7 **(a)** **(i)** Explain the *principle of superposition*.

……...……...

……...

……... [2]

(ii) Two-source interference fringes using light can only be obtained if light from the two sources is coherent.

Explain

1. the meaning of the term coherent,

…….

……... [1]

2. why in practice, interference fringes can be seen only if light from a single source is split into two.

…….

……... [1]

(iii) Coherent, monochromatic light from two narrow slits a distance 0.38 mm apart causes an interference pattern on a screen 1.20 m from the slits, as illustrated in Fig. 7.1.

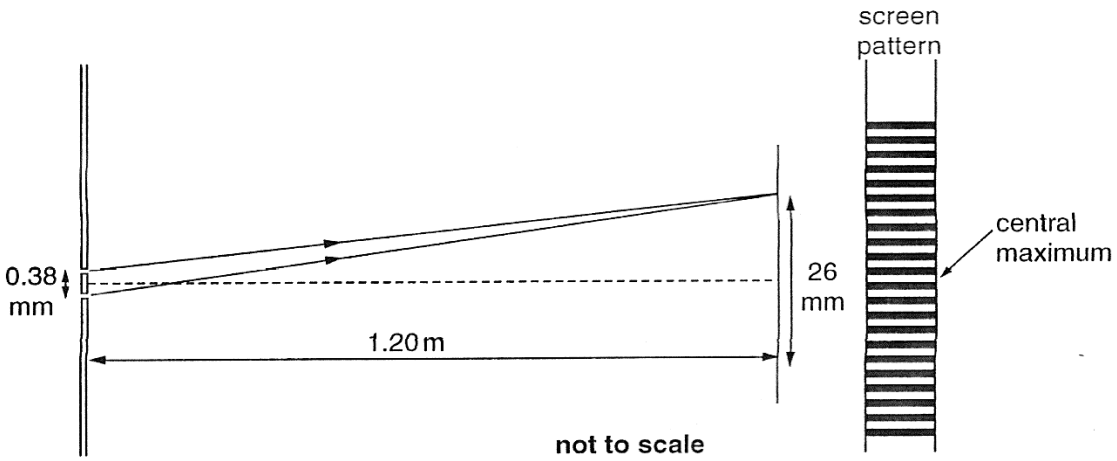

Fig. 7.1

The distance from the sixth bright fringe on one side of the pattern to the sixth bright fringe on the other side of the pattern is found to be 26 mm.

Calculate the wavelength of the monochromatic light.

wavelength = …….. m [3]

(iv) Another way of obtaining fringes similar to those described in (iii) is illustrated in Fig. 7.2.

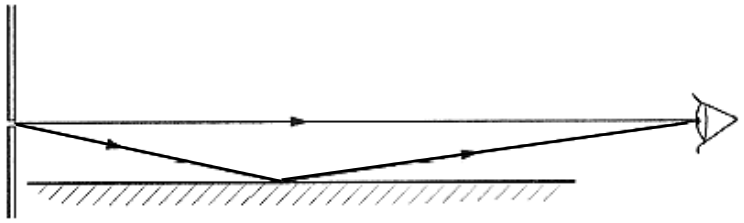

Fig. 7.2

A single slit is viewed both directly and by reflection from a mirror surface.

Explain why this system produces a fringe pattern.

……....

……....

……....

……....

..... [2]

(b) Fig. 7.3 shows a long horizontal tube that is closed at one end, containing a fine powder. A loudspeaker, connected to a signal generator, is positioned at the other end.

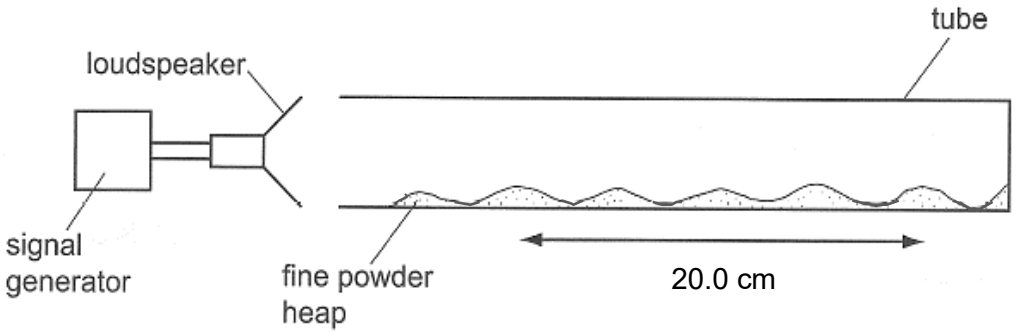

Fig. 7.3

At a particular frequency, a stationary wave is set up inside the tube and the powder forms small heaps and depressions in the tube. The speed of sound is 330 m s^{-1}.

(i) Explain, by reference to the properties of stationary waves, why the heaps and depressions are formed.

……...

……...

……...

…… [2]

(ii) The distance between five heaps as shown in Fig. 7.3 is 20.0 cm. Calculate the frequency of sound in the tube.

frequency = …….. Hz [3]

(iii) One of the stationary waves that may be formed in the tube is shown in Fig. 7.4.

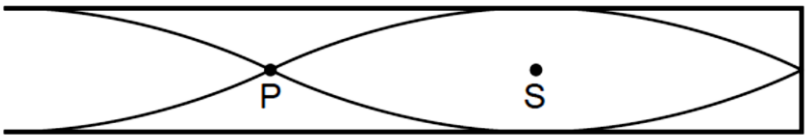

Fig. 7.4

Describe the motion of the air particles in the tube at

1. point P,

..... [1]

2. point S.

..... [1]

(c) Fig. 7.5 shows vertically polarised light of intensity 147 W cm^{-1} passing through a polaroid. The polarising axis of the polaroid is tilted at an angle of 23° to the vertical.

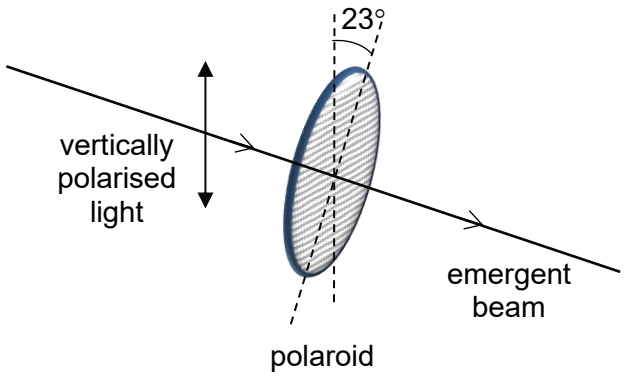

Fig. 7.5

(i) Determine the intensity of the emergent beam.

intensity = …… W cm^{-1} [2]

(ii) Determine the fractional reduction in the amplitude of the emergent beam.

fractional reduction = …… [2]