



- 4 (a) State the principle of superposition.

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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.

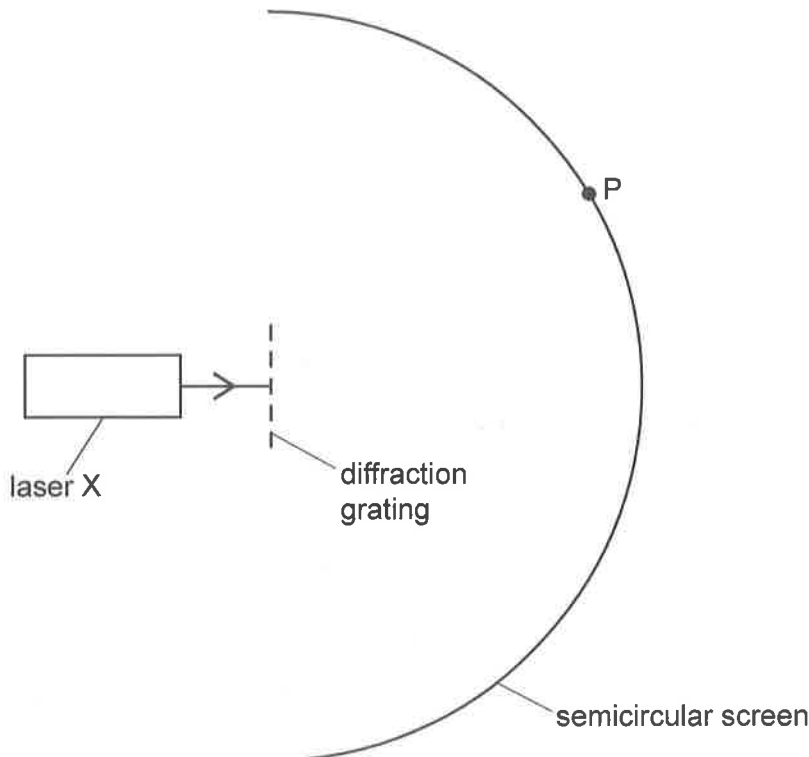


Fig. 4.1 (not to scale)

Light of wavelength λ_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 λ_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 $500 \text{ lines mm}^{-1}$ and λ_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]

