Physics 262 Exam 1 Solutions

1. (a) any two rays

(b) \[
\frac{1}{f} = -\frac{R}{2} \\
S = 2R \\
\frac{1}{2R} + \frac{1}{S} = -\frac{2}{R} \\
\frac{1}{S'} = -\left(\frac{1}{2R} + \frac{3}{R}\right) = -\frac{R + 4R}{2R^2} = -\frac{5}{2R} \\
S' = -\frac{2R}{5} \\
\text{polarizer}
\]

2. (a) \[
I_{\text{before}} = I_0 = \frac{E_0}{2M_0C} \\
I_{\text{after}} = \frac{(E_0 \cos \phi)^2}{2M_0C} = \frac{E_0^2 \cos^2 \phi}{2M_0C}
\]

(b) \[
E = eB \\
B_{\text{before}} = \frac{E_0}{c} \\
B_{\text{after}} = \frac{E_0 \cos \phi}{c}
\]
3. The critical angle \( \theta_{crit} \) is less than \( \theta_{crit} \) for water to air than for glass to air, so \( \theta_{crit} \) is smaller for glass to air than for glass to water.

\[
\sin \theta_{crit} = \frac{n_1}{n_2}
\]

4. The image before the retina for a nearsighted person.

5. \( E_l \) and \( E_r \) are in phase, so the result is linearly polarized light with polarization direction \( \frac{\pi}{4} \) from the y-axis in the \( y-z \) plane.

6. A birefringent material has two distinct indices of refraction that are associated with the direction of polarization of the light passing through the material.