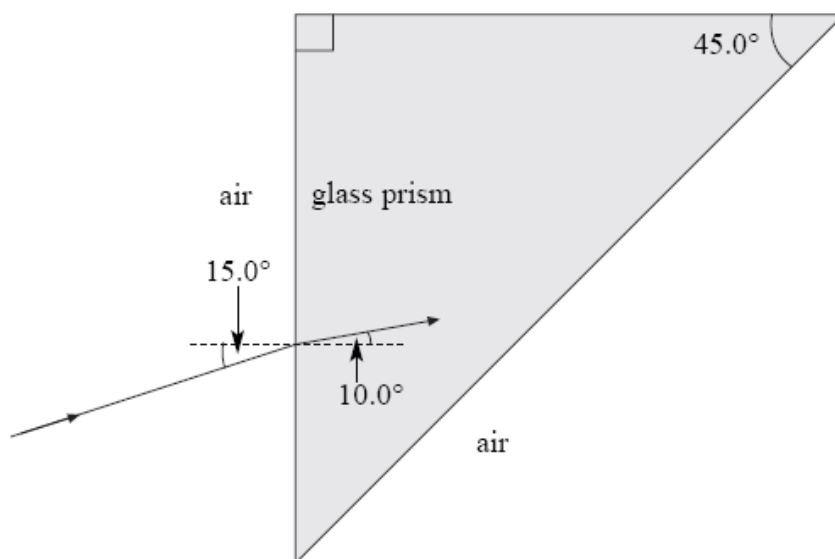


**Test on Waves**

Answer all the questions in the spaces below. A data sheet is supplied separately.  
 Show all your working. You are expected to use a calculator where appropriate.  
 You are reminded of the need for good English and clear presentation.

- 1 A ray of light passes from air into a glass prism as shown in **Figure 1**.

**Figure 1**



- (a) Confirm, by calculation, that the refractive index of the glass from which the prism was made is 1.49.

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 .....  
 .....  
 .....

(1 mark)

- (b) On **Figure 1**, draw the continuation of the path of the ray of light until it emerges back into the air. Write on **Figure 1** the values of the angles between the ray and any normals you have drawn.

the critical angle from glass to air is less than  $45^\circ$

(2 marks)

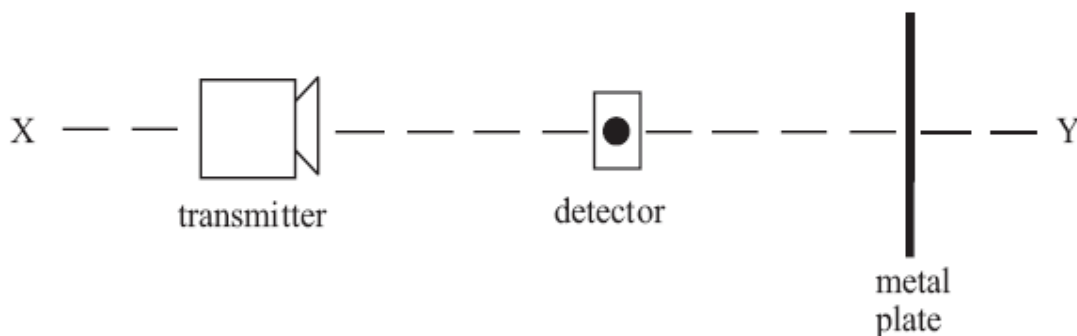
2

The sound quality of a portable radio is improved by adjusting the orientation of the aerial. Which statement is a correct explanation of this improvement?

- A The radio waves from the transmitter are polarised.
- B The radio waves from the transmitter are unpolarised.
- C The radio waves become polarised as a result of adjusting the aerial.
- D The radio waves become unpolarised as a result of adjusting the aerial.

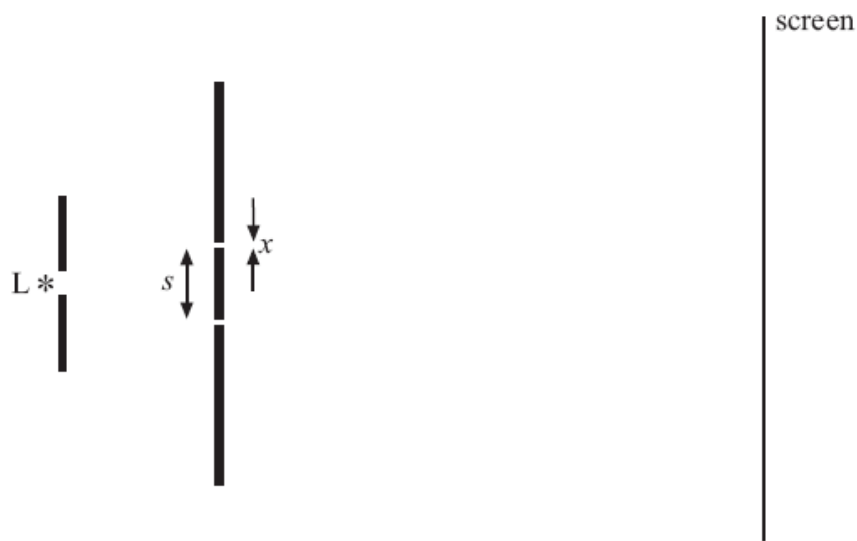
3

A microwave transmitter is used to direct microwaves of wavelength 30 mm along a line XY. A metal plate is positioned at right angles to XY with its mid-point on the line, as shown.



When a detector is moved gradually along XY, its reading alternates between maxima and minima. Which one of the following statements is **not** correct?

