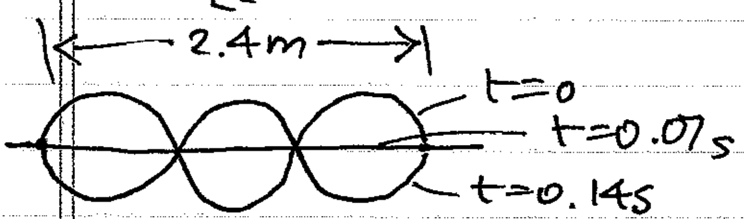
Problem 14-36



(a) speed of wave along the spring?

$v = \lambda f \quad \lambda = \frac{2}{3}L = \frac{2}{3}2.4 = 1.6\,m$

Get f from T

from figure $T = 2 \times 0.14s = 0.28\,s$

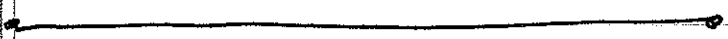
$v = \lambda f = (1.6) \times (0.28)^{-1} =$ ~~0.448~~ = ~~0.45 m/s~~

$= (1.6) \times (3.57) = 5.7\ m/s$

(b) speed of a crest of the standing wave?

A standing wave does not travel, so $v = 0$.

Problem 14-48



$v = \sqrt{F_T/\mu}$

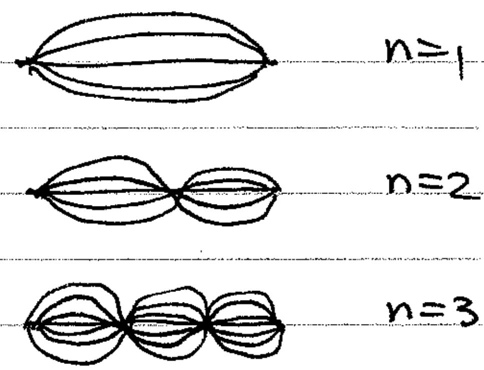
$L = 8.0\,m$

In these conditions, $v = 12\ m/s$

For standing waves

2 nodes at the ends ←

$L = n\frac{\lambda}{2}$



find the frequency.

Use $v = \lambda f$ we know v

we read off λ from figure

$n=1$ $\lambda = 2L = 2 \times 8.0 = 16\ m$

$f = \frac{v}{\lambda} = \frac{12}{16} = 0.75\ Hz$

$n=2$ $\lambda = L = 8.0\ m$

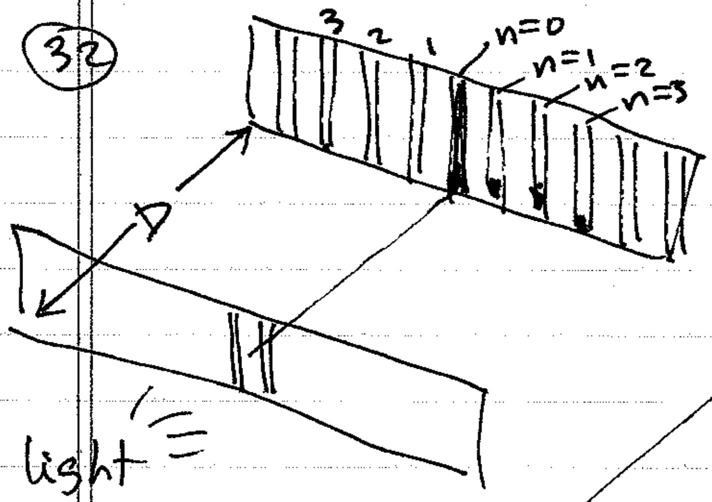
$f = \frac{v}{\lambda} = \frac{12}{8} = 1.5\ Hz$

$n=3$ $\lambda = \frac{2}{3}L = \frac{2}{3}\,8.0\,m = 5.\bar{3}\ m$

$f = \frac{v}{\lambda} = \frac{12}{5.33} = 2.3\ Hz$

Problems 15-32/34

(32)



(a) Which point are 3 λ's further from one slit than the other?

