11-20-13 / 11-22-13

Test 3, Final Exam
[CH 34, 35, 36, 18(E.C.) = Test 3]

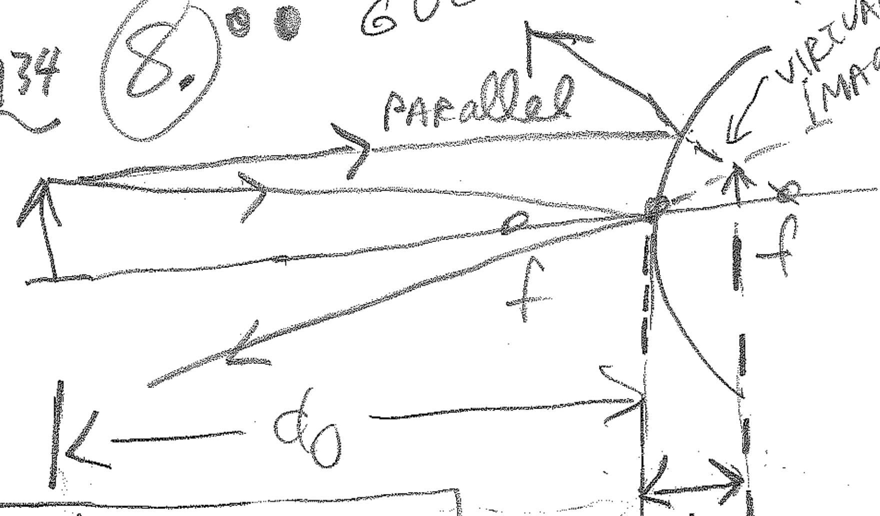
Review ⟶ 3 more labs.

after Break. TODAY: use
nvaphysics.com sample Tests + Book problems
+ online prelecture assignments.
(due @ 9:20PM)

CH 34:
(8.), (58.), (64.) .

GUESS $m < 1$ and $m > 0$

CH 34 (8.) :



$f = R/2$

$f < 0$; $R < 0$ } negative

$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$

$d_i < 0$

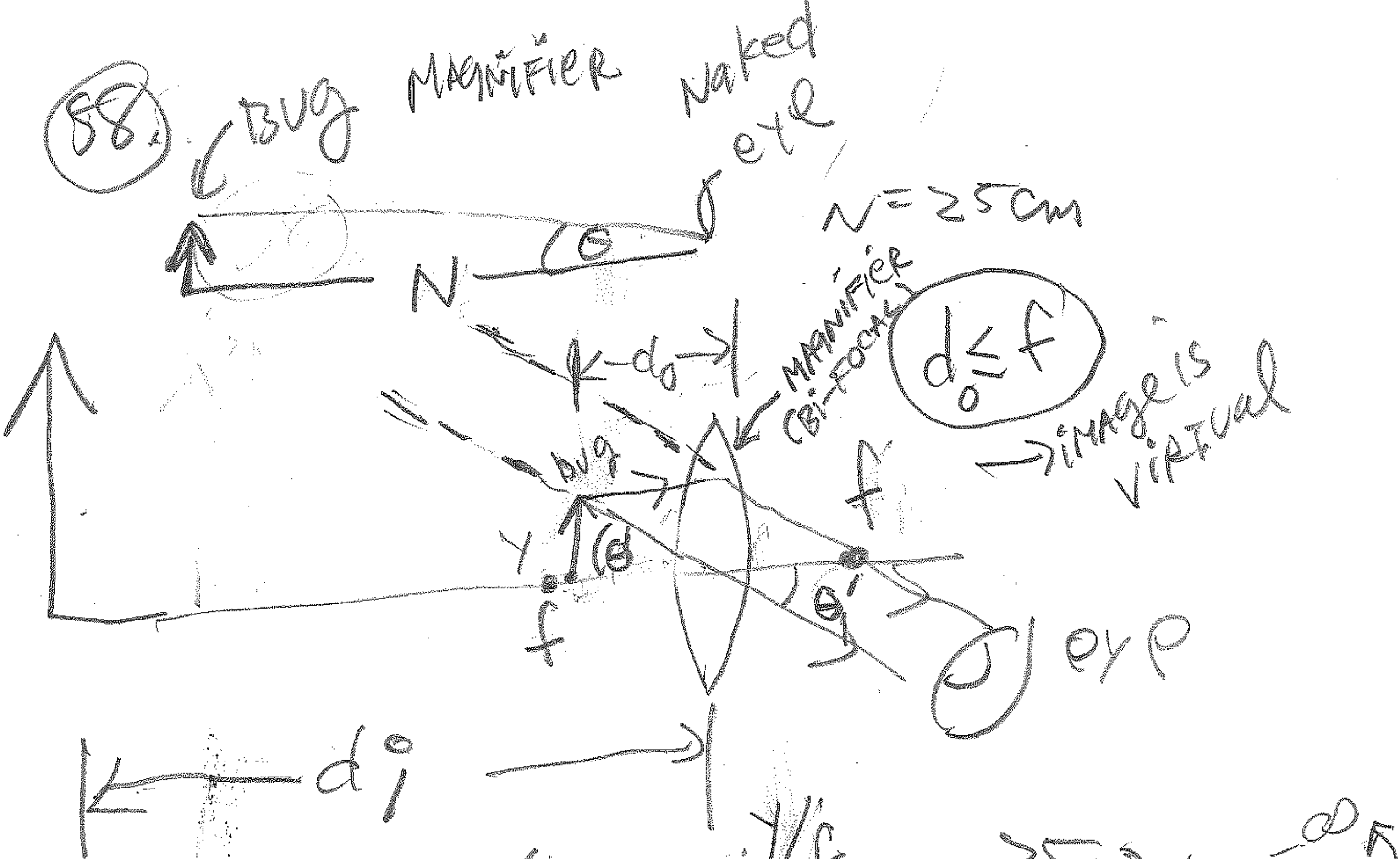
$m = \frac{-d_i}{d_o} > 0$

WORK: $d_i = ?$; $m = ?$

$-\frac{1}{3} = \frac{1}{d_o} + \frac{1}{d_i}$; $d_o = 24$

Find d_i ; $m = -\frac{d_i}{d_o}$

convex MIRROR



IF $d_o = f$: $M = \frac{\theta'}{\theta} = \frac{y/f}{y/25} = \frac{25}{f}$ $\Big\}$ $d_i = -\infty$, $d_o = f$

