



Rewarding Learning

ADVANCED

General Certificate of Education

2022

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]

FRIDAY 24 JUNE, MORNING



AZ041

TIME

1 hour 45 minutes.

INSTRUCTIONS TO CANDIDATES

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

Answer **all nine** 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.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	

Total Marks	
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2 (a) (i) Circle all the electromagnetic waves from the list below.

Radio Infra-red Visible Light Ultrasound [1]

Electromagnetic waves transfer energy and can be reflected and refracted.

(ii) Describe **two** other similarities of electromagnetic waves.

1. _____

2. _____ [2]

(b) (i) Calculate the time period of a wave whose frequency is 200 Hz.

You are advised to show your working.

Time period = _____ s [2]

(ii) State the time period in (b)(i) in ms.

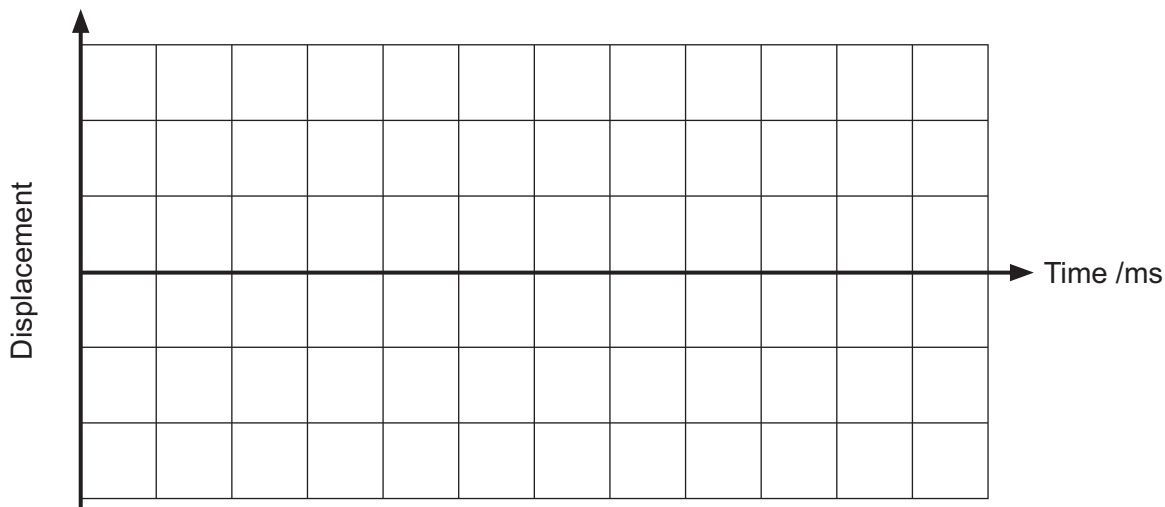
Time period _____ ms [1]