$d \sin\theta = n\lambda$

↑ angles at which you get light

The 2 points labeled 3 above

(b) At which point is the path difference

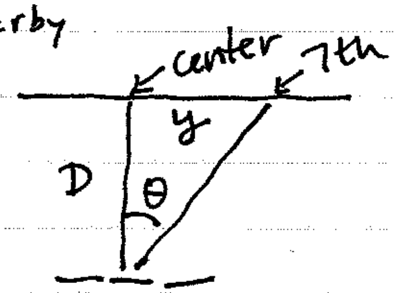
$p.d. = n \frac{\lambda}{2}$

↑ odd

all points midway between two nearby bright lines

(34) $D = 2.50\,m$ slits are $d = 3.0\times10^{-5}\,m$ apart

~~fringes are 2.50x~~



Distance from center fringe to 7th one is $3.75\times10^{-3}\,m$.

(a) What is θ for the 7th fringe?

$\tan\theta = y/D = 3.75\times10^{-3}/2.50 = 0.0015$

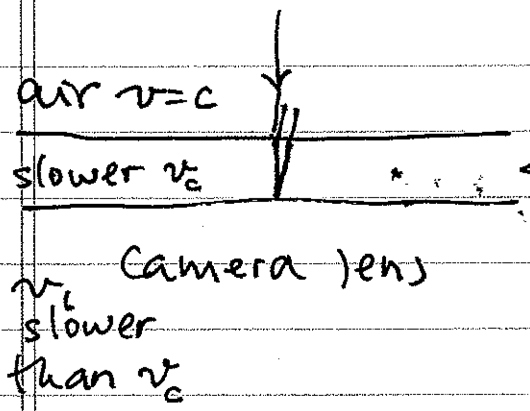
$\theta = \tan^{-1} 0.0015 = 0.086°$

(b) From $d\sin\theta = n\lambda$, $\lambda = \frac{d\sin\theta}{n} = \frac{3.0\times10^{-5}\sin 0.086°}{7}$

$= 6.4\times10^{-9}\,m$

Problem 15-54

green light $\lambda = 5.5 \times 10^{-7}$ m



← coating, min thickness $d = 1.05 \times 10^{-7}$ m for destructive interference

Find v_c in the coating

Use: For destructive interference

path difference p.d. $= \frac{1}{2}\lambda_c$ + possible $\frac{1}{2}\lambda$'s from reflections

