Name_____

Physics 111 Quiz #7, October 27, 2025

Please show all work, thoughts and/or reasoning to receive partial credit. The quiz is worth 10 points total, and all parts may not be of equal weight.

I affirm that I have carried out my academic endeavors with full academic honesty.

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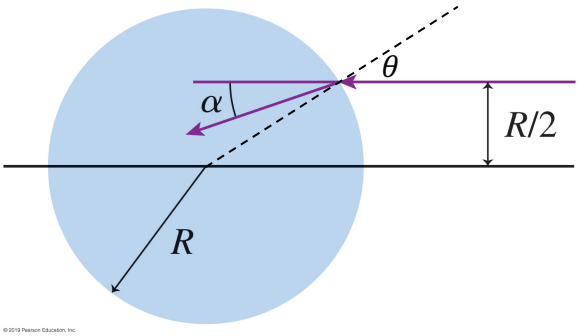
1. The figure below shows a ray of light incident on a glass cylinder ($n_{glass} = 1.5$) of radius R. At what angle of incidence, θ, does the light make in air, measured with respect to the normal to the surface (the dashed line) of the glass cylinder? If you cannot determine a value, use $\theta = 30^0$.

$$\sin\theta = \frac{R/2}{R} = \frac{1}{2}$$

$$\theta = \sin^{-1}\left(\frac{1}{2}\right) = 30^0$$



2. What is the angle α of the ray after it has entered the glass cylinder?

$$n_{air}\sin\theta_{air} = n_{glass}\sin\theta_{glass} \rightarrow \theta_{glass} = \sin^{-1}\left(\frac{n_{air}}{n_{glass}}\sin\theta_{air}\right) = \sin^{-1}\left(\frac{1.0}{1.5}\sin 30\right) = 19.5^0$$

$$\theta = \alpha + \theta_{glass} \rightarrow \alpha = \theta - \theta_{glass} = 30^0 - 19.5^0 = 10.5^0$$

3. Suppose you have a converging lens made out of glass with a focal length f. At what location would an object need to be placed (in terms of f) such that the image produced by the lens is virtual and 3 times the size of the object?

$$M = \frac{h_i}{h_o} = \frac{d_i}{d_o} \rightarrow d_i = \left(\frac{h_i}{h_o}\right) \cdot d_o = \left(\frac{3h_o}{h_o}\right) \cdot d_o = 3d_o$$

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_o} = \frac{1}{d_o} - \frac{1}{3d_o} = \frac{2}{3d_o} \rightarrow d_o = \frac{2}{3}f$$

4. Suppose you have a converging lens made out of glass with a focal length f. At what location would an object need to be placed (in terms of f) such that the image produced by the lens is real and 3 times the size of the object?

$$M = \frac{h_i}{h_o} = \frac{d_i}{d_o} \rightarrow d_i = \left(\frac{h_i}{h_o}\right) \cdot d_o = \left(\frac{3h_o}{h_o}\right) \cdot d_o = 3d_o$$

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_o} = \frac{1}{d_o} + \frac{1}{3d_o} = \frac{4}{3d_o} \rightarrow d_o = \frac{4}{3}f$$

5. Are the results of parts 3 and 4 consistent with what you know about image formation using a converging lens? To earn full credit, explain why the results are or are not. Simply saying yes, they are or no, they are not will earn no credit.

Yes, the results are consistent. For a virtual image the object distance needs to be smaller than the focal length of the lens, which we have in part 3. For a real image, the object distance needs to be larger than the focal length of the lens, which we have in part 4.