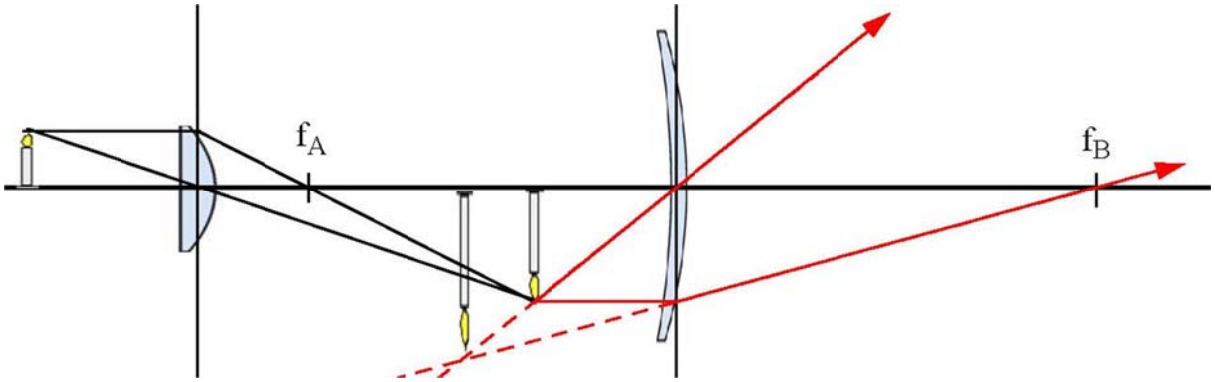
ANSWERS OPTICS, FYSA13

O1 Answers:

a) n = 1.57

O2 Answers:

a) distance =36.0 cm
b) distance =31.0 cm
c) y’ = -12.0 cm
d) R2 = -4.16 cm
e)

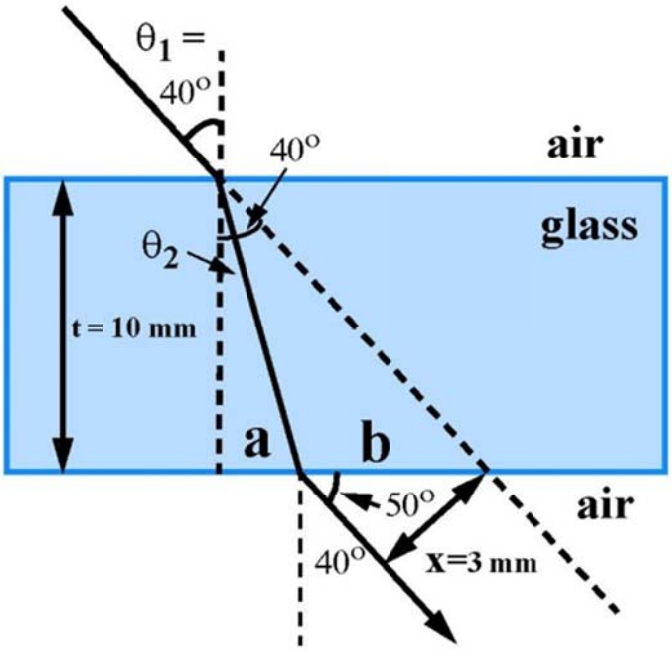


O3 Answers:

a) 2.49 cm
b) 1.56 cm
c) 25.6 cm

SOLUTIONS OPTICS, FYSA13

O1 Solutions:



O1a $\sin 50^\circ = \frac{x}{b} \Rightarrow b = \frac{x}{\sin 50^\circ} = \frac{3,0}{\sin 50^\circ} = 3,92\text{mm}$

$\tan 40^\circ = \frac{a+b}{t} \Rightarrow a+b = t \cdot \tan 40^\circ$

$a = t\cdot\tan 40^\circ - b = 10,0 \tan 40^\circ - 3,92 = 4,47\text{mm}$

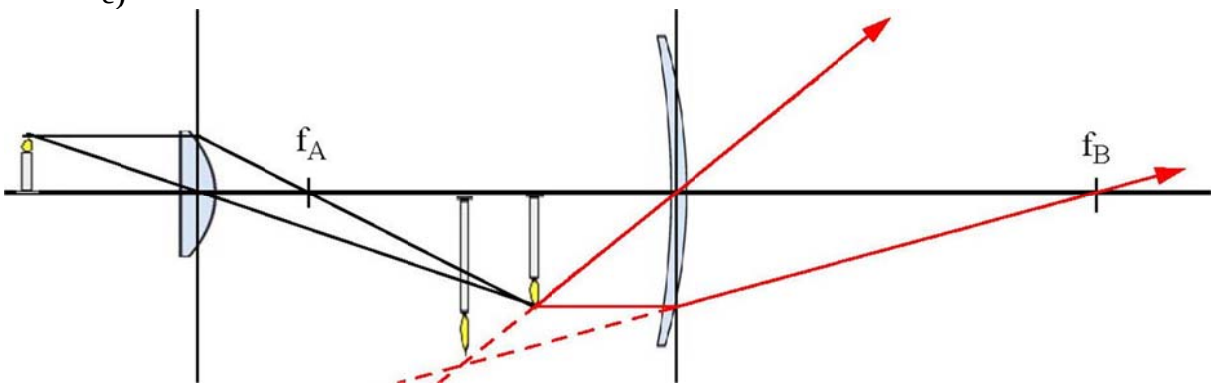
$\tan\theta_2 = \frac{a}{t} \qquad \theta_2 = \arctan\left(\frac{4,47}{10,0}\right) = 24,1^\circ$

Snells lag: $1,00\cdot\sin\theta_1 = n\cdot\sin\theta_2$

$n = \frac{\sin\theta_1}{\sin\theta_2} = \frac{\sin 40^\circ}{\sin 24,1^\circ} = 1,57$

O2 Solutions:

a) S = 12.0 cm, f=8.0 cm, s'=24.0 cm, distance = s+s´=36 cm
b) S = 34-24 = 10.0 cm, f= 30.0 cm, s´ = -15.0 cm, distance = 12.0+34.0+s´=31.0 cm
c) mA = -2.0, mB = 1.5, m=3, y' = -12.0cm
d) R2 = -4.16 cm
e)



O2a) $s_A' = \frac{s_A \cdot f_A}{s_A - f_A} = \frac{12.0 \cdot 8.0}{12.0 - 8.0} = 24.0\,cm$

distance $= s_A + s_A' = 12.0 + 24.0 = 36.0\,cm$

b) $s_B' = \frac{s_B \cdot f_B}{s_B - f_B}$

$s_B = 34.0 - 24.0 = 10.0\,cm$

$s_B' = \frac{10.0 \cdot 30.0}{10.0 - 30.0} = -15.0\,cm$

distance $= s_A + 34.0 + s_B' = 12.0 + 34.0 - 15.0 = 31.0\,cm$

c) $m_A = -\frac{s_A'}{s_A} = -\frac{24.0}{12.0} = -2.00$

$m_B = -\frac{s_B'}{s_B} = -\frac{-15.0}{10.0} = 1.50$

$M = m_A \cdot m_B = -3.00$

$M = \frac{y'}{y} \Rightarrow y' = M \cdot y = -3.00 \cdot 4.0 = -12.0\,cm$

d) $\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

$\frac{1}{8.0} = 0.52\left(\frac{1}{\infty} - \frac{1}{R_2}\right)$

$\frac{1}{8.0 \cdot 0.52} = 0 - \frac{1}{R_2}$

$R_2 = -8.0 \cdot 0.52 = -4.16\,cm$