In general $d_o \neq f$ (BUT $d_o < f$)

$d_i = -25\text{ cm}$

$d_o = \frac{f \cdot d_i}{d_i - f} > 0 \longleftarrow \frac{1}{d_o} = \frac{1}{f} - \frac{1}{d_i}$

$$M = \frac{\theta'}{\theta} = \frac{y/d_o}{y/25} = \frac{25}{d_o} = 25\left(\frac{1}{f} - \frac{1}{d_i}\right)$$

$$= 25\left(\frac{1}{f} + \frac{1}{25}\right)$$

$d_o = \frac{25 \cdot f}{f + 25}$ | ASSUME $|d_i| = 25$

$d_i = -25$

$$M = 1 + \frac{25}{f} = M$$

(58) (a) $\frac{25}{f}$ ← eyes are relaxed

$(d_i = -\infty,\ d_0 = f$

$\frac{1}{f} = \frac{1}{d_0} + \frac{1}{d_i}$; if $d_0 = f$

$\Rightarrow d_i = -\infty)$

MAGNIFIER $= \frac{25}{6} = 4\frac{1}{6}$

(b) FIND: d_0: $\frac{1}{d_0} = \frac{1}{f} + \frac{1}{25} = \frac{1}{f} - \frac{1}{d_i}$; $d_i = -25$

Eyes are tense

NOTE: $\longrightarrow M = 1 + \frac{25}{f} = 1 + \frac{25}{6} = 5\frac{1}{6}$

$= \frac{30}{6}$

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(64) see fig (34.53)

and lecture notes 11-15-13

CH 35

(46), sample Exams,

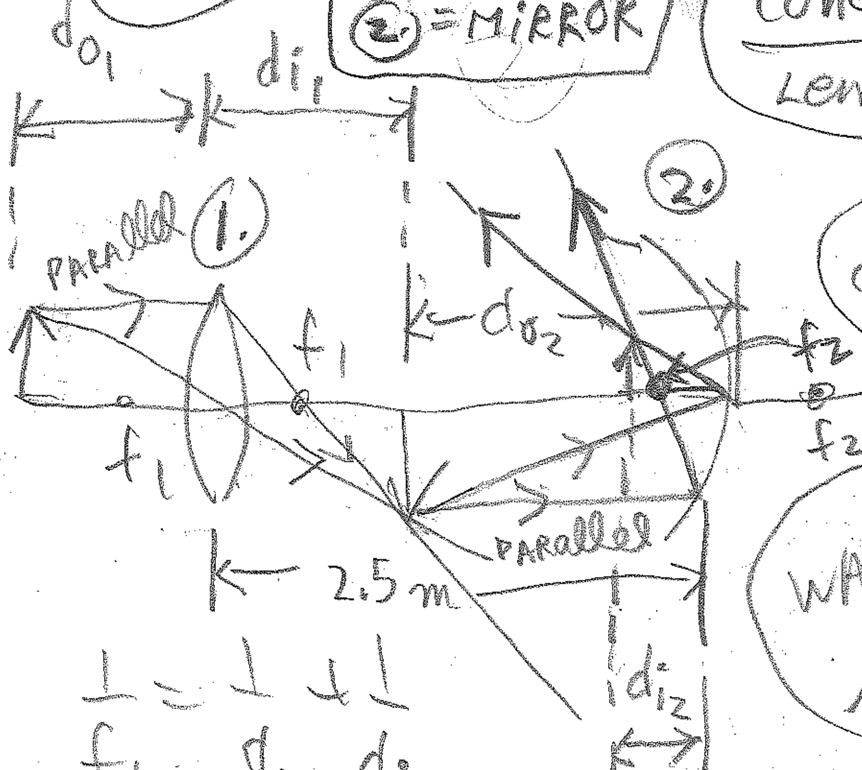
lecture notes 11-15-13

Sample test 3

#2.

1. = LENS
2. = MIRROR

CONCAVE MIRROR + Lens on the left.



$d_{o_2} = 2.5 - 1$

$= 1.5 \text{ (m)}$

WARNING not scaled

$$\frac{1}{f_1} = \frac{1}{d_{o_1}} + \frac{1}{d_{i_1}}$$

$$\frac{1}{0.5} = \frac{1}{1} + \frac{1}{d_{i_1}} \Rightarrow d_{i_1} = \frac{(1)(0.5)}{1-0.5}$$

