9.

Given: f = focal length of converging lens = 16cm, d_o = object distance from optical centre of lens = 11cm

Required: D_i = distance of image from optical centre of lens

Application: Thin Lens Equation $\Rightarrow \frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$

Solution: $\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o} \Rightarrow \frac{1}{16} = \frac{1}{d_i} + \frac{1}{11} \Rightarrow \frac{(16)(11)}{16} = \frac{(16)(11)}{d_i} + \frac{(16)(11)}{11}$

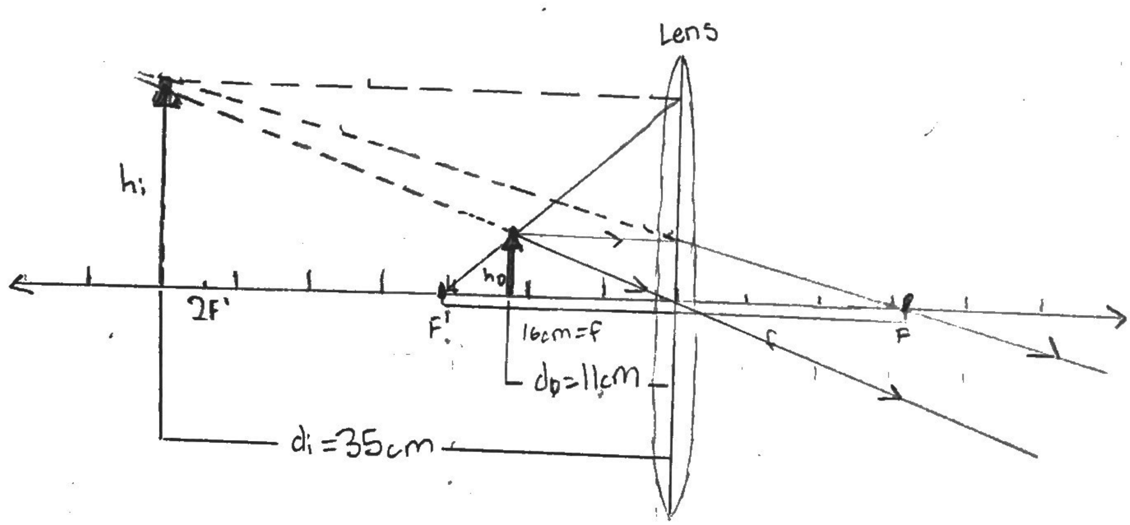
Sig Digs

$\Rightarrow 11 = \frac{(16)(11)}{d_i} + 16 \Rightarrow -5 = \frac{176}{d_i} \Rightarrow d_i = \frac{176}{-5} = -35.2 \approx -35$

$\therefore d_i = -35\text{cm}$; image is virtual and 35cm in front of lens

Statement: Through the Thin Lens Equation, we can see that the image of the insect is virtual, and forms 35cm in front of the lens.

Ray Diagram - Q9



Scale = 1cm : 5cm

13 (all a,b,c)

Given: Magnification $= 5.6x$, $d_o = 9.4cm$, Type of image = virtual, attitude of image = upright

Required: a) Image location (d_i), b) Focal length of lens, c) Type of lens

Application: TLE $\Rightarrow \frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$, Mag. Eq = $M = -\frac{d_i}{d_o}$

Solution:

a) $M = -\frac{d_i}{d_o} \Rightarrow 5.6 = -\frac{d_i}{9.4} \Rightarrow d_i = -(9.4)(5.6) \Rightarrow d_i = -52.64 \approx -53cm \therefore d_i = -53cm$

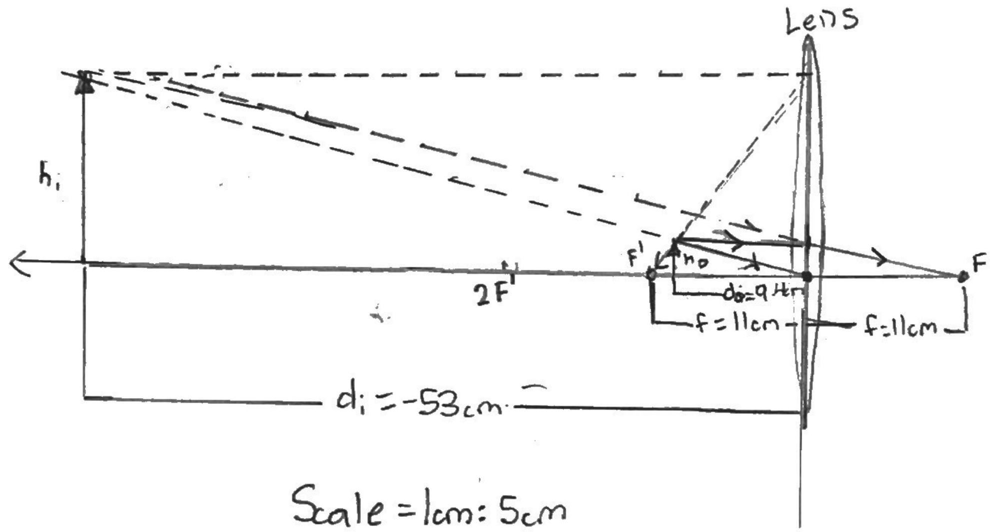
b) $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i} \Rightarrow \frac{1}{f} = \frac{1}{9.4} - \frac{1}{53} \Rightarrow f = \frac{1}{\frac{1}{9.4} - \frac{1}{53}} = 11.4266 \approx 11cm \therefore$ Focal length $= 11cm$

c) This is a converging lens; the image is virtual and upright, but because the magnification is >1, the image is also larger, which is a property that diverging lenses do not satisfy.

State:

Through the Thin Lens Equation & Magnification Equation, we have shown that the image is 53cm in front of the lens, the focal length is 11cm, and the lens is a converging one.

Ray Diagram - Q13



Scale = 1cm : 5cm