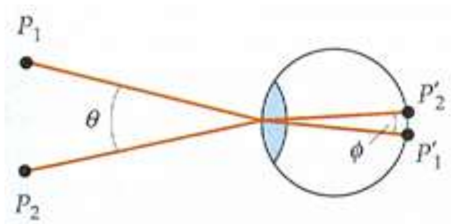
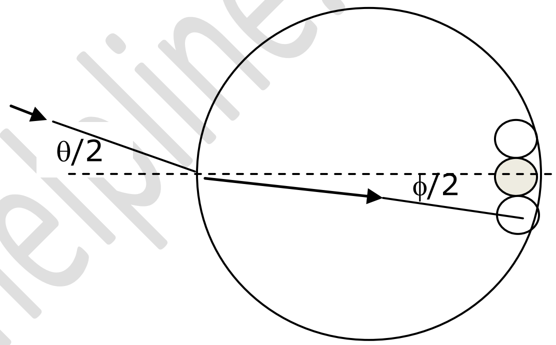
Q- If two point objects close together are to be seen as two distinct objects, the images must fall on the retina on two different cones that are not adjacent. That is, there must be an un-activated cone between them. Assume the separation of the cones is 0.8 μm. Model the eye as a uniform 2.2 cm diameter sphere with a refractive index of 1.34.



(a) What is the smallest angle θ the two points can subtend?

As the angles involved are very small if we write angles in radians then

$$\sin(\phi/2) = (\phi/2) = d/D = 0.8*10^{-6}/(2.2*10^{-2}) = 3.64*10^{-5} \text{ radians}$$



Thus the angle formed by the images at eye lens will be

$$\phi = 2*3.64*10^{-5} = 7.28*10^{-5} \text{ radians}$$

Hence applying Snell's law we get angle subtended by the objects on the eye lens will be given by

$$\mu = \frac{\sin i}{\sin r} = \frac{\sin(\theta/2)}{\sin(\emptyset/2)} = \frac{\theta}{\emptyset}$$

Or $1.34 = \frac{\theta}{\emptyset}$

Or $\theta = 1.34*\phi = 1.34*2*3.64*10^{-5} = 9.75*10^{-5}$ radians

(b) How close can two points be if they are 50 m from the eye?

Angle in radius = arc length/radius

Gives arc length = angle*radius

Or distance $P_1P_2 = 9.75*10^{-5}*50 = 4.88*10^{-3}$ m = 4.88 mm.