sound wave.

(i) What type of wave is a sound wave?

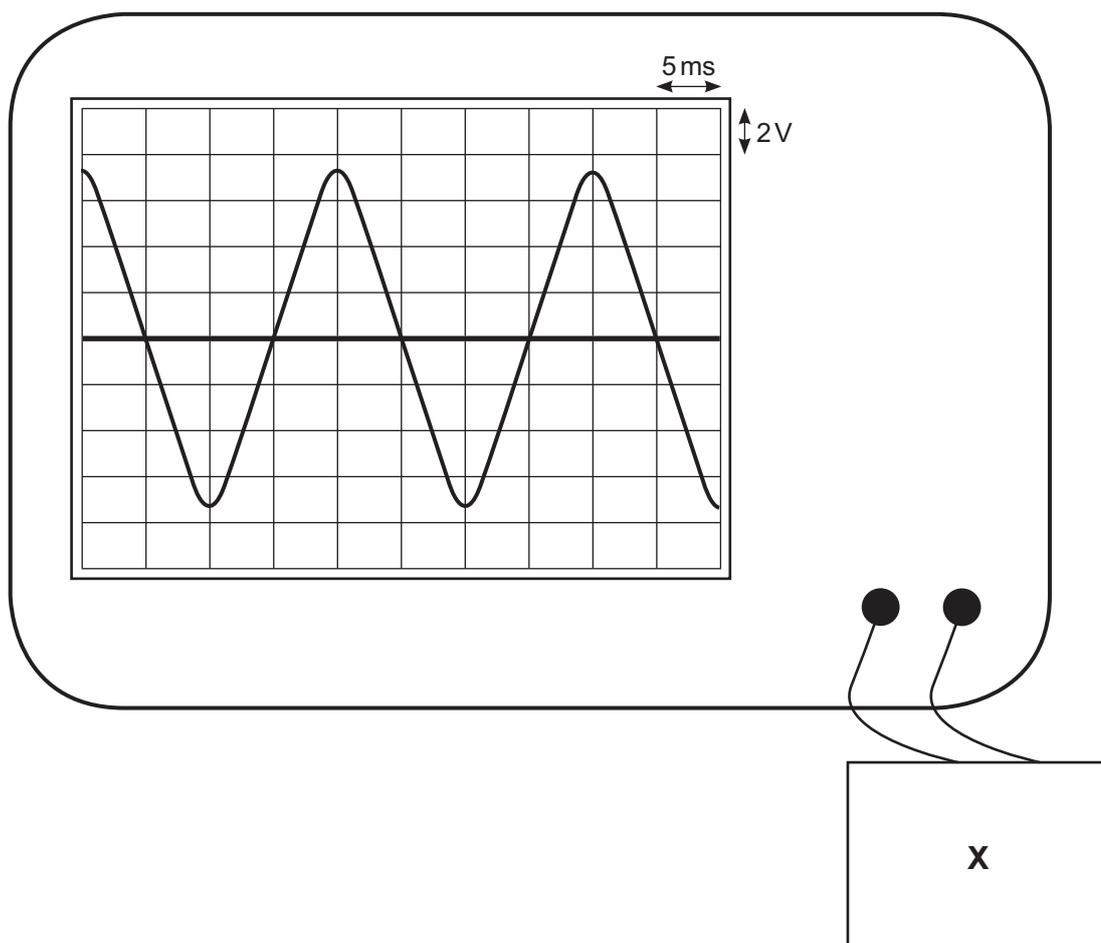
_____ [1]

(ii) Describe how the particles move as the sound wave passes through the air.

 _____ [2]

(b) The **sound is converted into an electrical signal** by a piece of equipment marked **X**.

This waveform is displayed on a cathode ray oscilloscope screen as shown in the diagram below.



(ii) Give the reasons for your choice of correct answers in **(c)(i)**.

1. _____

2. _____

_____ [2]

Examiner Only

Marks Remark

(b) Complete the table below by stating the part of the ear or its function.

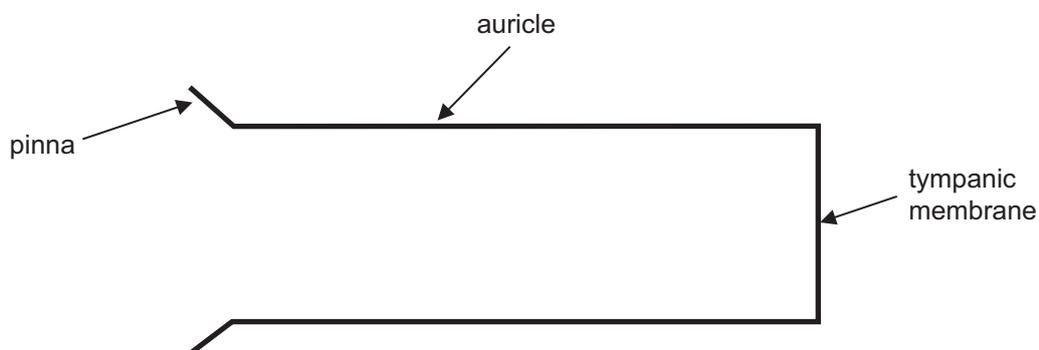
Function	Part of the ear
	Semi-circular canals
Connects to brain via the auditory nerve.	
Contains receptors which respond to different frequencies.	
Separates the air-filled middle ear from the fluid-filled inner ear.	
	Auditory nerve

[5]

Examiner Only	
Marks	Remark

- (c) The outer ear consists of the pinna, auricle and tympanic membrane. The pinna funnels sound into the auricle, which can be thought of as a pipe closed at one end.

