

Answer on Question #69312, Physics / Optics

you place a object 23cm in front of a diverging lens which has a focal length with magnitude of 13.4cm. determine how far the object should be placed to reduce image size by factor of 4.35

Find: d_o - ?

Given:

$$f=13.4 \text{ cm}$$

$$K=4.35$$

Solution:

If the distances from the object to the lens and from the lens to the image are d_o and d_i respectively, for a lens of negligible thickness, in air, the distances are related by the thin lens formula:

$$\frac{1}{d_o} - \frac{1}{d_i} = -\frac{1}{f} \quad (1),$$

where f is focal length of a diverging lens

Magnification of lens:

$$M = \frac{d_i}{d_o} \quad (2)$$

$$\text{According to the condition of the task: } M = \frac{1}{4.35} = 0.23 \quad (3)$$

$$\text{Of (2)} \Rightarrow d_i = M d_o \quad (4)$$

$$(4) \text{ in (1): } \frac{1}{d_o} - \frac{1}{M d_o} = -\frac{1}{f} \quad (5)$$

$$\text{Of (5)} \Rightarrow \frac{M-1}{M d_o} = -\frac{1}{f} \quad (6)$$

$$\text{Of (6)} \Rightarrow d_o = -\frac{(M-1)f}{M} \quad (7)$$

$$\text{Of (7)} \Rightarrow d_o = 44.86 \text{ cm}$$

Answer:

$$44.86 \text{ cm}$$

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