3 A beam of unpolarised light is incident normally on a polaroid P as shown in Fig. 3.1. The polarised light after passing through polaroid P has amplitude A and intensity I_o.

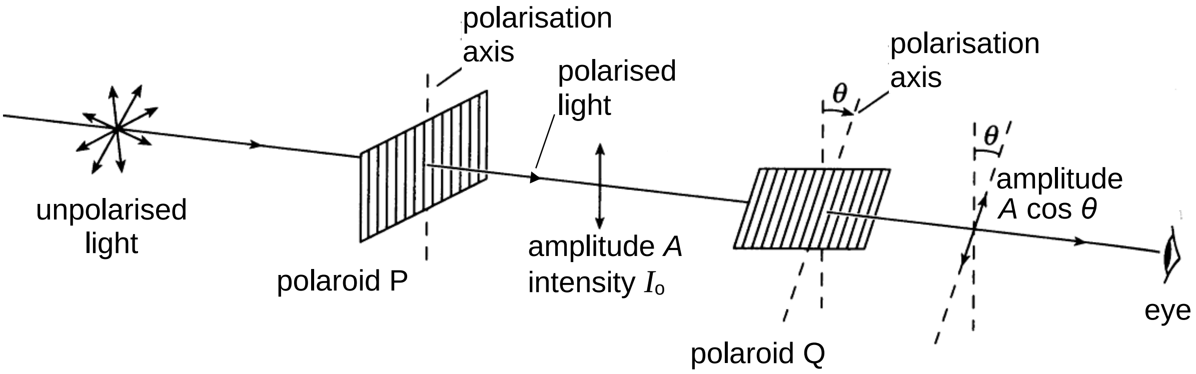

Fig. 3.1

The polarised light from polaroid P then passes through polaroid Q whose polarisation axis is inclined at an angle θ to the polarisation axis of polaroid P. This polarised light from Q has amplitude $A \cos \theta$.

(a) In Fig. 3.2, sketch a graph showing the variation of intensity of the polarised light from polaroid Q when it is rotated through $\theta = 0°$ to $\theta = 360°$.
Label all values on the axes.

Fig. 3.2

[2]

(b) Polaroid Q is now fixed with its polarisation axis kept at 90° to that of polaroid P. A third polaroid R is then inserted between polaroids P and Q, with its polarisation axis inclined at an angle ϕ to the polarisation axis of polaroid P, as shown in Fig. 3.3.

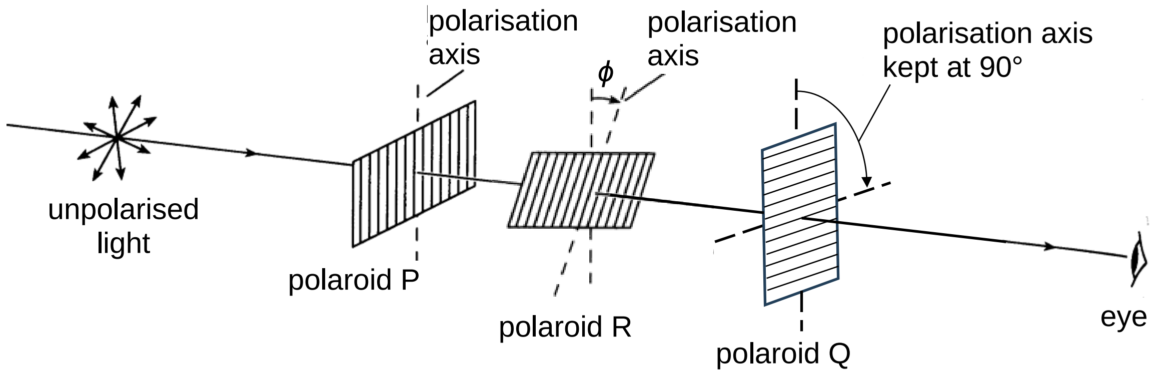

Fig. 3.3

(i) Calculate the intensity of the polarised light from polaroid Q in terms of I_o when ϕ is 30°.

intensity = …………………………… [2]

(ii) In Fig. 3.4, sketch a graph showing the variation of intensity of the polarised light from polaroid Q when polaroid R is rotated through ϕ = 0° to ϕ = 360°.
Label all values on the axes.

Fig. 3.4

[3]

(c) Explain why longitudinal waves cannot be polarised.

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