



Rewarding Learning

ADVANCED

General Certificate of Education

2018

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]

THURSDAY 31 MAY, AFTERNOON



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 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(b)**.

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

Total Marks	
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- 1 **Radio waves** and **microwaves** can be used to transmit television broadcast signals. These are intercepted and changed into **sound** and **light** signals by television and radio sets.

Old CRT (*cathode ray tube*) televisions emit very low energy **X-rays**. Modern flat screen televisions do not produce X-rays, but emit **infra-red** radiation.

- (a) (i) Complete **Table 1.1** below to classify the six waves printed in bold in the paragraphs above as either transverse or longitudinal.

Table 1.1

Transverse	Longitudinal

[3]

- (ii) Identify one of these waves that is part of the electromagnetic spectrum.

_____ [1]

- (iii) List two features that are unique to all electromagnetic waves.

1. _____

2. _____

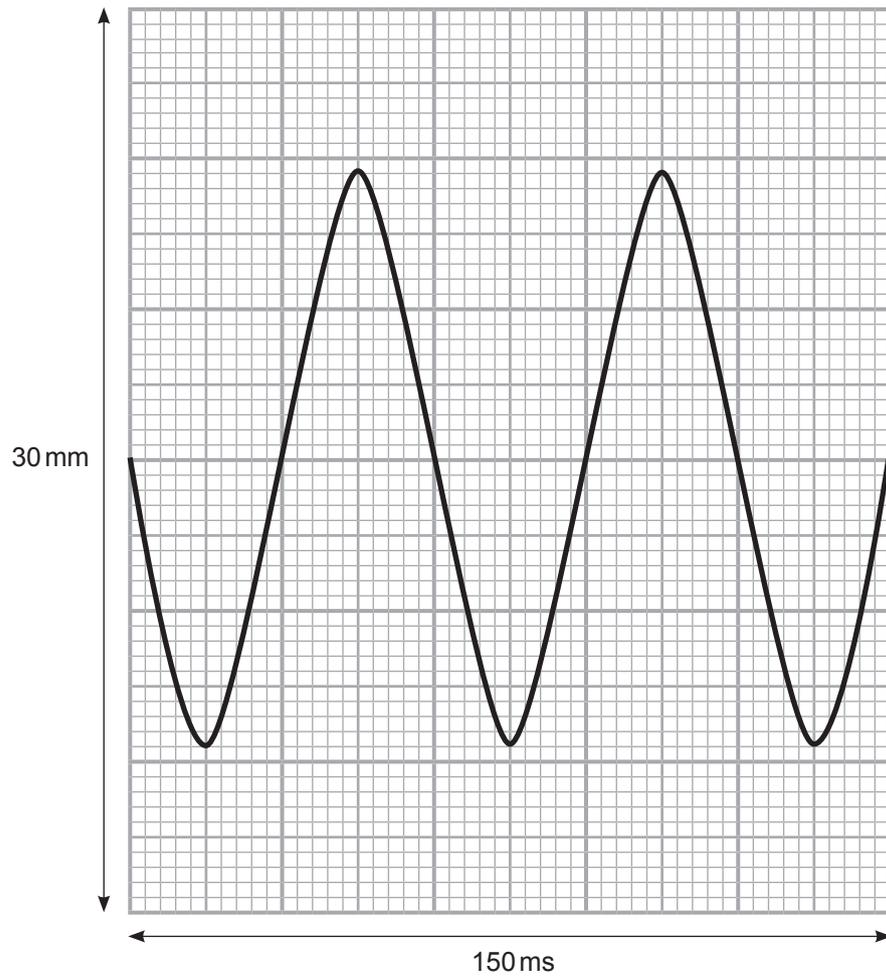
_____ [2]

Examiner Only

Marks

Remark

(b) Fig. 1.1 shows some features of a wave.



Source: Principal Examiner

Fig. 1.1

- (i) On Fig. 1.1 above clearly label the amplitude using the letter A. [1]
- (ii) Calculate the amplitude of the wave shown in Fig. 1.1.

Amplitude = _____ mm [2]

Examiner Only	
Marks	Remark

2 The speed of sound can be determined using a resonance tube method.

- (a) (i) In the space below, draw a **labelled** sketch of the arrangement of the apparatus used to measure the speed of sound by this method.

[3]

- (ii) What data should be collected to enable the speed of sound to be calculated?

 _____ [2]

- (iii) After carrying out this experiment, a student plots a straight line graph as shown in **Fig. 2.1**.
 On this graph, label the axes.

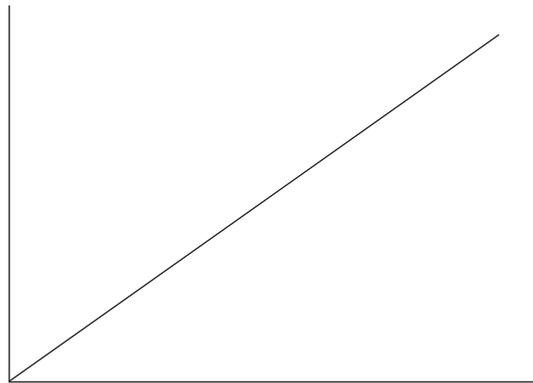


Fig. 2.1

[2]

- (iv) Describe how the graph in **Fig. 2.1** could be used to determine the speed of sound.