$$= \frac{0.5}{0.5} = 1 \text{ (m)}$$

$$\frac{1}{0.5} = \frac{1}{1.5} + \frac{1}{d_{i_2}}$$

$$d_{i_2} = \frac{(1.5)(0.5)}{1.5-0.5} = \frac{0.75}{1}$$

$$= 0.75 \text{ (m)}$$

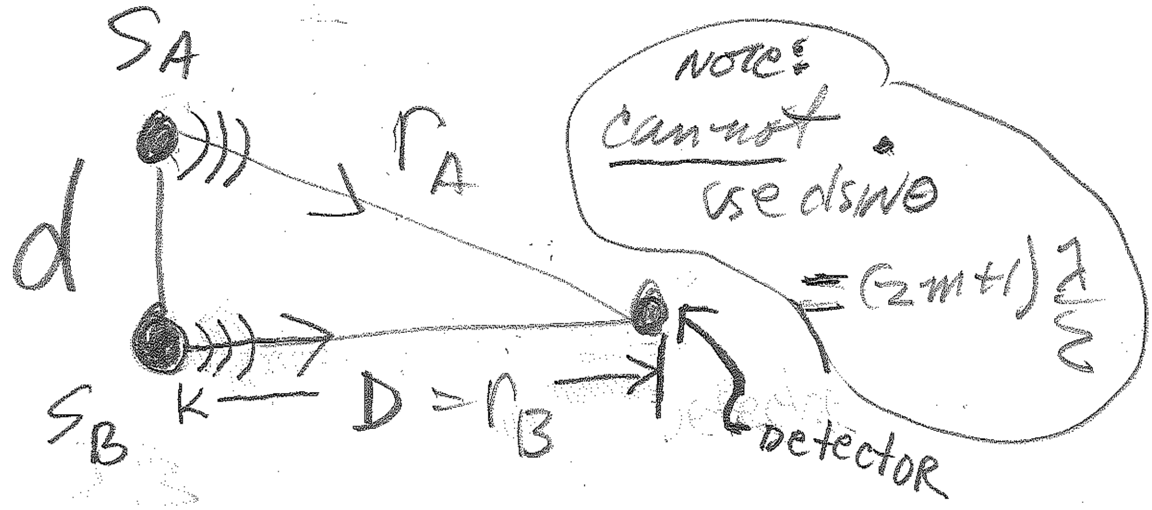
$$M_{TOTAL} = \frac{-d_{i_1}}{d_{o_1}} \cdot \frac{-d_{i_2}}{d_{o_2}}$$

$$= \left(-\frac{1}{1}\right) \cdot \left(-\frac{0.75}{1.5}\right)$$

$$= +\frac{0.75}{1.5} = +0.5$$

ch 35

(46)



$$r_A - r_B = \sqrt{d^2 + D^2} - D = (2m+1)\frac{\lambda}{2}$$

$m = 0, 1, 2, 3, 4 \ldots$

after BREAK sample EXAMS on THIN FILMS

"COMMERCIAL" BREAK

$$\sqrt{d^2 + D^2} = D + (2m+1)\frac{\lambda}{2}$$

$$d^2 + \cancel{D^2} = \cancel{D^2} + D\cdot(2m+1)\lambda + (2m+1)^2\frac{\lambda^2}{4}$$

$\boxed{D > 0}$

$$D = \frac{d^2 - (2m+1)^2\frac{\lambda^2}{4}}{(2m+1)\lambda} \; ; m = 0, 1, 2, 3 \ldots$$