- A The distance between two minima could be 15 mm.
- B The distance between two maxima could be 30 mm.
- C The distance between a minimum and a maximum could be 30 mm.
- D The distance between a minimum and a maximum could be 37.5 mm.



In a double slit system used to produce interference fringes, the separation of the slits is  $s$  and the width of each slit is  $x$ .  $L$  is a source of monochromatic light. Which one of the following changes would **decrease** the separation of the fringes seen on the screen?

- A moving the screen closer to the double slits
- B decreasing the width,  $x$ , of each slit, but keeping  $s$  constant
- C decreasing the separation,  $s$ , of the slits
- D exchanging  $L$  for a monochromatic source of longer wavelength

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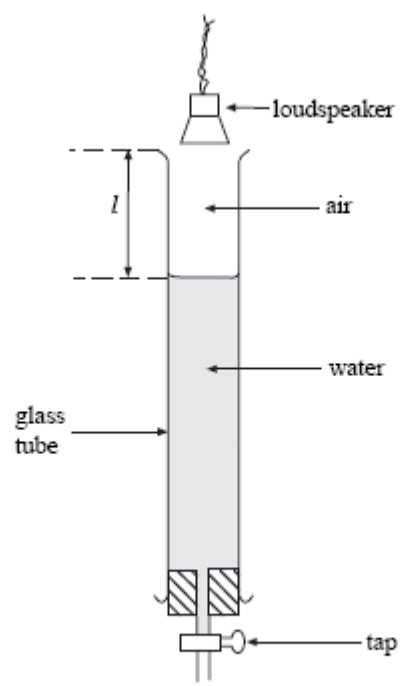


Figure 1

A small loudspeaker emitting sound of constant frequency is positioned a short distance above a long glass tube containing water. When water is allowed to run slowly out of the tube, the intensity of the sound heard increases whenever the length  $l$  (shown in Figure 1) takes certain values.

- (a) Explain these observations by reference to the physical principles involved.

You may be awarded marks for the quality of written communication in your answer.

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(4 marks)

- (b) With the loudspeaker emitting sound of frequency 480 Hz, the effect described in part (a) is noticed first when  $l = 168$  mm. It next occurs when  $l = 523$  mm.

Use both values of  $l$  to calculate

- (i) the wavelength of the sound waves in the air column,

.....  
.....

- (ii) the speed of these sound waves.

.....  
.....

*(4 marks)*

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6 (a) State what is meant by *coherent sources* of light.

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(2 marks)

(b)

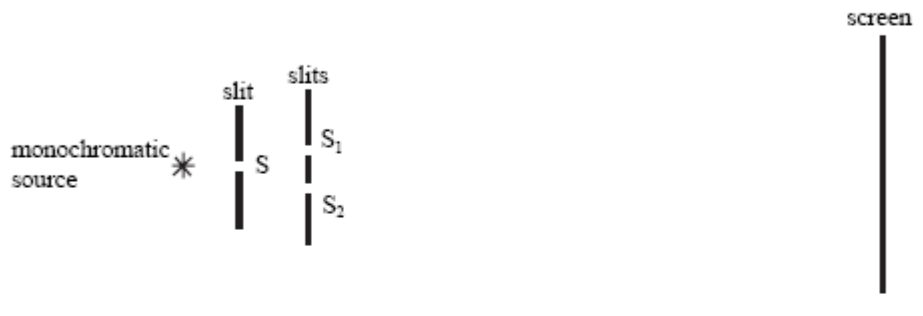


Figure 2

Young's fringes are produced on the screen from the monochromatic source by the arrangement shown in Figure 2.

You may be awarded marks for the quality of written communication in your answers.

(i) Explain why slit S should be narrow.

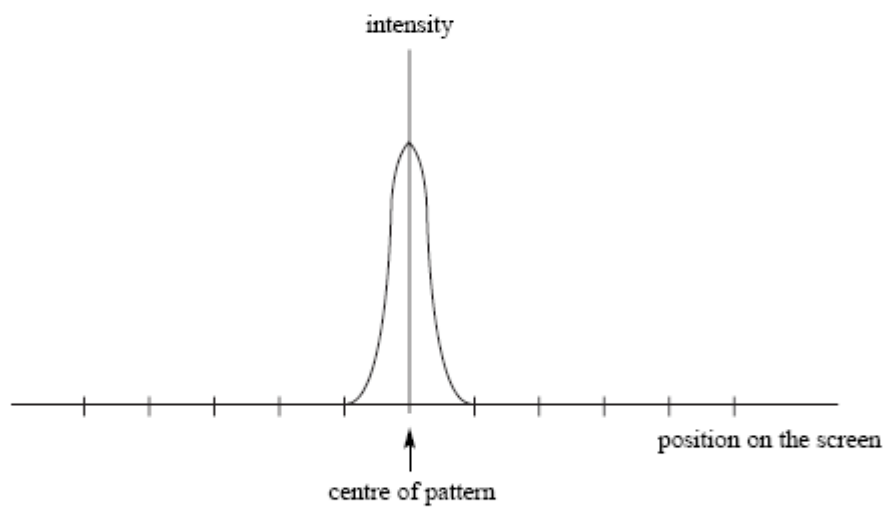
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(ii) Why do slits  $S_1$  and  $S_2$  act as coherent sources?

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(4 marks)

- (c) The pattern on the screen may be represented as a graph of intensity against position on the screen. The central fringe is shown on the graph in **Figure 3**. Complete this graph to represent the rest of the pattern by drawing on **Figure 3**.



**Figure 3**

*(2 marks)*

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Total = 25 marks

**End of Examination.  
Now go back and check your work**