Roadmap Solution

Monday, April 24, 2023 2:44 PM

Physics 203

Quizbit | Ray Optics

Part A: Work individually to produce a handwritten solution to **Part A (question 1)** of this Quizbit. Submit an image of your solution to Canvas. The quality of your solution and communication is far more important than the final answer!

1) A drawing of "Trogdor the Burninator" is placed **5.0 cm** from a converging lens of focal length **10 cm**. You do not need to draw Trogdor in detail. Instead, represent them as a single arrow pointed upwards from the optical axis.

Hints:
$v = f\lambda$
$v = c / n$
$n_1 \sin(\theta_1) = n_2 \sin(\theta_2)$
$1/f = 1/d_o + 1/d_i$
$m = - d_i / d_o$

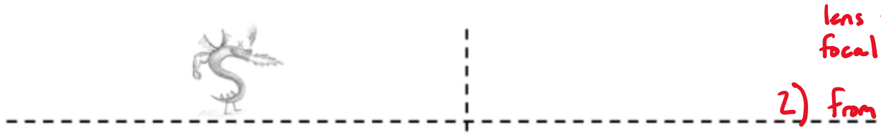
Hint: the width of a standard piece of 8.5" by 11" paper is about 20 cm.

(a) Carefully, and as precisely as you can, draw a ray diagram for this scenario.

1) parallel from obj to lens → bends towards focal pt

2) from left focal pt → obj → bends parallel

3) from obj → middle of lens



$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

(b) Using the mathematical model, show how to find the image distance for this scenario.

(c) A drawing of Trogdor is now placed 5.0 cm from a diverging lens of focal length 10 cm. Using the mathematical model, find the magnification of the image for this scenario. Is it a real or virtual image? Explain.

$$m = -\frac{d_i}{d_o}$$

Part B: As a group, assign roles to each member. One person should be the writer, one should be the recorder in charge of submitting the group solution to Gradescope (or Canvas), and if you have a third member, they should be the advice giver. Write each group member's name on the solution! Make sure to rotate roles so that each person has a chance to be the writer. **Work together to produce a written solution to Part A, then additionally answer Part B (question 2)**. Submit an image of your work to Gradescope or Canvas.

2) Four layers of transparent materials are placed against each other. The first layer has an index of refraction of $\mathbf{n_1 = 3.20}$, the second $\mathbf{n_2 = 3.55}$, the third $\mathbf{n_3 = 2.75}$, and the last $\mathbf{n_4 = 2.30}$. Red light of wavelength 685 nm is incident from the first layer on the second layer at an angle of 43 degrees with respect to the surface (see image). At what angles of refraction does the light travel into each layer of material? Draw a representation of the light's path. Make sure to label each angle of refraction.