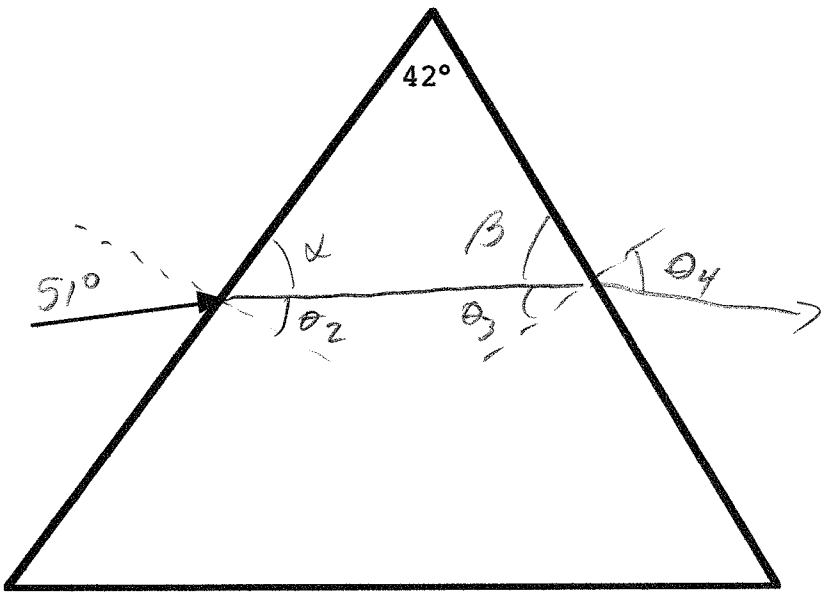
# Physics 10164 - Exam 3A

Each problem is worth 25 points. Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work even if you get the right answer. Clearly indicate your answer with a circle of a box and remember to include correct units and significant figures.

1. White light is incident on the prism below (surrounded by air) with an angle of 51°. The index of refraction for red light is 1.61 and for blue light is 1.68. What is the angular separation between the blue and red light when they leave the prism?




red:

$1.0 \sin 51 = 1.61 \sin \theta_2$

$\theta_2 = 28.86°$

$\alpha = 61.14°$

$\beta = 180 - 61.14 - 42$

$= 76.86°$

$\theta_3 = 90 - 76.86°$

$= 13.14°$

$1.61 \sin 13.14° = 1.00 \sin \theta_4$

$\theta_4 = 21.47°$

blue: $1.0 \sin 51 = 1.68 \sin \theta_2$

$\theta_2 = 27.6°$, $\alpha = 62.4°$

$\beta = 75.6$

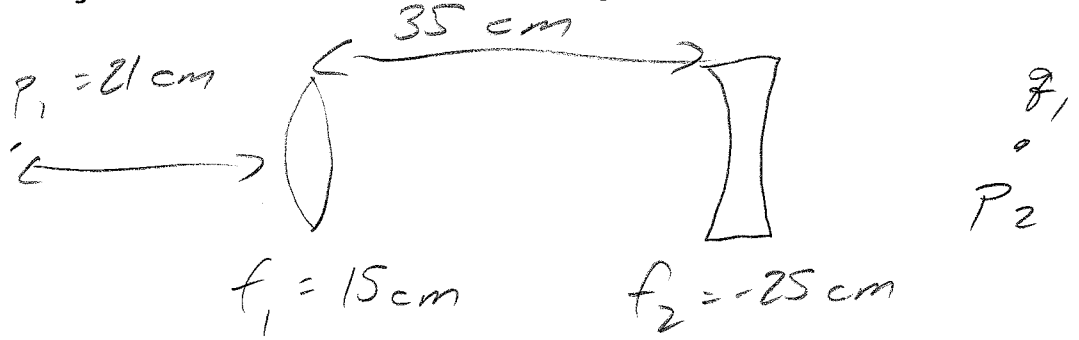
$\theta_3 = 14.4°$

$1.68 \sin 14.4 = 1.00 \sin \theta_4$

$\theta_4 = 24.70°$

$21.47 - 24.70 = \boxed{3.2°}$

2. An object is placed 21 cm in front of a converging lens with a focal length of 15 cm. A diverging lens with a f = -25 cm is located 35 cm behind the converging lens. Determine the location and magnification of the final image.




$$\frac{1}{21} + \frac{1}{q_1} = \frac{1}{15} \qquad q_1 = 52.5$$

$$p_2 = -52.5 + 35 = -17.5 \text{ cm}$$

$$\frac{1}{-17.5} + \frac{1}{q_2} = \frac{1}{-25}$$

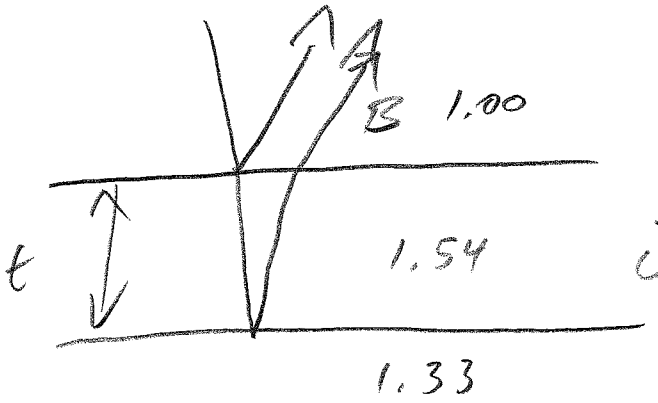
$$q_2 = 58.3 \text{ cm} \quad \text{or} \quad \boxed{58 \text{ cm behind lens 2}}$$

$$M_1 = -\frac{q_1}{p_1} = -\frac{52.5}{21} = -2.5$$

$$M_2 = -\frac{q_2}{p_2} = -\frac{58.3}{-17.5} = 3.33$$

$$\boxed{M_{TOT} = -8.3}$$

3. A thin film of oil (n = 1.54) floats on water (n = 1.33). The thickness of the oil film is 380 nm. What wavelength or wavelengths of light in the visible range (between 400 and 700 nm) will reflect brightly from this surface?




$\delta_A = \frac{1}{2}$

$\delta_B = 0 + \frac{2tn}{\lambda_0}$

$\delta_B - \delta_A = \frac{2tn}{\lambda_0} - \frac{1}{2} = 0, 1, 2, 3, \ldots$

$\frac{2tn}{\lambda_0} = \frac{1}{2}, \frac{3}{2}, \frac{5}{2}, \ldots$

$\lambda_0 = 4tn, \frac{4tn}{3}, \frac{4tn}{5}, \ldots$

$= 2341, 780, (468), 334$

**468 nm**

4. The normal near point for the eye is 25 cm, but Bob's eyes have a near point of 38 cm. What optical power will Bob's glasses have to be to correct his vision (in diopters)?

$p = 25\ cm$

$q = -38\ cm$

$\frac{1}{25} + \frac{1}{-38} = \frac{1}{f}$

$f = 73\ cm$

or $0.73\ m$

$P_0 = \frac{1}{.73} = \boxed{1.4\ d}$