3(a) A beam of vertically polarized light is incident normally on a polarizing filter, as shown in Fig 3.1

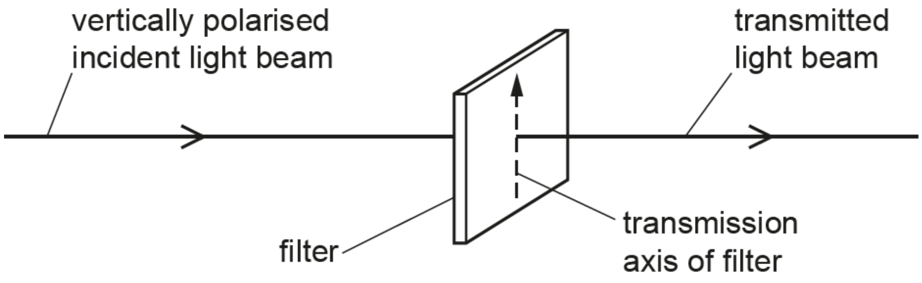

Fig 3.1

(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 3.2, 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. [1]

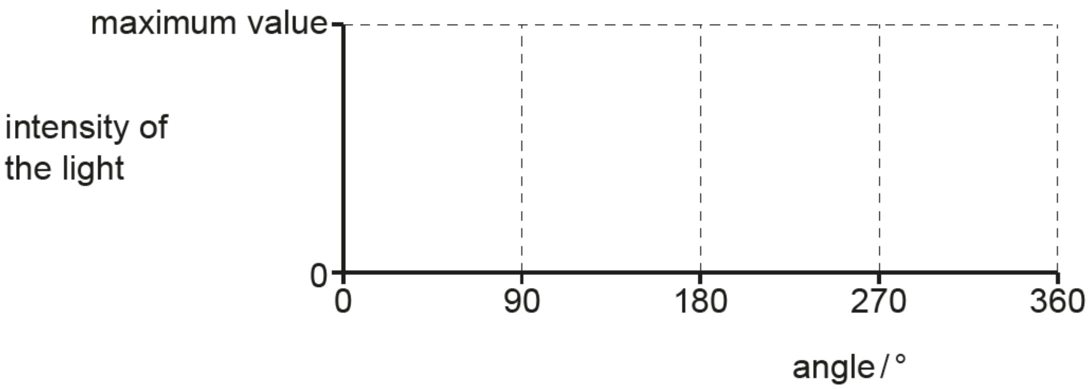

Fig 3.2

(ii) The intensity of the light in the incident beam is 7.6 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 W m^{-2}. Calculate the angle θ. [2]

θ = ……………………………

(b) State what is meant by the diffraction of a wave. [2]

……………………………………………………………………………………………………

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(c) A beam of light wavelength 4.3×10^{-7} m is incident normally on a diffraction grating in air, as shown in Fig 3.3.

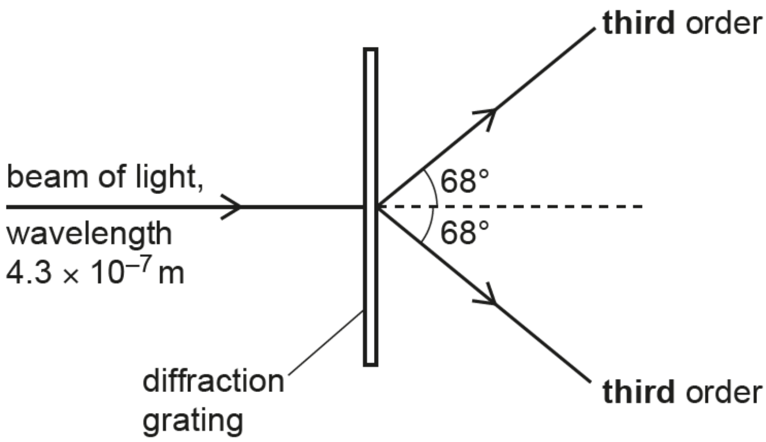

Fig 3.3

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 *a* of the diffraction grating. [2]

a = …………………………

(ii) Determine a different wavelength of **visible** light that will also produce a diffraction maximum at an angle of 68°. [2]

Wavelength = …………………………..