Answer on Question #65171, Physics / Optics

A plano-convex lens of radius 1.0 m is placed on an optically flat glass plate and is illuminated by an extended monochromatic source. Assume that the point of contact is perfect. The diameters of the 10th and 5th dark rings in the reflected light are 4.50 × 10−3m and 3.36 × 10−3m. Next, the space between the lens and the glass plate is filled with a liquid. The diameter of the 5th ring changes to 3.0×10−3m. Calculate the refractive index of the liquid when the ring is (i) dark, and (ii) bright, if the wavelength of light is 589 nm.

Find: n_{dark} - ? n_{bright} - ?

Given:

R=1.0 m

$r_5=1.5\times10^{-3}$ m

$\lambda=589\times10^{-9}$ m

Solution:

For dark ring: $r_5 = \sqrt{\frac{kR\lambda}{n}}$ (1), where k=5

Of (1) $\Rightarrow$ $n = \frac{kR\lambda}{{r_5}^2}$ (2)

Of (2) $\Rightarrow$ n=1.3089

For bright ring: $r_5 = \sqrt{\frac{(2k-1)R\lambda}{2n}}$ (3), where k=5

Of (3) $\Rightarrow$ $n = \frac{(2k-1)R\lambda}{2{r_5}^2}$ (4)

Of (4) $\Rightarrow$ n=1.1780

Answer:

(i) 1.3089

(ii) 1.1780