In this case $2d = \frac{1}{2}\lambda_c$

In this case, $2 \times \frac{1}{2}\lambda$'s, so this is not needed

so

$$\lambda_c = 4d$$

$$= 4 \times 1.05 \times 10^{-7}\text{ m} = 4.20 \times 10^{-7}\text{ m}$$

Now use

$$v_{air} = c = \lambda f$$

$$v_c = \lambda_c f$$

so $\frac{c}{\lambda} = \frac{v_c}{\lambda_c}$

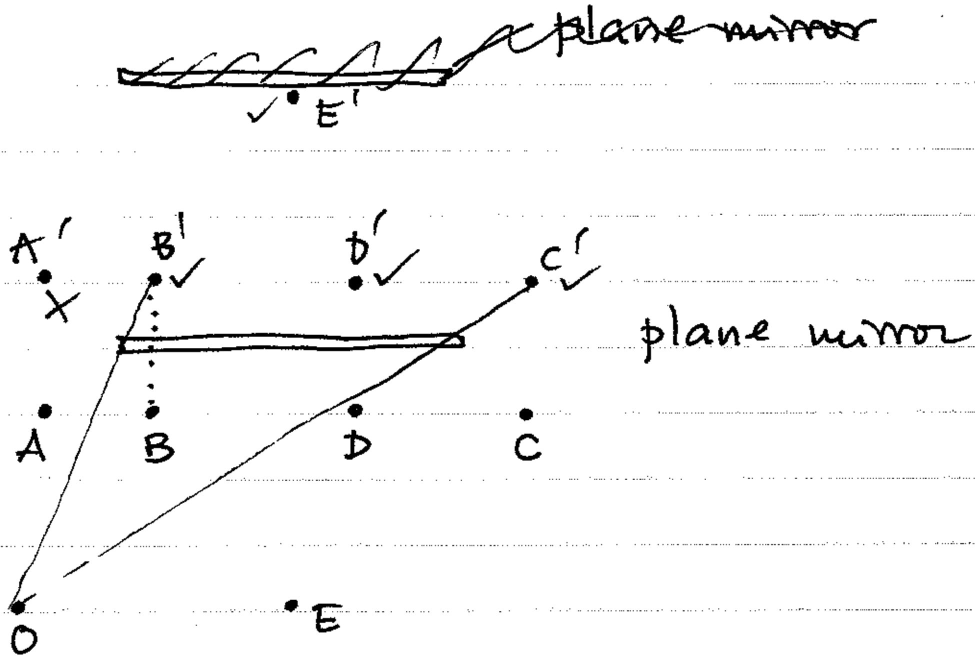
↓

$$v_c = \frac{\lambda_c}{\lambda} c$$

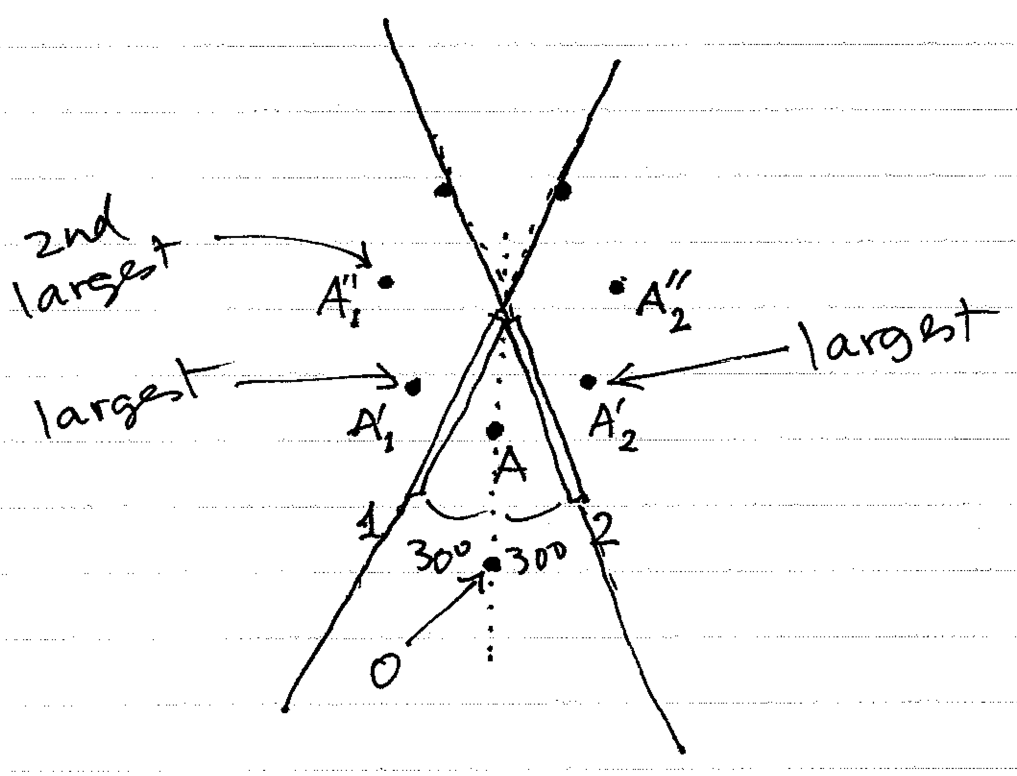
$$= \frac{4.20 \times 10^{-7}}{5.5 \times 10^{-7}} 3.00 \times 10^8$$

