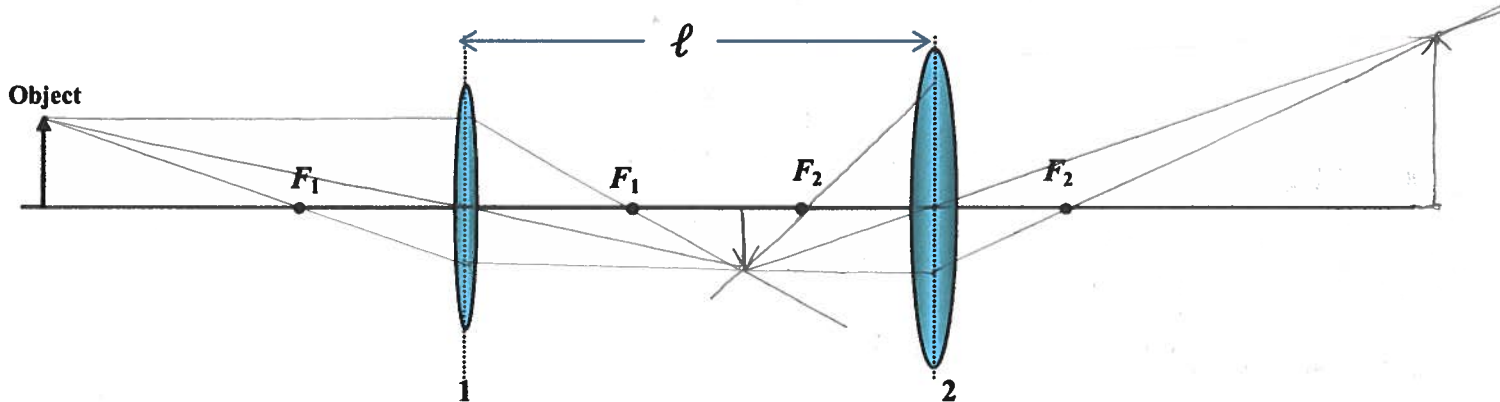


PHYS 2112- Take Home Quiz- Optics

→ → Due on **Friday, Nov. 1** in class

An object is located to the left of a compound lens system consisting of two converging lenses (lens 1 and lens 2). The focal lengths of the two lenses are shown in the diagram below.



- (a) Sketch the principal rays for the compound lens system on the diagram above.
 (b) Using your sketch as a guide, circle all of the adjectives that describe the final image.

Real Upright Reduced
 Virtual Inverted Enlarged

- (c) Assuming that lens 1 has focal length $f_1 = 20.0$ cm and that the object is a distance $p_1 = 2.50f_1 = 50.0$ cm, find the imaged distance i_1 for the image produced by the lens 1.

$$\frac{1}{i_1} = \frac{1}{f_1} - \frac{1}{p_1} = \frac{1}{20.0\text{cm}} - \frac{1}{50.0\text{cm}} = 0.03 \text{ cm}^{-1} \Rightarrow i_1 = 33.3\text{cm}$$

- (d) Assuming that lens 2 has focal length $f_2 = 16$ cm and that lens 2 is $\ell = 56.0$ cm from lens 1, find the image distance i_2 for the image produced by the second lens.

$$p_2 = + (\ell - 33.3\text{cm}) = + (56.0\text{cm} - 33.3\text{cm}) = +22.7\text{cm}$$

$$\frac{1}{i_2} = \frac{1}{f_2} - \frac{1}{p_2} = \frac{1}{16.0\text{cm}} - \frac{1}{22.7\text{cm}} = 0.0184\text{cm}^{-1} \Rightarrow i_2 = 54.2\text{cm}$$

- (e) What is the magnification of the image that is produced by the compound lens system?

$$M = \frac{-i_1}{p_1} \times \frac{-i_2}{p_2} = \frac{-33.3\text{cm}}{+50.0\text{cm}} \times \frac{-54.2\text{cm}}{+22.7\text{cm}} = 1.6$$

FOR FULL CREDIT: Show all relevant work and commentary. * All numerical values must include appropriate units, not just the final answer. Use extra paper if necessary. **Staple all of your work together for submission.** (*When in doubt, write it out.)