5

(a)

Interference fringes may be observed using a light-emitting laser to illuminate a double slit. The double slit acts as two sources of light.

(i)

Explain the part played by diffraction in the production of the fringes.

[2]

(ii) Explain the reason why a double slit is used rather than two separate sources of light.

[1]

(ii)

State two changes to the fringe pattern with when an identical beam of light passes through a diffraction grating which has the same separation between adjacent slits as the double slit.

1.

2.

[2]

(b)
A laser emitting light of a single wavelength is used to illuminate slits S_1 and S_2, as shown in Fig. 5.1.

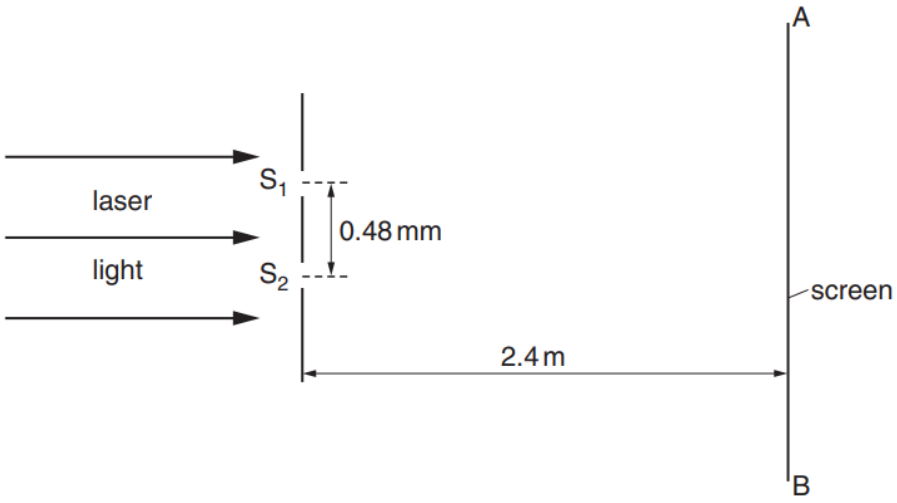

Fig. 5.1 (not to scale)

An interference pattern is observed on the screen AB. The separation of the slits is 0.48 mm. The slits are 2.4 m from AB. The distance on the screen across 16 fringes is 36 mm, as illustrated in Fig. 5.2.

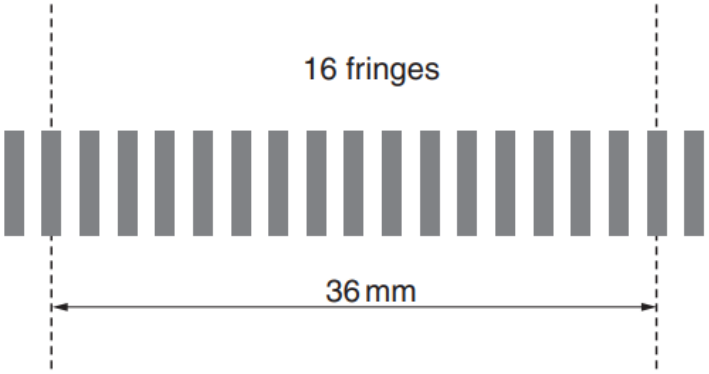

Fig. 5.2

Calculate the wavelength of the light emitted by the laser.

wavelength =

m
[3]

(c)
Two dippers D_1 and D_2 are used to produce identical waves on the surface of water, as illustrated in Fig. 5.3.

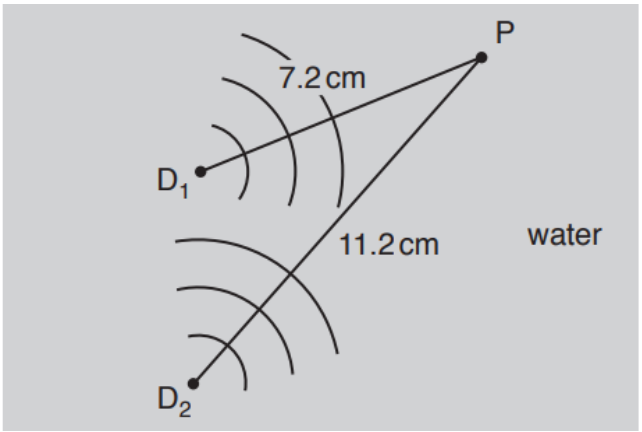

Fig. 5.3

Point P is 7.2 cm from D_1 and 11.2 cm from D_2. The wavelength of the waves is 1.6 cm. The phase difference between the waves produced at D_1 and D_2 is zero.

(i)

State and explain what is observed at P.

[2]

(ii)

State and explain the effect on the answer to **(c)(i)** if the apparatus is changed so that, separately,

1. the phase difference between the waves at D_1 and at D_2 is 180°,

[1]

2. the intensity of the wave from D_1 is less than the intensity of that from D_2.

[1]

[Total: 12]