Midterm Exam 2

Ch. 36

Law of Reflection:

$\theta_{\text{incident}} = \theta_{\text{reflected}}$

Snell's Law:

$n_1 \sin\theta_1 = n_2 \sin\theta_2$

Total internal reflection when $\theta > \theta_C$:

$\sin\theta_C = \frac{n_2}{n_1}$ (note $n_1 > n_2$)

Ch. 37

Plane mirror:

$i = -s$

Spherical mirror (radius R):

$f \approx \frac{R}{2}$

$\frac{1}{s} + \frac{1}{i} = \frac{1}{f}$ (also true for thin lens)

$M = \frac{-i}{s} = \frac{f}{f - s}$

Spherical boundary (radius R) betwen n_1 and n_2:

$\frac{n_1}{s} + \frac{n_2}{i} = \frac{n_2 - n_1}{R}$

Thin lens in air:

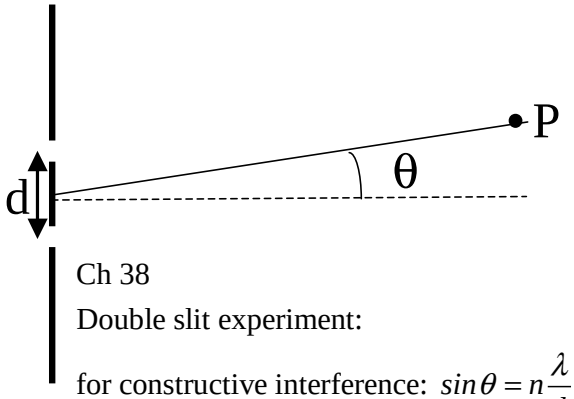
$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

$\rightarrow \frac{1}{s} + \frac{1}{i} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

Sign convention for lenses AND mirrors

$R > 0$ if center of curvature is on the same side as the side to which light is going

$R < 0$ if center of curvature is opposite to the side to which light is going



Ch 38

Double slit experiment:

for constructive interference: $\sin\theta = n\frac{\lambda}{d}$

for destructive interference: $\sin\theta = \left(n + \frac{1}{2}\right)\frac{\lambda}{d}$

where $n = 0, \pm1, \pm2, \pm3\ldots$

Intensity pattern for double slit:

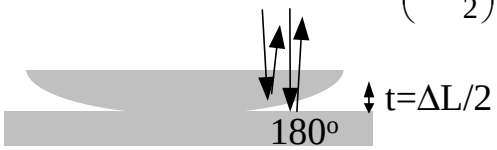
$I_{net} = 4I_0 \cos^2\left(\frac{\pi d}{\lambda}\sin\theta\right)$

where I_0 is the intensity for a **single** slit

$\Delta\phi_{total} = \Delta\phi_{path} + \Delta\phi_{reflection}$; $\Delta\phi_{path} = 2\pi\frac{\Delta L}{\lambda}$

Newton's rings if one reflection undergoes 180° phase shift and the other does not:

constructive interference if $\Delta L = \left(n + \frac{1}{2}\right)\lambda$

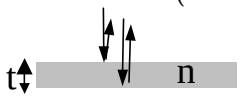


Thin-film interference (for reflection):

constructive interference if $4nt = (2m-1)\lambda$

destructive interference if $4nt = 2(m-1)\lambda$

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



Thin-film coating interference (for reflection):

constructive interference if $nt = \frac{1}{2}m\lambda$

destructive interference if $nt = \frac{1}{2}\left(m + \frac{1}{2}\right)\lambda$

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