4 **(a)** State what is meant by a polarised wave.

……

……

…… [1]

(b) Two sheets of polaroid P and Q are placed close to each other. Their directions of polarisation are parallel to each other, as shown in Fig. 4.1.

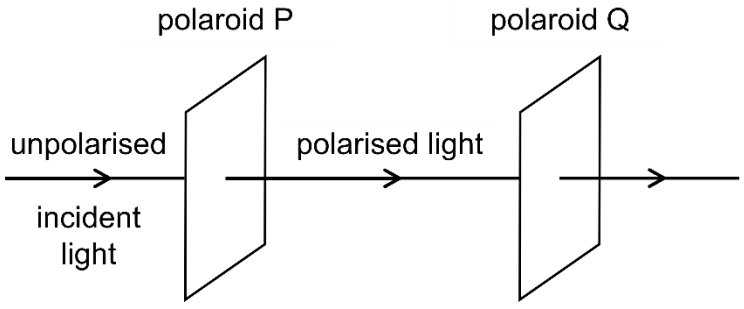

Fig. 4.1

A monochromatic beam of unpolarised light is incident on polaroid P. The beam after passing through polaroid Q has an amplitude of A_0.

Polaroid Q is now rotated about the axis of the light beam by 30°.

Determine the amplitude of the light, in terms of A_0, after passing through polaroid Q.

amplitude = …… [2]

(c) State what is meant by the diffraction of light waves.

……

……

…… [1]

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(d) After passing through polaroid Q, the light is incident normally on a single slit and a diffraction grating.

Fig. 4.2 shows two of the emerging beams from the grating. The angle between the two first-order emerging beams is 16°.

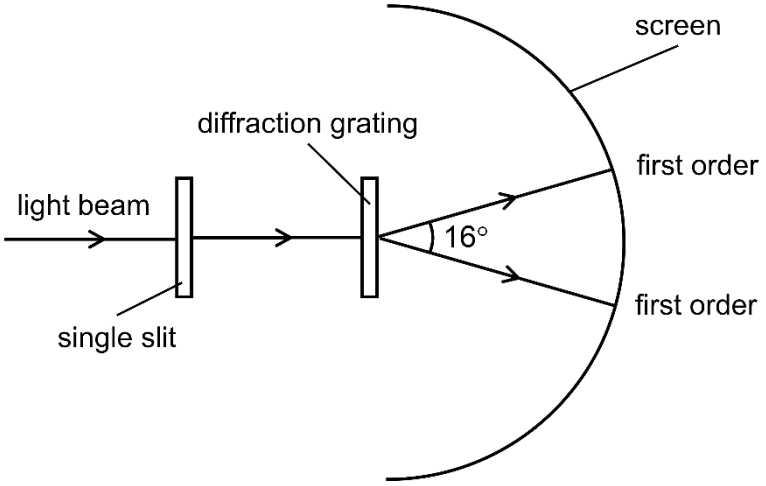

Fig. 4.2 (not to scale)

The grating has a line spacing of 3.4×10^{-6} m.

(i) Calculate the wavelength of the light.

wavelength = ……..…… m [2]

(ii) Hence, state the colour of the visible light beam.

…… [1]

[Turn over

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(iii) Determine the total number of emerging beams from the grating that can be observed on the screen.

number of emerging beams = ……..…… [2]

(iv) State and explain the change(s), if any, to the diffraction pattern on the screen when polaroids P and Q are removed.

……..

……..

……..

……..…….. [2]

[Total: 11]