

- 6 (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.

Explain

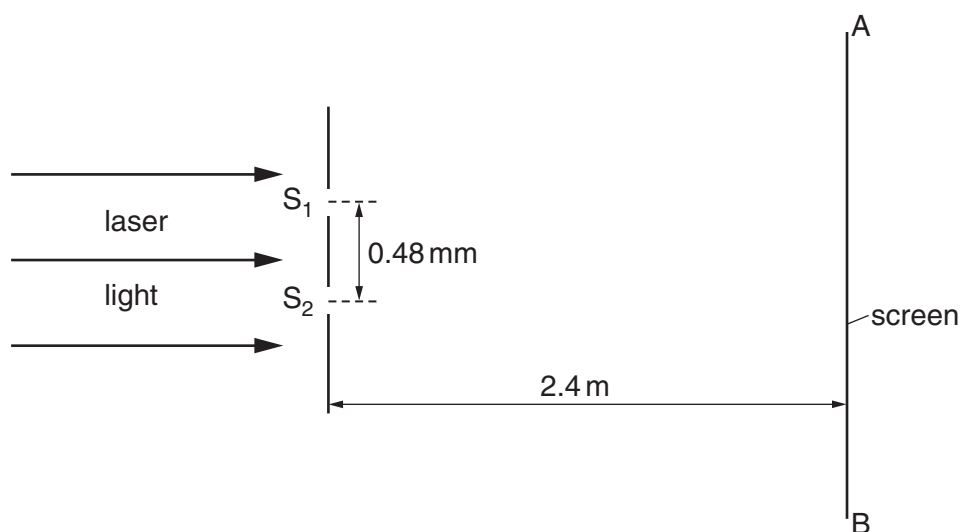
- (i)** the part played by diffraction in the production of the fringes,

.....  
.....  
.....[2]

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

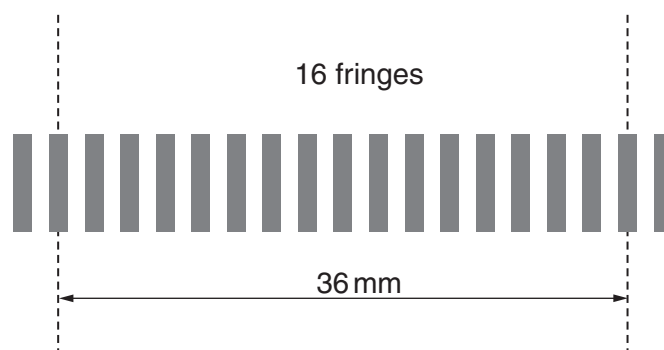
.....  
.....  
.....[1]

- (b) A laser emitting light of a single wavelength is used to illuminate slits  $S_1$  and  $S_2$ , as shown in Fig. 6.1.



**Fig. 6.1** (not to scale)

An interference pattern is observed on the screen AB. The separation of the slits is  $0.48 \text{ mm}$ . The slits are  $2.4 \text{ m}$  from AB. The distance on the screen across 16 fringes is  $36 \text{ mm}$ , as illustrated in Fig. 6.2.

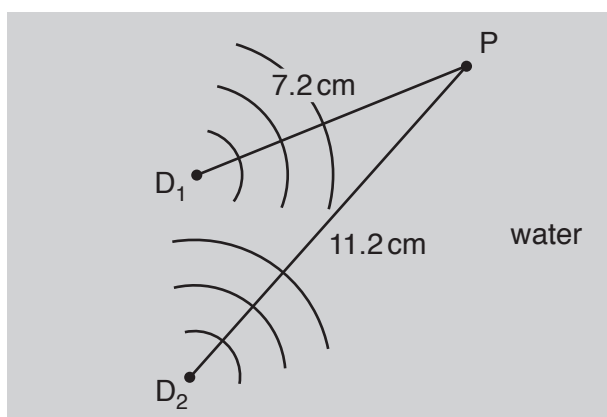


**Fig. 6.2**

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. 6.3.



**Fig. 6.3** (not to scale)

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  $180^\circ$ ,

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

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

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

[2]

[Total: 10]