Examiner Only	
Marks	Remark

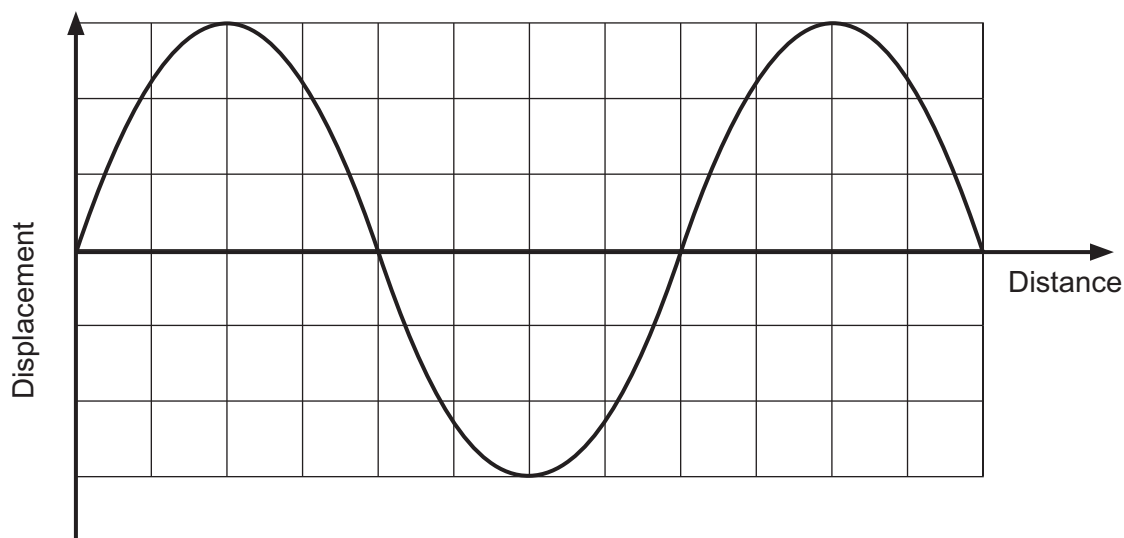
- (iii) On the graph below, sketch a displacement against time graph for two wave cycles for the wave of constant amplitude, with a frequency of 200 Hz.

Include a scale for the time axis.

[3]



- (c) The following diagram shows a **displacement against distance graph** for a wave.



- (i) On the diagram above, mark the wavelength of the wave. [1]

- (ii) On the diagram above, sketch the wave with the same amplitude and wavelength, but 90° out of phase. [2]

Examiner Only

Marks	Remark

- 3 Describe the contributions made by each of the main structures of the middle and inner ear to enable different sounds to be heard.

Quality of written communication will be assessed in this question.

Middle ear

Inner ear

[6]

Examiner Only	
Marks	Remark

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(Questions continue overleaf)

- (ii) If the observer stands 6.0 m from the source the intensity drops to 11% of the initial value.

Calculate the difference in the intensity level observed at 2.0 m from the source compared to that at 6.0 m from the source.

You are advised to show your working.

Difference in intensity level = _____ dB [4]

- (c) Dogs have a hearing range that stretches from 40 Hz to 65 kHz, with the greatest sensitivity occurring between 3000 and 12000 Hz. Dogs can hear intensities as low as -15 dB.

Compare dog hearing to human hearing. Use the table below to summarise your comparisons.

You are advised to show any calculations in the space below the table.

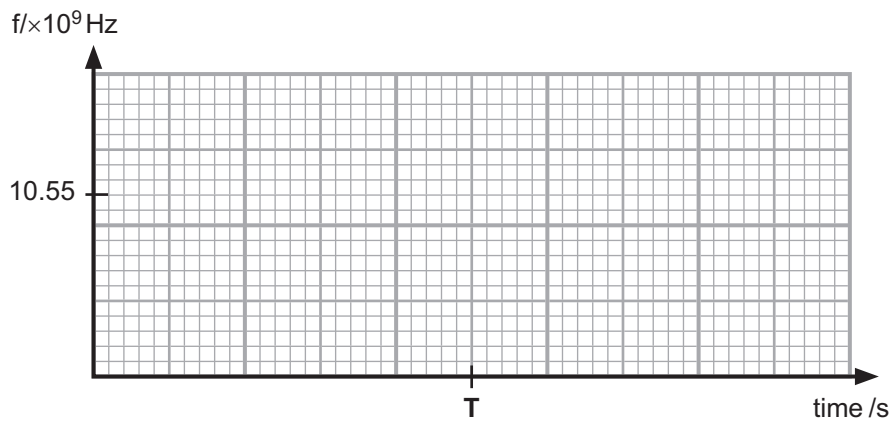
	Dog hearing	Human hearing
Audio frequency range /Hz	40 – 65000	
Threshold of hearing /Wm ⁻²		1 × 10 ⁻¹²
Maximum sensitivity /Hz	3000 – 12000	

[5]

Examiner Only

Marks Remark

- (ii) Complete the following frequency graph to show the frequency of the radio waves reflected from the car as the car travels at a steady speed towards the stationary radar gun and then passes it at time **T**.



