7 **(a)** State the meaning of the following terms associated with wave motion.

(i) *intensity* of a wave

.....

.....[1]

(ii) *phase difference* between two waves of the same frequency

.....

.....

.....[2]

(iii) *coherence* of waves

.....

.....

.....[2]

(b) **(i)** Red light has a wavelength of about 7.0×10^{-7} m. State a value for the wavelength of light in the violet section of the visible spectrum.

wavelength = ... m [1]

(ii) In music, moving up an octave in sound represents a doubling of the frequency of the sound. Use your answer to part **(b)(i)** to estimate how many light octaves cover the visible spectrum.

number of octaves = ...[1]

(c) Fig. 7.1 shows a full scale wave pattern of the crests of microwaves after passing through a pair of slits separated by a distance of 1.0 cm.

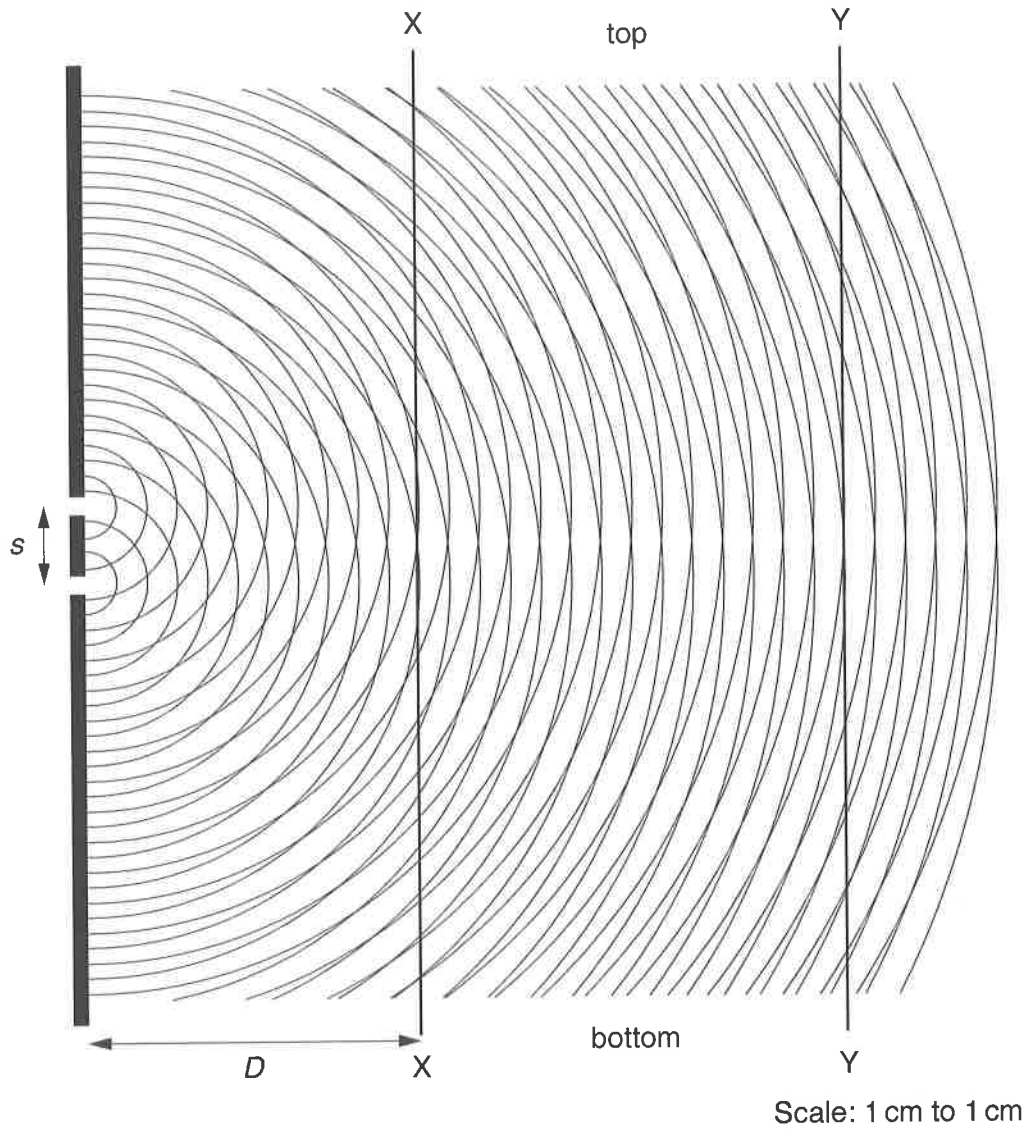

Fig. 7.1

(i) Make a measurement and determine an accurate value for the wavelength λ of the microwaves. Show the method you use to do this.

wavelength = ... cm [2]

(ii) Two vertical lines XX and YY are drawn across the pattern, along which a suitable detector might be moved to show interference.

1. On Fig. 7.1, draw the 5 lines from the centre between the slits along which there are maxima of intensity. [1]

2. Mark on line XX the position of all the points of maximum intensity. [1]

3. Measure the average fringe width w along line XX.

w = ... cm [2]

4. Use your answer for w from part **3**, the distance D of the line XX from the centre of the pair of slits and the slit separation s to calculate the wavelength λ.

$$\lambda = \frac{ws}{D}.$$

λ = ... cm [2]

(iii) Calculate a third value for the wavelength λ making use of line YY.

λ = ... cm [1]

(iv) Suggest why the values you have obtained for the wavelength λ in parts **(i)**, **(ii) 4.** and **(iii)** do not all agree with one another.

.....

.....

.....[2]

(d) Explain why diffraction is necessary for the interference pattern in part **(c)** to be formed.

.....

.....

.....[2]

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