Name:_____

Section:_____

Physics 1402: Test 3

Su2-09

Chapters 25-28

Please show all work and justify all calculations with equations in answer questions. Please only answer a maximum of two problems per page and please only write on the front of the answer pages.

1. List the components of the electromagnetic spectrum in order of decreasing frequency. Please include red and blue in your list in place of the visible region of the spectrum.

2. An unpolarized beam of light of intensity I_o is passed through a linear polarizer with its axis of transmission at an angle of 40° from the horizontal. Then the light is passed through a vertical linear polarizer. In terms of I_o what is the intensity of the light between the first and second linear polarizers? In terms of I_o what is the final intensity of the light after passing through both polarizers?

3. What is the focal length of the corrective lens needed to allow a nearsighted person to see a star in focus if their near point is 5cm from their eye and their far point is 80cm from their eye? Based on your calculation is this lens converging or diverging and how do you know. Is this lens concave or convex?

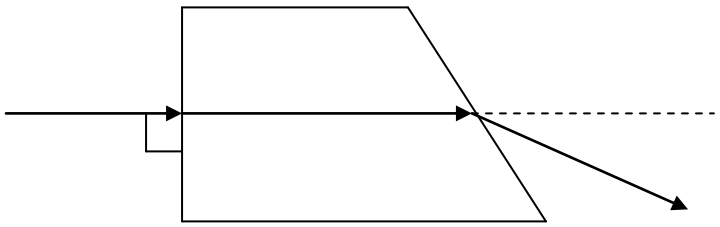
4. A double slit experiment is set up such that light with a wavelength of 650nm creates an interference pattern on the screen 3m away. If the third minima is 10cm from the central axis what is the separation of the two slits?

5. At one location on a thin film (n=1.2) 700nm light will constructively interfere when the film is suspended in air. A) What is the thickness of the thin film at this location assuming the interference is 1st order (m=1)? B) Now the same material is floated on water (n=1.33) assuming the no other changes are made to the film what wavelength of light will now constructively interfere at the location in part A?

$$\Delta l = 2nt - \frac{1}{2}\lambda$$

$$\Delta l = 2nt$$

6. You have a prism that you wish to measure the index of refraction for. As shown in the picture the base of the prism is 2.5cm and the two sides are 4.0cm and 5cm. The incident ray is perpendicular to the base as shown and the transmitted, refracted ray is deflected by an angle of $\alpha = 34°$ from its original path. Please calculate the angle of incidence, angle of refraction for the light as it leaves the prism, and the index of refraction for the prism.



7. Use ray tracing to locate the image for each of the diagrams shown here. State whether each image is upright or inverted and whether it is real or virtual. The diagrams are convex mirror, concave mirror, convex lens, and concave lens.

8. An optical system consists of three lenses numbered from left to right with the object being 16cm to the left of the first lens (f_1=+8.0cm). The second lens (f_2=-12.0cm) is 6.0 cm to the right of the first. A third lens (f3=+20.0cm) is 40.0 cm to the right of the second. Determine the image distances for each lens: d_{i1}, d_{i2}, and d_{i3}. Also determine the total magnification of the system for this object.

9. Hydrogen gas is very abundant in the universe and emits light at a wavelength of 482.6nm. The wavelength of the light can be measured using a spectrometer in the lab or connected to a telescope. The spectrometer has a diffraction grating with 4000lines per cm and an observing screen 0.60m from the grating. A) How far from the central bright fringe would the first maximum be from this light?

9B. Now you observe light from a distant galaxy and conclude the galaxy is receding from us with a speed of v=0.40c. What would the measured wavelength of the light emitted from the hydrogen gas inside the galaxy be on earth?

$$f' = f\left(1 \pm \frac{u}{c}\right)$$