A simplified diagram of the outer ear is shown below.



- (i) On the diagram above, draw a graphical representation of the standing waves in the auricle observed for the first harmonic. [1]
- (ii) Mark all nodal positions using the letter **N**, and all antinodal positions using the letter **A**, on your sketch of the standing wave pattern. [1]
- (iii) The fundamental resonant frequency of the auditory canal is approximately 3.5 kHz and the speed of sound in air is 340 ms^{-1} . Calculate the length of the auricle in **cm** for a normal adult.

You are advised to show your working.

Length = _____ cm [4]

- (iv) What is the significance of resonance in the auditory canal at 3.5 kHz?

_____ [1]

Examiner Only	
Marks	Remark

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(Questions continue overleaf)

- (iii) A long-sighted man wishes to buy a pair of reading glasses to enable him to focus comfortably on a book held 25 cm from his eyes.

The off-the-shelf glasses come in 3 strengths: 0.75 D, 1.25 D and 2.75 D.

What strength should he choose if the closest he can focus without the reading glasses is a distance of 80 cm from the eye?

Show your working.

Strength of reading glasses = _____ D [3]

Examiner Only	
Marks	Remark

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(Questions continue overleaf)

6 (a) (i) What is the Doppler effect?

[2]

(ii) Describe how the Doppler effect can be **observed** when an emergency vehicle sounding a siren approaches and passes by a stationary observer.

[2]

Examiner Only	
Marks	Remark

7 This question is about an experiment to determine the critical angle of glass.

(a) (i) Sketch a labelled diagram of the assembled apparatus needed to perform this experiment. Draw and label the incident ray.

[3]

(ii) Describe how the equipment is used to find the critical angle.

[4]

(iii) Suggest a way to ensure the result of this experiment is reliable.

[1]

(iv) Suggest a way to improve the accuracy of this experiment.

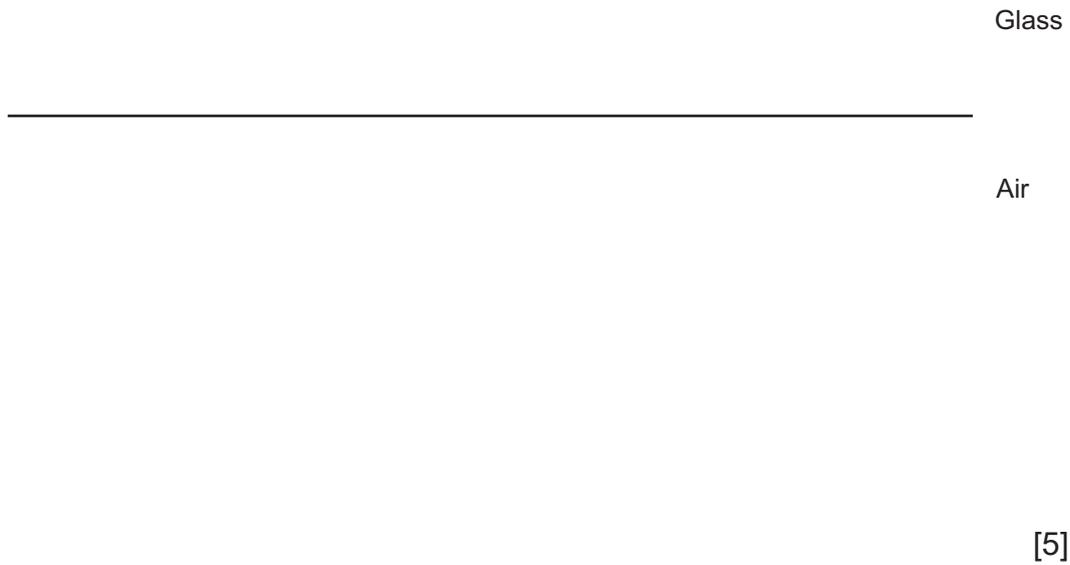
[1]

Examiner Only	
Marks	Remark

(b) The diagram below shows the boundary between glass and air.

Complete the diagram below to show how a ray of light behaves when it is incident at the critical angle at the boundary.

Label your diagram appropriately.



(c) (i) Describe the difference in the structure of a single-mode fibre and a multi-mode fibre.

_____ [1]

(ii) Signal distortion is a problem in multi-mode fibres. Describe how this occurs.

_____ [2]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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