

700.

Problem 48.21 (RHK)

We have to find the action of a half-wave plate (that is, a plate twice as thick as a quarter-wave plate) on (a) linearly polarized light (assume the plane of vibration to be at 45° to the optic axis of the plate), (b) circularly polarized light, and (c) unpolarized light.

Solution:

We resolve the linearly polarized light into two components: one in which vibrations are in the plane determined by the direction of propagation and the optic axis, and the other in which the vibrations are in the plane perpendicular to the first plane.

(a)

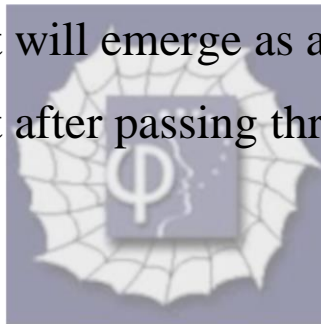
As the plane of vibration of the incident light is at 45° to the optic axis of the plate, the two components will be of equal magnitudes and let us assume that their phase difference is zero. When the plane polarized light passes through a half-wave plate, the



phase difference between the vibrations of the two components will be π and the resultant vibration will be plane polarized but the direction of linear polarization will have rotated by $\pi/2$.

(b)

Let us assume a right-circularly polarized light is incident on the half-wave plate. As an additional phase difference of π will be introduced between the two orthogonal vibrations, a right-circularly polarized light will emerge as a left-circularly polarized light after passing through a half-wave plate.



(c)

An unpolarized light will emerge as an unpolarized light after passing through a half-wave plate.