(#6) – CH35

$$D = \frac{d^2 - (2m+1)\left(\lambda^2/4\right)}{(2m+1)\lambda}$$

$$\lambda = c \cdot \frac{1}{f}$$

$$\lambda = \frac{3\times10^{8}\ m/s}{5.8\times10^{6}\ s^{-1}}$$

$$= 0.517\times10^{2}\ m$$

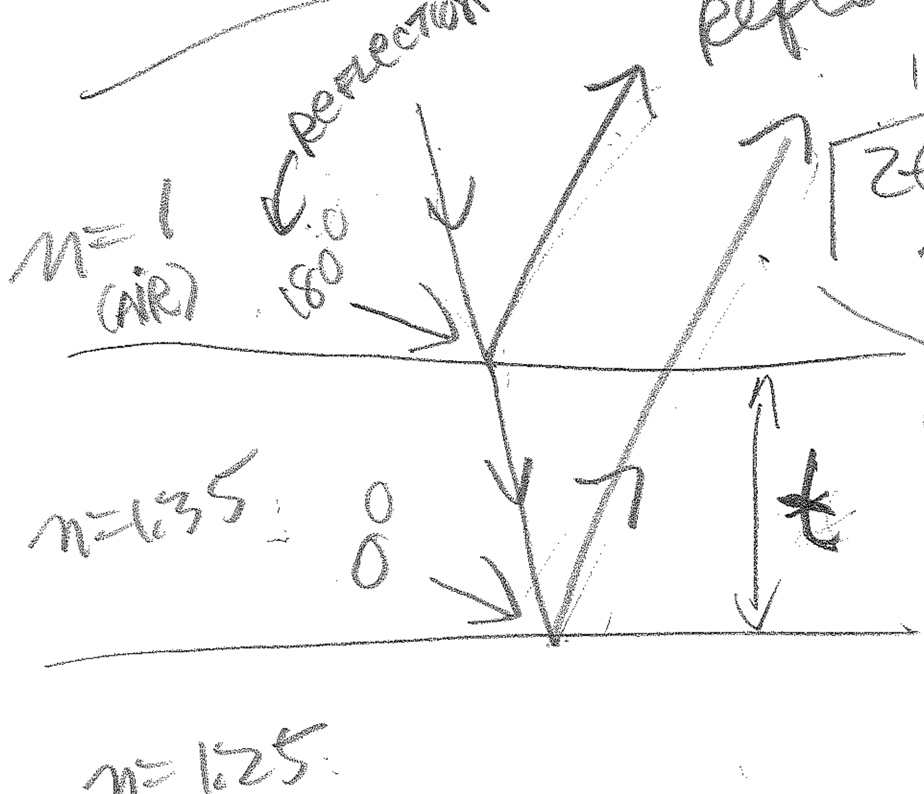
$$= 51.7\ m \text{ (RADIO WAVES)}$$

$$D = \frac{(200)^2 - (2m+1)668.2}{(2m+1)(51.7)}$$

$$\frac{40000 - 668.2(2m+1)}{(2m+1)(51.7)}$$

$D > 0$ for $m = 0, 1, 2, 3 \ldots$

Sample test Example



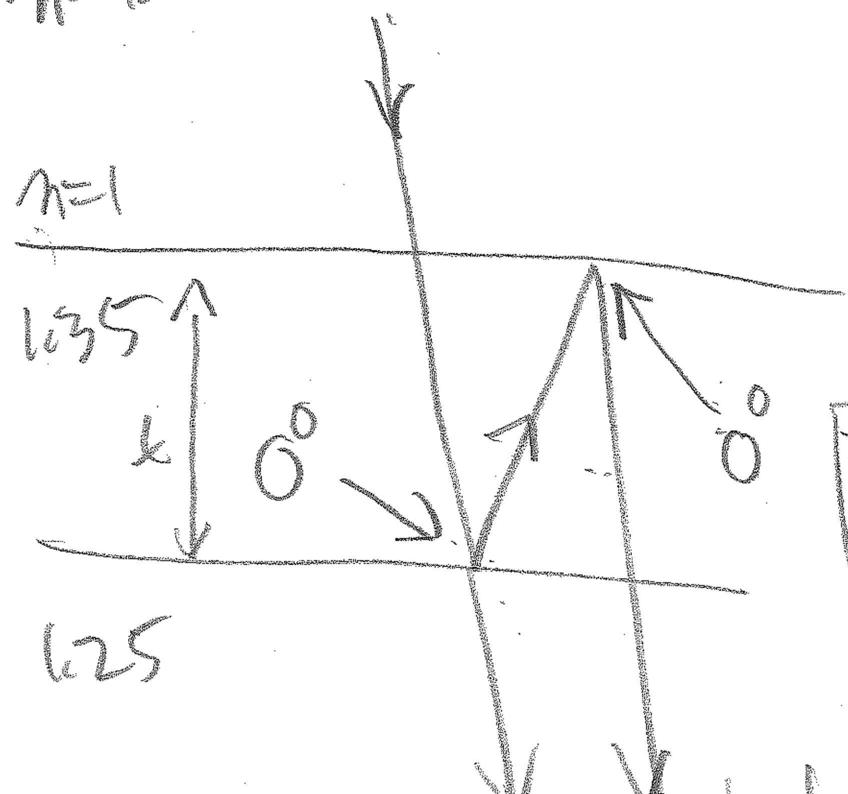
reflected (BRIGHT)

$180^0 \Rightarrow$

$$2t = (2m+1)\frac{\lambda}{2}$$

$$\lambda = \frac{\lambda_0}{1.35}$$

CONSTRUCTIVE: use DESTRUCTIVE FORMULA - net 180^0 PHASE difference



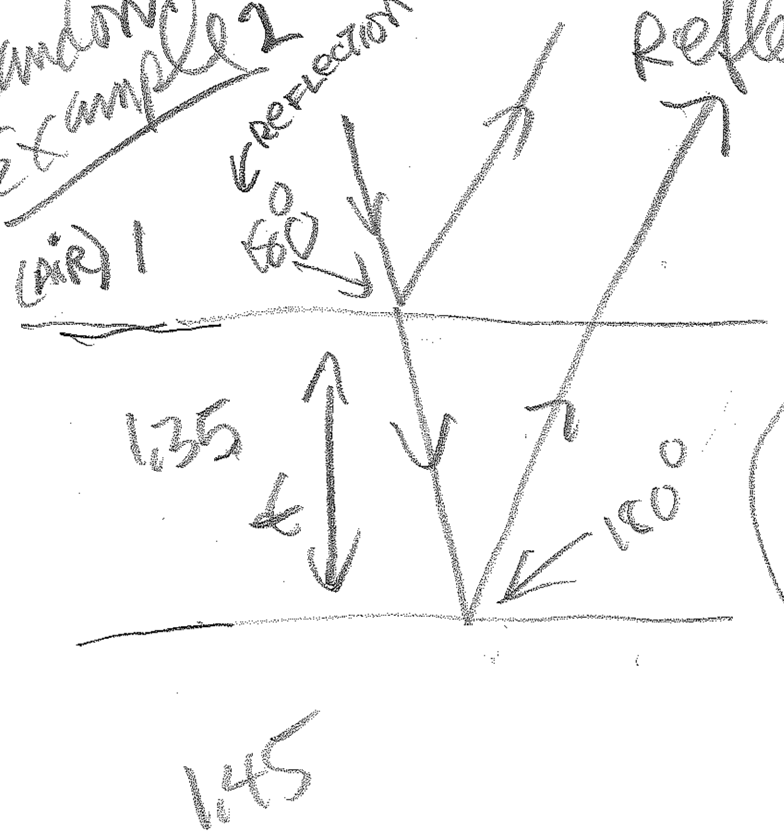
$0^0 + 0^0 = 0^0 \Rightarrow$

$$2t = m\lambda$$

$$\lambda = \lambda_0 / 1.35$$

Transmitted (BRIGHT)

Random Example 2



Reflected (BRIGHT)