 _____ [2]

Examiner Only	
Marks	Remark

(b) In another experiment, a student produces a standing wave on a stretched string.

(i) On Fig. 2.2, label the equipment marked X.

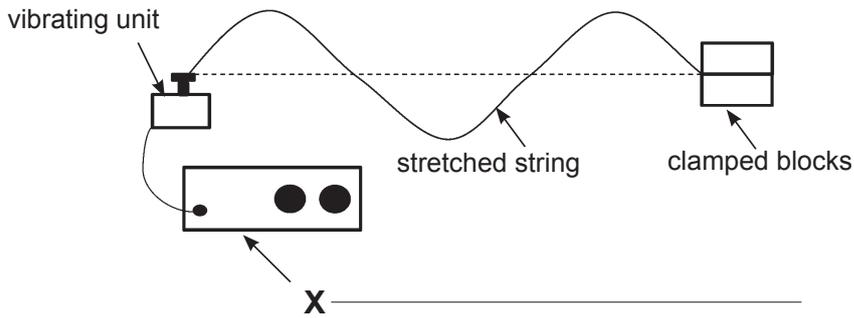


Fig. 2.2

Source: Principal Examiner

[1]

(ii) On Fig. 2.2 above, using the letters N and A respectively, mark two nodal and two antinodal positions.

[2]

(iii) On Fig. 2.3 below, sketch the wave pattern observed for the first harmonic (fundamental frequency).



Fig. 2.3

[1]

(iv) If the length of the stretched string between the supports in Fig. 2.3 is 60 cm, calculate the wavelength of the wave.

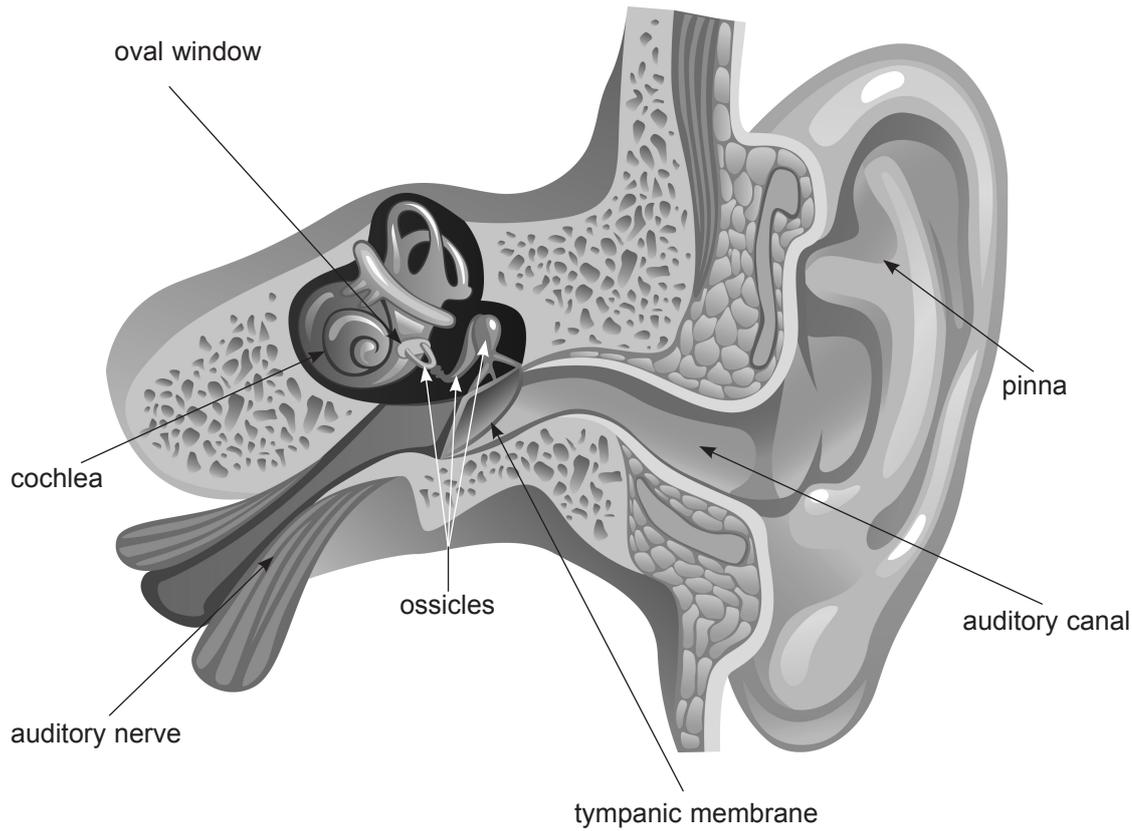
Wavelength = _____ cm [1]

(v) When a standing wave is observed on a stretched string, the string is said to be in resonance. How would a student know that resonance has been reached in this example?

