Optics #6 p 846 Problems 41, 43, 62
online Two Lens System

p 846 - Problems

41) $f = 6\,cm$ camera lens
$d_o = 3\,m$
$d_i = ?$

$$d_i = \left(\frac{1}{f} - \frac{1}{d_o}\right)^{-1}$$

$$= \left(\frac{1}{.06m} - \frac{1}{3m}\right)^{-1}$$

$$= .061\,m$$

43) $d_o = 12.6\,cm$
$f = 12.0\,cm$
$h_o = 2.0\,cm$

a) $d_i = ?$

$$d_i = \left(\frac{1}{f} - \frac{1}{d_o}\right)^{-1}$$

$$= \left(\frac{1}{12cm} - \frac{1}{12.6cm}\right)^{-1}$$

$$= 252\,cm$$

b) $m = \frac{h_i}{h_o} = -\frac{d_i}{d_o}$ $\quad h_i = -\frac{d_i h_o}{d_o}$

$$= -\frac{(252\,cm)(2\,cm)}{12.6\,cm}$$

$$= -40\,cm$$

(6) (8)

Optics #18   P 847 Problem 62 Thin Lens System

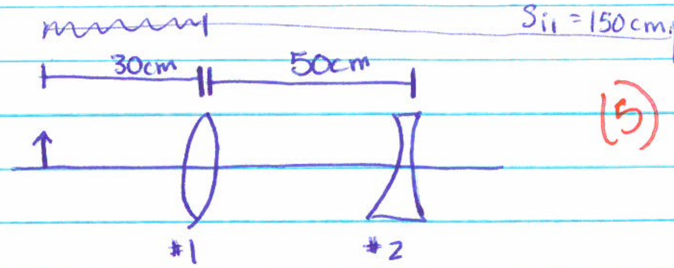
p 847 - Problems

(62)

$f_1 = +25cm$

$f_2 = -40cm$

$d_{between} = 50cm$



(5)

$h_o = 2$ cm

$d_o = 30cm$ from 1

A) $d_i = ?$

① $d_{i_1} = \left(\frac{1}{f} - \frac{1}{d_o}\right)^{-1} = \left(\frac{1}{25cm} - \frac{1}{30cm}\right)^{-1} = 150cm$

② $S_{o_2} = d - S_{i_1} = 50cm - 150cm = -100cm$

③ $S_{i_2} = \left(\frac{1}{f} - \frac{1}{d_o}\right)^{-1} = \left(\frac{1}{-40cm} - \frac{1}{-100cm}\right)^{-1} = -67cm$

(2)

B) upright

$m_1 = -\frac{d_i}{d_o} = -\frac{(+)}{(+)} = -$ inverted

$m_2 = -\frac{d_i}{d_o} = -\frac{(-)}{-} = -$ inverted of the

$M = (m_1)(m_2) = (-)(-) = +$ inverted

↑ upright

C) virtual

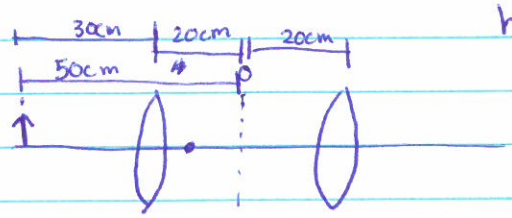
S_{i_2} is $-$, virtual

Concave only make virtual images

~~8~~ 6

- Online - Two lens system

• Two converge lens $x = -20cm$ $f = +10cm$
$x = +20cm$ $f = +8cm$
$h_o = 1.00cm$ $x = -50cm$



a) ① $d_{i_1} = \left(\frac{1}{f} - \frac{1}{d_o}\right)^{-1} = \left(\frac{1}{10cm} - \frac{1}{30cm}\right)^{-1} = 15cm$

② $d_{o2} = d - d_{i_1} = 40cm - 15cm = 25cm$

③ $d_{i_2} = \left(\frac{1}{f} - \frac{1}{d_o}\right)^{-1} = \left(\frac{1}{8cm} - \frac{1}{25cm}\right)^{-1} = 11.8cm$

(2) X coordinate 20cm + 11.8cm 31.8cm

b) $h_i = ?$ $M = (m_1)(m_2) = \left(-\frac{d_{i_1}}{d_{o_1}}\right)\left(-\frac{d_{i_2}}{d_{o_2}}\right)$

$M = \left(\frac{15cm}{30cm}\right)\left(\frac{11.8cm}{25cm}\right) = .236$

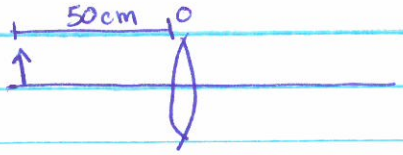
$M_{tot} = (m_1)(m_2)$

$M = \frac{h_{i_1}}{h_{o_1}} \cdot \frac{h_{i_2}}{h_{o_2}}$ $h_{i_2} = M_{tot}\, h_{o_1}$

$= (.236)(1.00cm)$

$= .236cm$

c) upright (+ magnification)

d) 

f_3 single lens do same job

$d_o = 50\text{cm}$
$d_i = 31.8\text{cm}$

$$f = \left(\frac{1}{d_o} + \frac{1}{d_i}\right)^{-1}$$

$$= \left(\frac{1}{50\text{cm}} + \frac{1}{31.8\text{cm}}\right)^{-1}$$

$$= 19.4\text{cm}.$$

(1)

e) image size?

- different size
- oriented differently

$$m = -\frac{d_i}{d_o} = -\frac{(31.8\text{cm})}{50\text{cm}}$$

$$= -.636$$

↑ inverted ↑ larger