$180° + 180° = 360° = 0°$

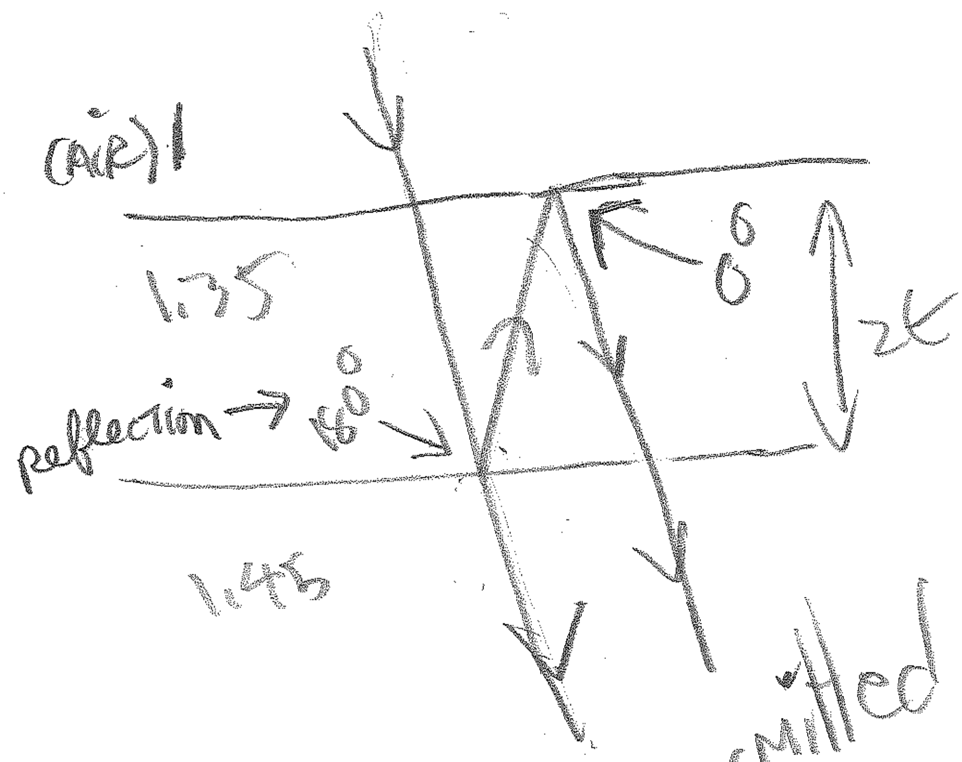
$\Rightarrow$

$2t = m \cdot \lambda$

$m = 1, 2, 3, 4 \ldots$

IF $t > 0$.

$\lambda = \frac{\lambda_0}{1.35}$



TRANSMITTED (BRIGHT)

$180° \Rightarrow$

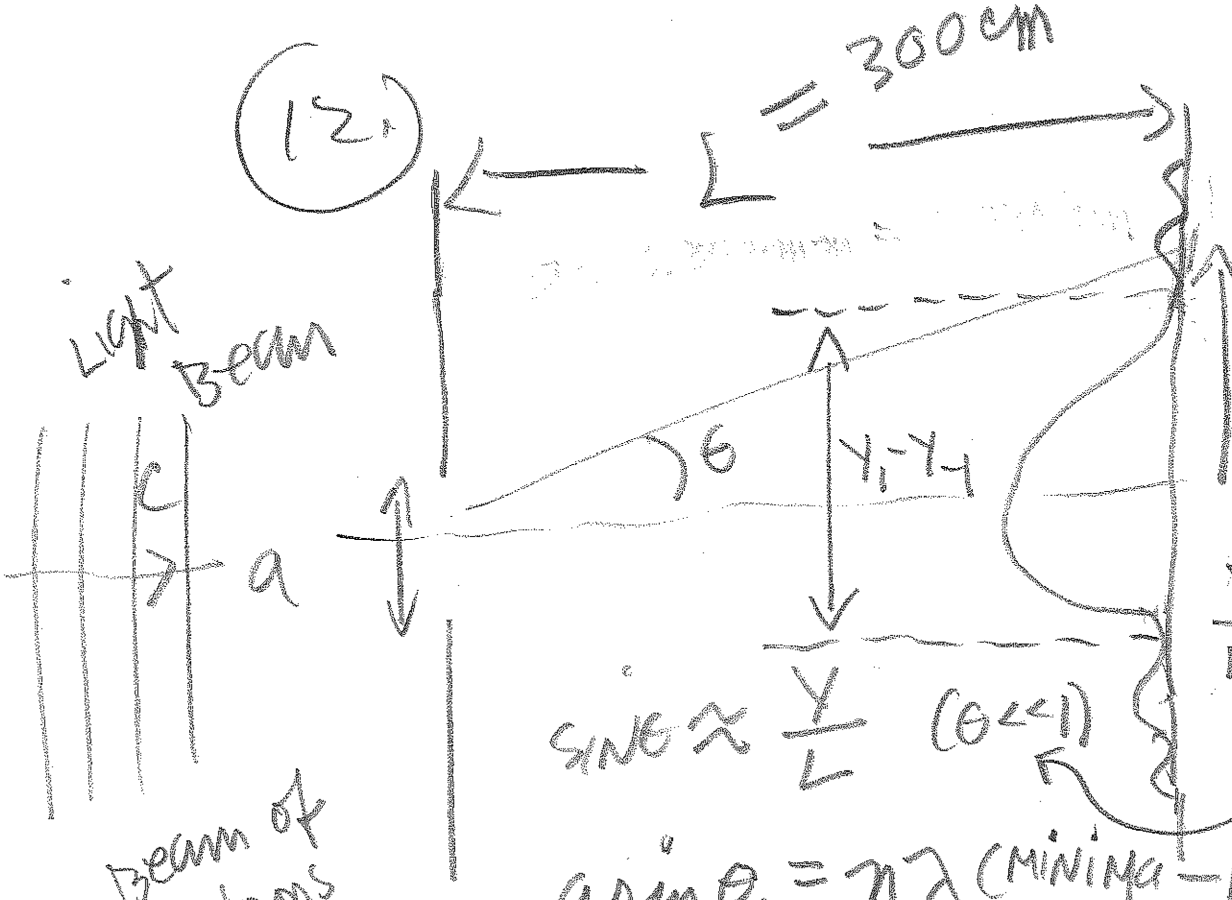
$2t = (2m+1)\frac{\lambda}{2}$

$\lambda = \frac{\lambda_0}{1.35}$

CH 36 (12.) (20.)

(20.) Nice SUMMARY problem.

(12.)



$\frac{Y_1}{L} = \frac{\lambda}{a} = \frac{633\times10^{-9}}{0.35\times10^{-3}}$

$\sin\theta \approx \frac{Y}{L}$ $(\theta \ll 1)$

$a \sin\theta_n = n\lambda$ (MINIMA — DARK spots)

$a \cdot \frac{Y_n}{L} = n\lambda$ $\theta \ll 1$

Beam of electrons ALSO SHOW DIFFRACTION DUE TO QUANTUM PHYSICS (aka 5) → PHYSICS 5

(a) $Y_1 - Y_{-1} = \frac{2 \cdot \lambda \cdot L}{a}$

SOLVE FOR Y_1, Y_{-1} → SUBTRACT

CH 36

(12) (a)

central width $= \dfrac{2(633\times10^{-9})(3.0)}{0.35\times10^{-3}}$ $\ll 1$

$= y_1 - y_{-1}$

(b) FIND: $y_2 - y_1$; $y_n = \dfrac{L\cdot n\cdot\lambda}{a}$; GET y_2, y_1 and SUBTRACT

fun begins

ch36 (#20) WARMUP:

$a < d$

$a\sin\theta = \lambda$ (1st MIN)

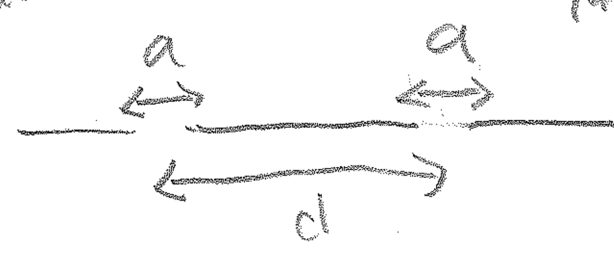
$d\sin\theta' = \lambda$ (1st MAX)

$\theta' < \theta$

↑ interference ↑ DIFFRACTION

$\boxed{\frac{d}{a} = 4}$

4th interference MAX is washed out BY 1ST DIFFRACTION MIN



$a < d$

$a = d/4$

#20 warm-up

$a \sin\theta = \lambda$

$d \sin\theta = 4\lambda$

$\sin\theta = \frac{\lambda}{a} = \frac{4\lambda}{d}$

→ $\boxed{\frac{d}{a} = 4}$

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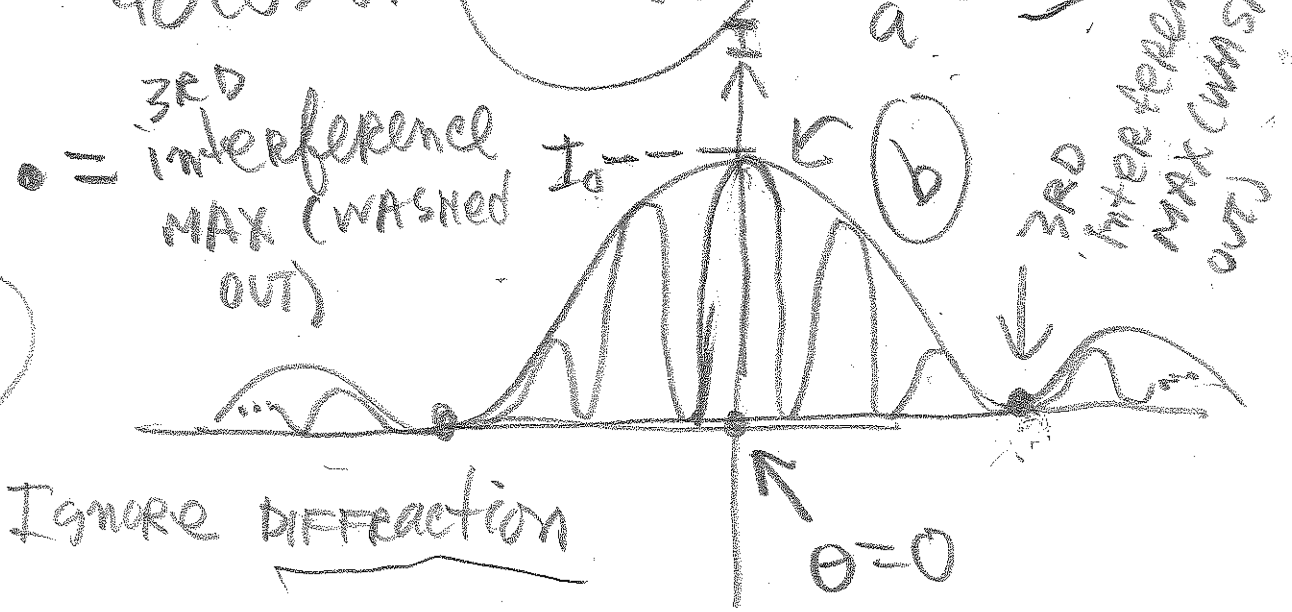
focus on (#20) $\frac{d}{a} = 3$



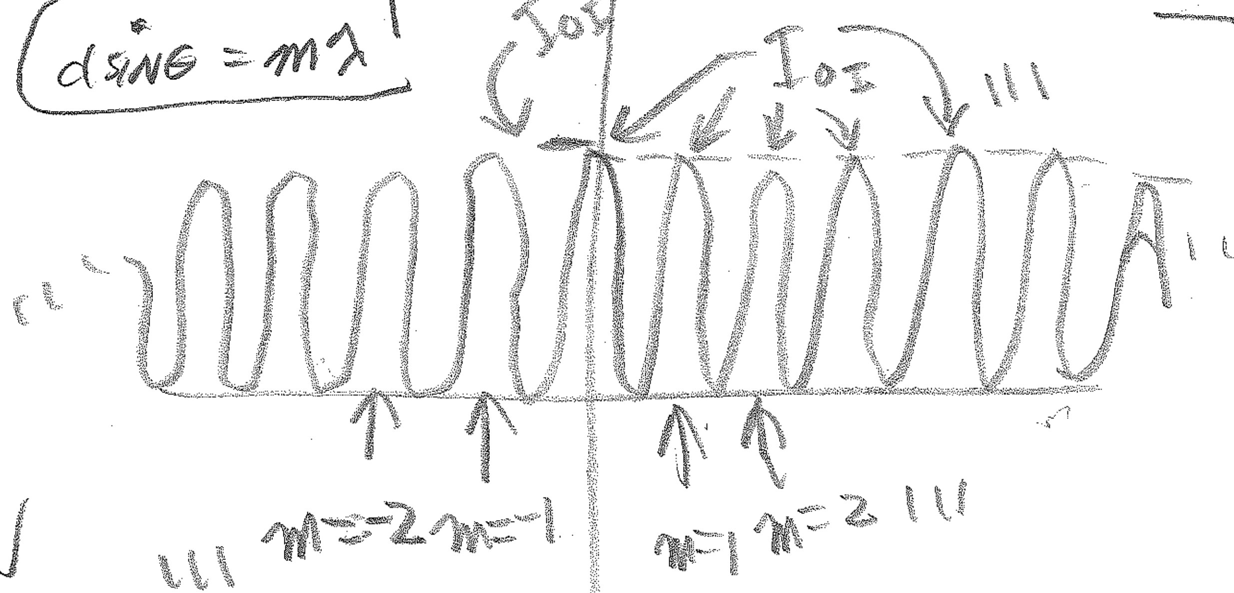
20 (a) Ignore DIFFRACTION

CH 36, #20

(a) <u>Ignore diffraction</u>*

$\Rightarrow$ 2 slit interference (<u>CH 35</u>)

