16. A hunter who is a bit of a braggart claims that from a distance of 1.6 km he can selectively shoot either of two squirrels who are sitting ten centimeters apart on the same branch of a tree. What's more, he claims that he can do this without the aid of a telescopic sight on his rifle. **(a)** Determine the diameter of the pupils of his eyes that would be required for him to be able to resolve the squirrels as separate objects. In this calculation use a wavelength of 498 nm (in vacuum) for the light. **(b)** State whether his claim is reasonable, and provide a reason for your answer. In evaluating his claim, consider that the human eye automatically adjusts the diameter of its pupil over a typical range of 2 to 8 mm, the larger values coming into play as the lighting becomes darker. Note also that under dark conditions, the eye is most sensitive to a wavelength of 498 nm.

$$\theta_{minimum} = \frac{1.22\,\lambda}{D} \approx \frac{y}{L}$$

Solve for the diameter

$$D = \frac{1.22\,\lambda L}{y} = \frac{1.22\,(498\ x\ 10^{-9}m)(1.6\ x\ 10^{3}m)}{10\ x\ 10^{-2}m} = 9.72\ x\ 10^{-3}m = 9.72\ mm$$

Since the diameter 9.7 mm > 8 mm which would suggest that it is unlikely that the hunter can do this unless he has an eye which expands the size of his pupil beyond what is normal.

$$D = 9.7\ mm$$
The claim is unreasonable as he would need to be able to create a larger diameter pupil than most people can.