_____ [1]

Examiner Only	
Marks	Remark

3 Fig. 3.1 shows a diagram of the human ear.



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Fig. 3.1

(a) Complete **Table 3.1** by identifying the main parts of the outer, middle and inner ear as shown in **Fig. 3.1**. One example has already been completed.

Table 3.1

Outer ear	Middle ear	Inner ear
pinna		

[3]

Examiner Only	
Marks	Remark

- 5 (a) (i) Sketch a labelled diagram of a fibre optic cable. Include the path of a ray of light travelling through the fibre undergoing total internal reflection.

Indicate, using the letter **R**, which part of the cable has the higher refractive index.

[3]

- (ii) Describe one **advantage** and one **disadvantage** of a single mode fibre optic cable.

Advantage: _____

Disadvantage: _____

_____ [2]

- (iii) State **one** use of a single mode fibre optic cable.

_____ [1]

Examiner Only	
Marks	Remark

(c) Briefly outline how communication via Bluetooth technology takes place and suggest **one** current use.

Example of current use: _____

_____ [4]

Examiner Only	
Marks	Remark

- 6 A student is required to perform an **accurate** experiment to measure the **power** of a lens.



Fig. 6.1

- (a) (i) Describe the procedure the student should follow to obtain a **series** of readings using the equipment shown in Fig. 6.1.

[4]

- (ii) How should the student process the results to obtain the power of the lens?

[3]

Examiner Only	
Marks	Remark

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(Questions continue overleaf)

- 7 **Fig. 7.1** shows a graph of intensity level response against frequency for an average human ear.

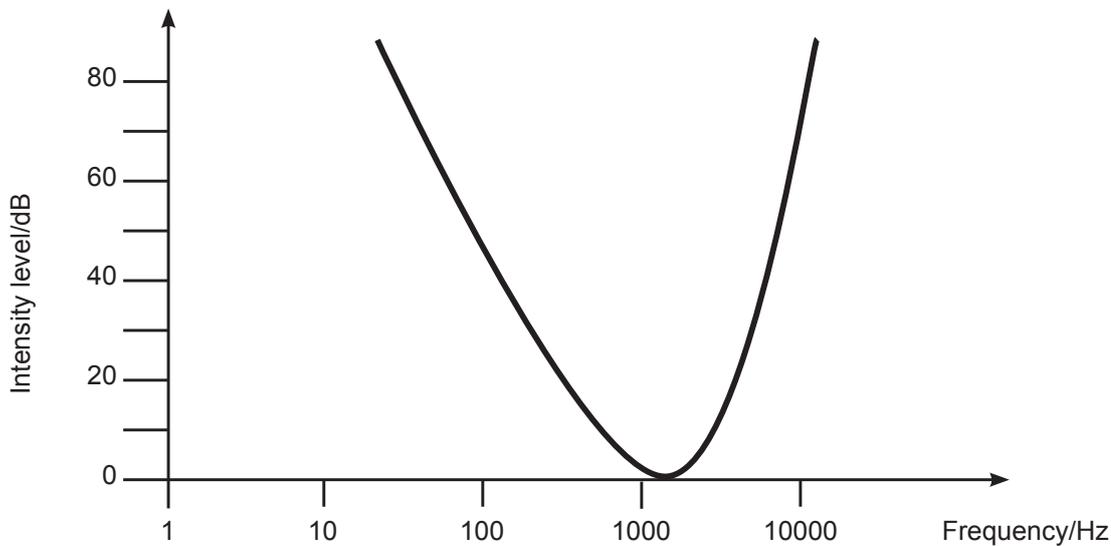


Fig. 7.1

- (a) (i) Long exposure to sounds above 80 dB will result in permanent ear damage.

Shade on **Fig. 7.1** the area representing the range of sounds that can be detected by the average human ear without causing ear damage. [2]

- (ii) The graph shows a minimum at 0 dB. What is the physical significance of this?

_____ [1]

- (iii) State the approximate range of frequencies at which the ear is most sensitive, providing an explanation as to why the ear is most sensitive in this range.

_____ [2]

Examiner Only	
Marks	Remark

- (iv) A television is producing sound at an intensity level of 40 dB. Using **Fig. 7.1**, describe the **differences** noticed by a listener if the intensity level is increased to 80 dB.

_____ [3]

- (b) Sound is a subjective experience. What does this mean?

_____ [1]

- (c) A student is asked to establish experimentally the loudness of an unknown sound source in phons. The student is provided with a signal generator connected to a speaker to create a standard sound source.

- (i) How is the standard sound created from the source?

_____ [1]

- (ii) State the other piece of equipment required to carry out this experiment.

_____ [1]

- (iii) Outline the procedure for the loudness of the unknown source to be determined.

_____ [3]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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