$d \sin\theta = m\lambda$



*Explanation:

$a \to 0$

$\frac{a}{\lambda} \to 0$

(a) $d\sin\theta = m\lambda$ (MAX)

$m = 0, 1, 2, 3 \ldots$

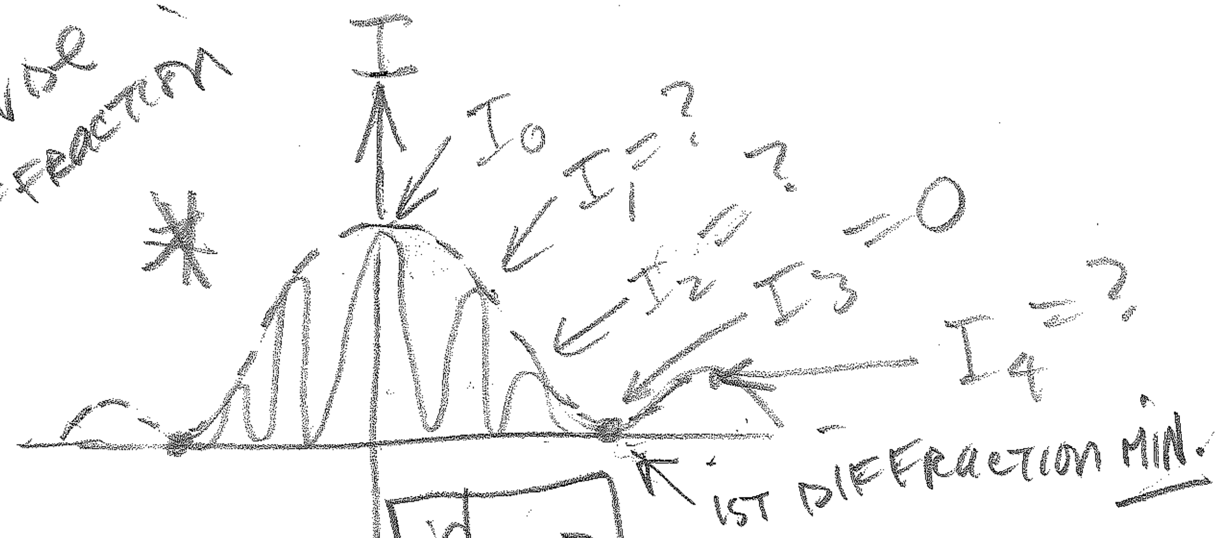
$$\theta = \sin^{-1}\left(\frac{m\lambda}{d}\right)$$

$$\theta_1 = \sin^{-1}\left(\frac{\lambda}{d}\right) \approx \frac{\lambda}{d}, \frac{\lambda}{d} \ll 1$$

$$\theta_2 = \sin^{-1}\left(\frac{2\lambda}{d}\right), \text{ ETC}$$

for θ_3, θ_4

(b) INCLUDE DIFFRACTION *



$$\frac{d}{a} = 3$$

Ch 36 (20) (b) table

$$\boxed{\frac{d}{a} = 3}$$

$$I = f_D \cdot f_I$$

$$f_D = I_{0_D}\left[\frac{\sin \beta/2}{\beta/2}\right]^2$$

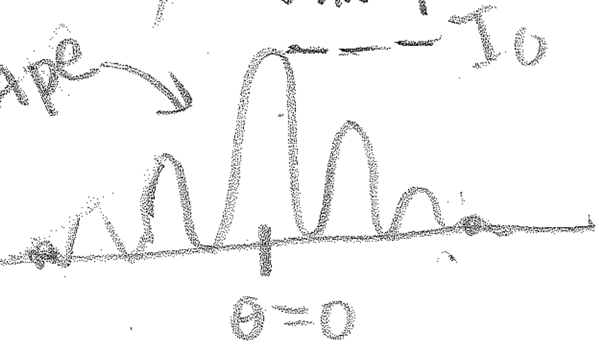
$$\beta = \frac{2\pi a \sin\theta}{\lambda}$$