[2]

Examiner Only	
Marks	Remark

6 Write a detailed account of the structure, function and use of a step-index multi-mode fibre optic cable.

Include in your description:

- The parts of a fibre optic cable
- The materials used in each part
- How light is transported throughout the fibre
- A use of a multi-mode fibre

Structure

Materials

How light is transported

Use

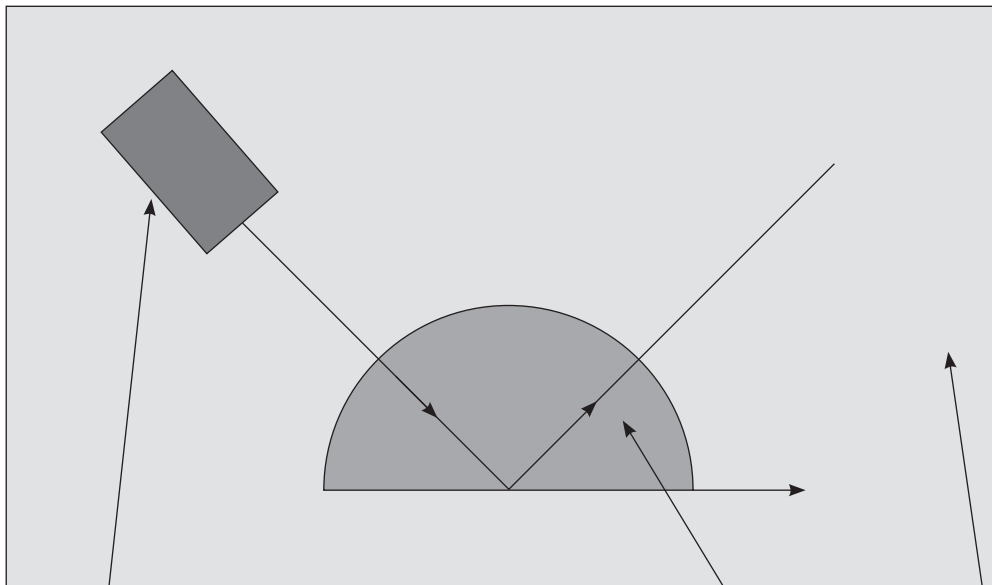
[8]

Examiner Only	
Marks	Remark

- 7 (a) (i) The critical angle for glass is 41.8° .
What does this statement mean?

[2]

The critical angle for glass can be determined using the equipment below.



ray box attached to power supply

semi-circular
glass block

white page

- (ii) Label the refracted ray and the critical angle on the diagram above. [2]

- (iii) Name the required measuring instrument in this experiment.

[1]

- (iv) Explain why the incident ray must be directed towards the centre of the flat side of the block.

[2]

Examiner Only

Marks Remark

- (b) (i) A student wants to measure the focal length of a converging lens from a series of readings.
Draw a labelled diagram of the **assembled** apparatus used to measure focal length.

[2]

- (ii) One set of results collected in this experiment showed that when the lens was placed 20.4 cm from the object a focused image formed **80.0 cm from the object**.

Use these results to calculate the focal length of the lens used in this experiment.

You are advised to show your working.

Focal length = _____ cm [4]

- (iii) Calculate the power of the lens used in this experiment.

You are advised to show your working.

Power = _____ D [2]

- (iv) Circle which of the following correctly describe the image observed.

real upright virtual inverted

[1]

Examiner Only	
Marks	Remark

(c) Macular degeneration is an eye defect which mostly affects the elderly.

Many of the cone cells of the macula fail to respond to light.

One of the eyesight problems encountered by someone suffering from macular degeneration is blurred vision.

Suggest another eyesight problem associated with macular degeneration.

[1]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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