



- 4 (a) State the principle of superposition.

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

- (b) Suggest why diffraction is observed when sound waves travel through an open doorway, but diffraction is **not** observed when light waves travel through the open doorway.

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

- (c) A semicircular screen is placed a few metres from a diffraction grating such that the screen is centred about the midpoint of the diffraction grating, as shown in Fig. 4.1.

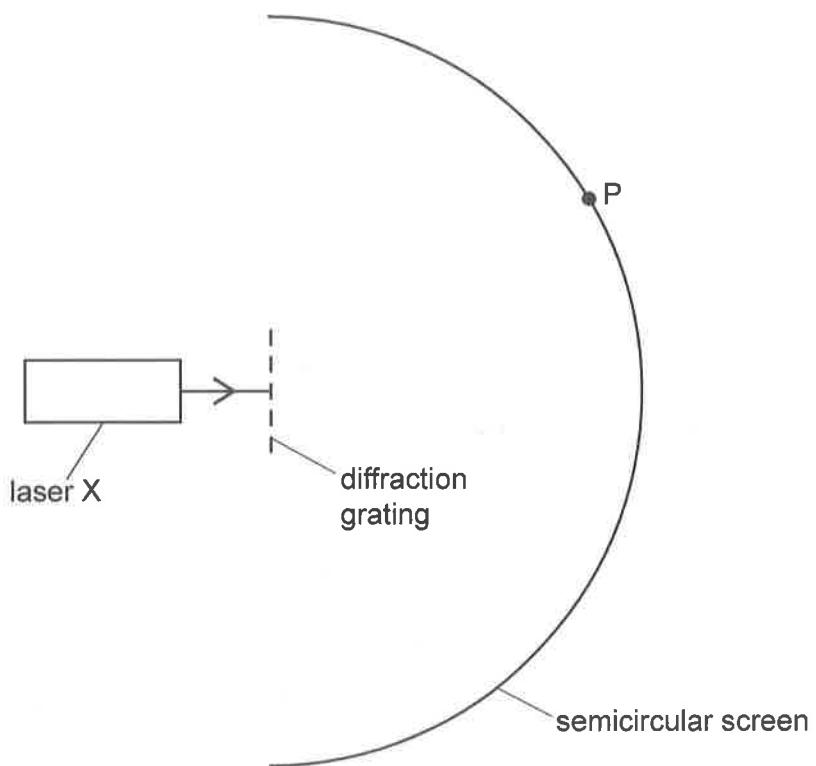


Fig. 4.1 (not to scale)

Light of wavelength  $\lambda_X$  from laser X is incident normally on the diffraction grating. A **second**-order maximum is observed on the screen at point P.





Laser X is removed and replaced with laser Y.

Light of wavelength  $\lambda_Y$  from laser Y is then incident normally on the same diffraction grating. A first-order maximum is observed on the screen at P.

- (i) Show that:

$$\lambda_Y = 2\lambda_X.$$

[2]

- (ii) The diffraction grating has 500 lines  $\text{mm}^{-1}$  and  $\lambda_X$  is 340 nm.

Determine the difference between the total number of maxima visible on the screen with laser X and the total number visible with laser Y.

difference = ..... [3]

[Total: 9]

