5 **(a)** A beam of vertically polarised light is incident normally on a polarising filter, as shown in Fig. 5.1.

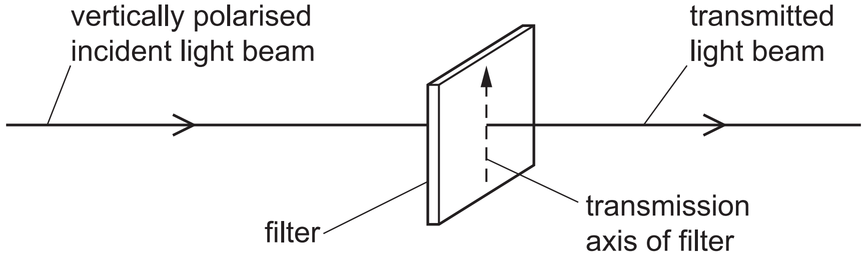

Fig. 5.1

(i) The transmission axis of the filter is initially vertical. The filter is then rotated through an angle of 360° while the plane of the filter remains perpendicular to the beam.

On Fig. 5.2, sketch a graph to show the variation of the intensity of the light in the transmitted beam with the angle through which the transmission axis is rotated.

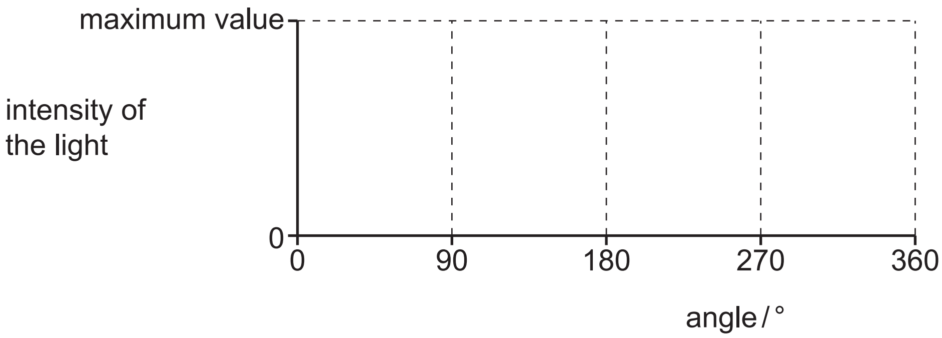

Fig. 5.2

[2]

(ii) The intensity of the light in the incident beam is $7.6\,\mathrm{W\,m^{-2}}$. When the transmission axis of the filter is at angle θ to the vertical, the light intensity of the transmitted beam is $4.2\,\mathrm{W\,m^{-2}}$.

Calculate angle θ.

θ = ...° [2]

(b) State what is meant by the diffraction of a wave.

....

....

.... [2]

(c) A beam of light of wavelength 4.3×10^{-7} m is incident normally on a diffraction grating in air, as shown in Fig. 5.3.

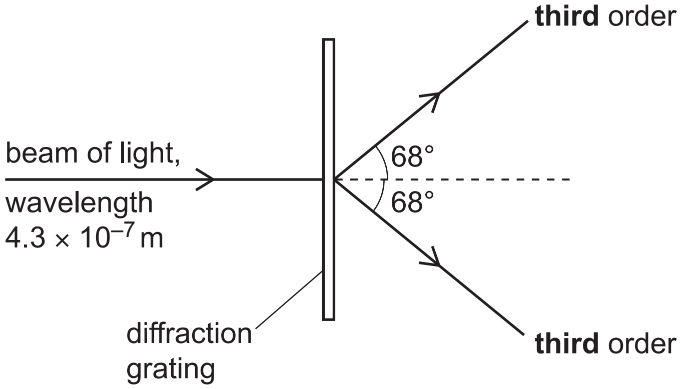

Fig. 5.3 (not to scale)

The **third**-order diffraction maximum of the light is at an angle of 68° to the direction of the incident light beam.

(i) Calculate the line spacing d of the diffraction grating.

d = ... m [2]

(ii) Determine a different wavelength of **visible** light that will also produce a diffraction maximum at an angle of 68°.

wavelength = ... m [2]

[Total: 10]