PHY 102 Quiz #6 Name _____

Score _____

Instructions:
1. Do all of your work on this sheet.
2. **Show all of your steps** in problems for full credit.
3. **Be clear and neat** in your work. Any illegible work, or scribbling in the margins, will not be graded.
4. Place your **answers in a box**.
5. If you need more space, you may use the back of the page and write **On back** in the problem space.

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1. **Multiple Guess (4 pts)** Find the answer which best fits the question and write it in the space provided.

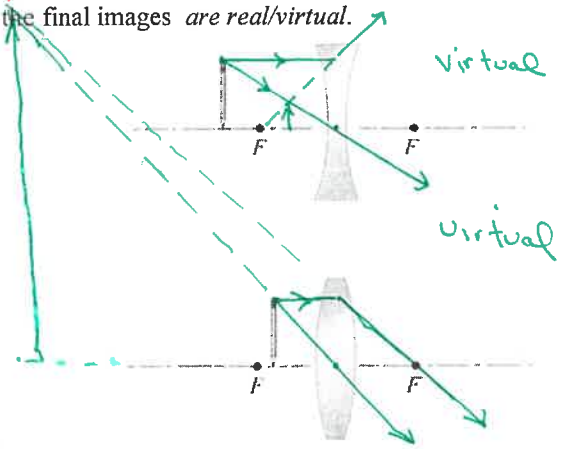
a. The lens of a farsighted eye can be corrected by
a) a converging lens; b) a diverging lens;
c) more intense light; d) none of these _a_

b. Which of the following is bent the most as it passes through a prism?
a) red b) green c) blue d) violet. _d_

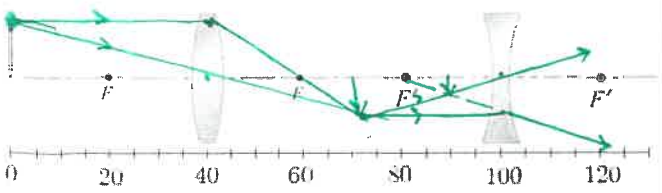
c. For a diverging lens the image always appears
a) real, inverted, smaller; b) virtual, inverted, larger;
c) virtual, upright, smaller; d) real, upright, larger;
e) none of these. _c_

d. Performing a diffraction experiment 10.0m deep in a swimming pool has what effect on the position of the maxima on a fixed underwater screen?
a) None. b) Maxima get closer together.
c) Maxima get farther apart.
d) Maxima get cancelled by minima. _b_

2. **Definition/Principle (4 pts))** Sketch the ray diagrams for the following lenses. Clearly show the images and indicate if the final images *are real/virtual.*



Bonus: Sketch the ray diagram for the system of lenses. Clearly show the images and describe the final image.



3. **Problems (12 pts)**

a. A forty year old finds that she has to hold a newspaper 45 cm from her eyes. What focal length contact lens does she need to correct her vision?

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

$= \frac{1}{25} + \frac{1}{-45}$

$f = \frac{25(45)}{45-25} = 56\,cm$

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b. Light of wavelength 620 nm is incident on a double slit. The angle between the central maximum and the second Order maximum is 4.90°. Determine the separation of the slits.

$d \sin\theta = 2\lambda$

$d = \frac{2(620\times10^{-9})}{\sin 4.90} = 1.45\times10^{-5}\,m$

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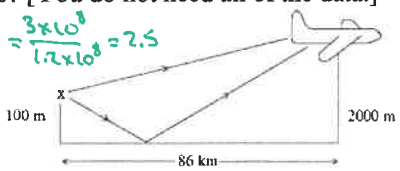
c. 120 MHz radio waves leave a radio tower and reach an airplane following two different paths. At 86.0 km from the tower the pilot loses the signal due to destructive interference. What is a possible minimum path difference between the two paths? [You do not need all of the data.]

$\Delta L = \frac{\lambda}{2}$ $\lambda = \frac{c}{f} = \frac{3\times10^8}{1.2\times10^8} = 2.5$

$= \frac{2.5}{2}$

$= 1.25\,m$



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d. A converging lens has a focal length of 20 cm. An object, which is 4 cm high, is placed at a point 40 cm to the left of the lens.

i. What is the position and size of the image?

$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} = \frac{1}{20} - \frac{1}{40} = \frac{1}{40}$ $d_i = 40\,cm$

$h_i = m h_o = -\frac{40}{40} 4 = -4\,cm$

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ii. Place a diverging lens with focal length -20 cm to the right of the converging lens. What is the position and size of the new image?

60cm

$d_o = 60 - 40 = 20$

$\frac{1}{d_i} = \frac{1}{-20} + \frac{1}{-20} = -\frac{1}{10}$

$d_i = -10\,cm$ $h_i = -\frac{-10}{20}(-4) = -2\,cm$

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iii. What is the total magnification of this system?

$m = m_1 m_2 = -1\left(\frac{1}{2}\right) = -\frac{1}{2}$

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