$$= 2.3 \times 10^8\text{ m/s}$$

Problem 16-12



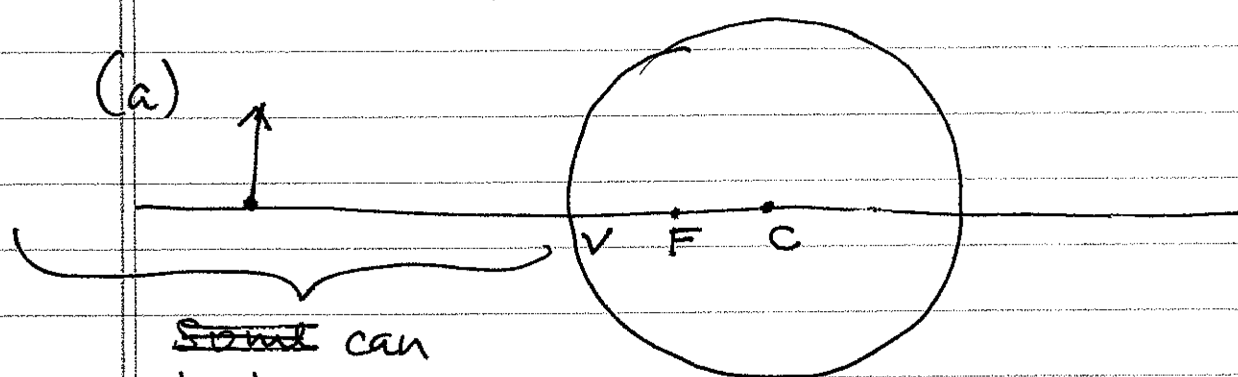
Problem 16-56



Problem 16-29

reflecting sphere

(a)



~~Somewhere~~ can I place an object anywhere here so that the image is larger than the object?

Relevant

$$M = -\frac{s_i}{s_o}$$

$$\frac{1}{s_o} + \frac{1}{s_i} = \frac{1}{f}$$

(also, $f = R/2$)

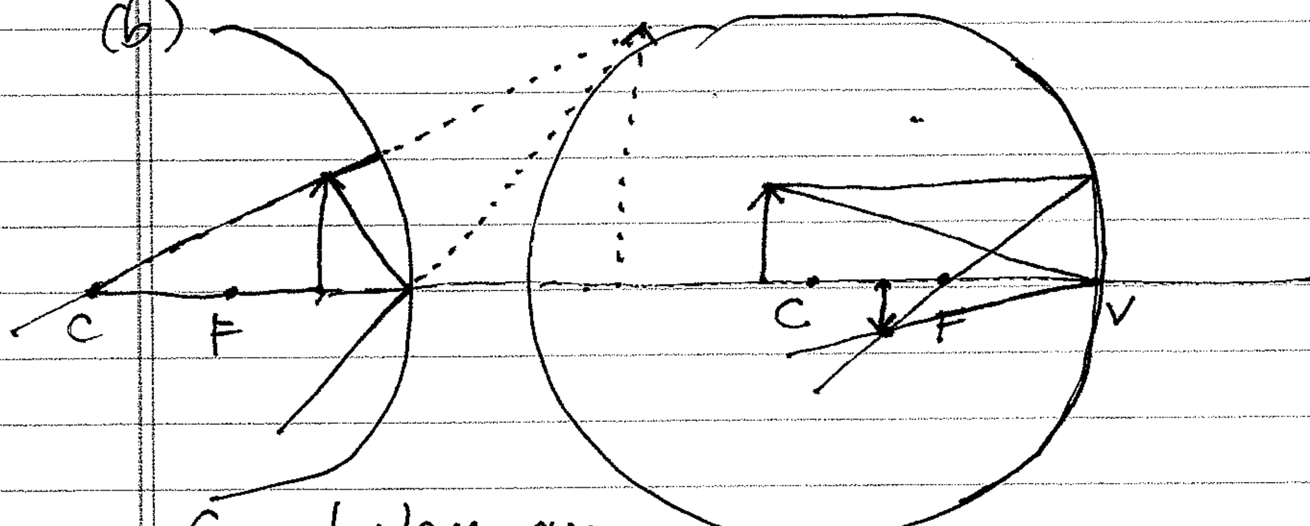
f negative

s_o positive.

$\Rightarrow$ s_i must be negative

& magnitude of s_i smaller than that of s_o

(b)



Can I place an object anywhere inside so that the image is larger than the object?