$$f_I = I_{0_I} \cdot \cos^2\frac{\phi}{2}$$

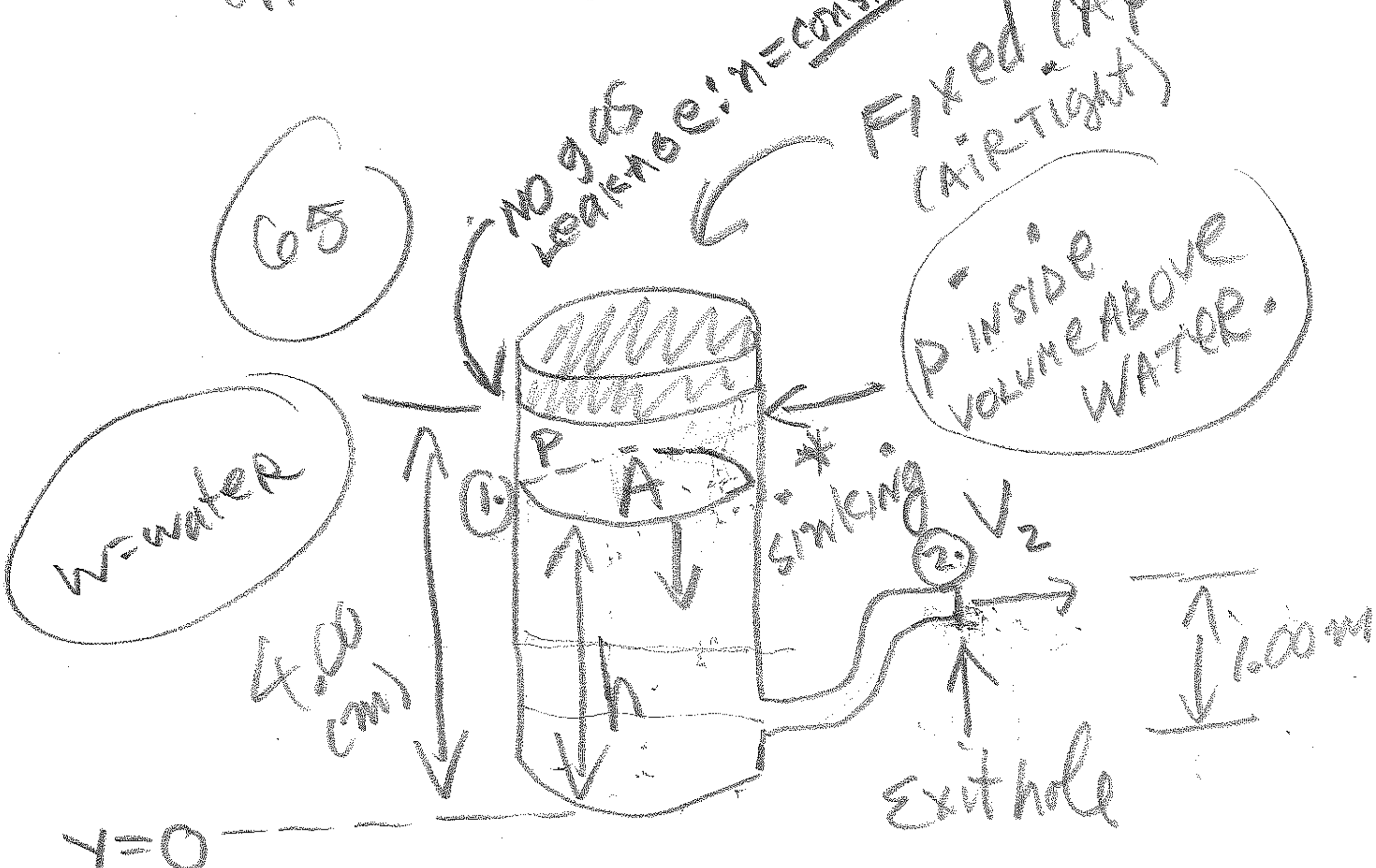
$$\phi = \frac{2\pi d \sin\theta}{\lambda}$$

		WORK
I_0 $(\theta = 0)$	$I_{0_D} \cdot I_{0_I}$	$f_D(0) = I_{0_D}$ $f_I(0) = I_{0_I}$
$I_1(\theta_1)$	$f_D(\beta_1) \cdot I_{0_I}$	$\beta_1 = \frac{2\pi d \sin\theta_1}{\lambda \cdot 3} = \frac{2\pi}{3}$ $d \sin\theta_1 = \lambda$
$I_2(\theta_2)$	$f_D(\beta_2) \cdot I_{0_I}$	$\beta_2 = \frac{2\pi d \sin\theta_2}{\lambda \cdot 3} = \frac{4\pi}{3}$
$I_3(\theta_3)$	0	$f_D(\beta_3) = 0 = \frac{\sin\pi}{\pi}$
$I_4(\theta_4)$	$f_D(\beta_4) \cdot I_{0_I}$	$\beta_4 = \frac{2\pi d \sin\theta_4}{\lambda \cdot 3} = \frac{8\pi}{3}$ $d \sin\theta_4 = 4\lambda$

TRUE SHAPE →



CH 34, 35, 36, (18)



CH 13, 18

CH18

$P V = nRT$

CH13

$\frac{1}{2}\rho_w v^2 + \rho_w g y + P = \text{const.}$

$\rho_w = 1000 \frac{kg}{m^3}$

REQUESTED: $V_2 = ?$ when $h = 3.50$ m

$\frac{1}{2}(1000)V_2^2 + (1000)g \cdot 1 + P_{ATM} = (1000) \cdot g(3.5) + P_{3.5}$

* water surface drops with speed $\approx 0 = V_1$ since area at top >> area of exit hole

$P_{3.5} = 4.20 \times 10^5 \frac{N}{m^2}$ ← use this

↕ plug into equation previous page.

Solve for v_2

$\approx 4.2\ ATM$

DO NOT USE → (ATM)

(b.)

Exit point → $\frac{1}{2}(1000)v_2^2 + (1000)g \cdot 1 + P_{ATM}$

FIND $v_2 < v_2(a)$

$= (1000) \cdot g \cdot (3.0) + P_{3.0}$

$P_{3.0} < P_{3.5}$

n = CONSTANT

Boyles Law:

$$\frac{P_{3.0} \cdot V_{3.0}}{T_{3.0}} = \frac{P_{3.5} \cdot V_{3.5}}{T_{3.5}} = nR$$

$V_{3.5} = A \cdot (0.5)$

$V_{3.0} = A \cdot (1)$

$$P_{3.0} = P_{3.5} \cdot \left(\frac{V_{3.5}}{V_{3.0}}\right)$$

$$= P_{3.5} \cdot (0.5)$$

Test 3:

WED: Dec 4th

on CH 34, 35, 36, 18 (EC?)

Final

Required:
- CH 18) T3 (E.C)
- 19
- 20
- 34 } T3
- 35
- 36

+ 2 problems for T1 and T2

11-22-13

PARTIAL SUMMARY

CH34

(1) MAGNIFIER

(2) a compound system

(i) lens - lens

(ii) lens - MIRROR

(iii) lens - lens - lens

ETC

(iv) lens - lens - MIRROR