Physics 262 Spring 2010 Exam #1

Name:_____

CLOSED BOOK, CALCULATORS ONLY
SHOW ALL WORK! Use extra blank sheets if necessary

$$c = 3.00 \times 10^{8}\,\mathrm{m\,s^{-1}} \qquad \varepsilon_{O} = 8.85 \times 10^{-12}\,C V^{-1} m^{-1}$$

1) (30 points)

The laser pointer I use in class operates at a wavelength of 670 nm and a power of 0.500 mW spread uniformly over a circle 1.20 mm in diameter.

1) A 15 points

What the amplitude of the electric field in this laser beam?

1) B **10 points**

What the amplitude of the magnetic field in this laser beam?

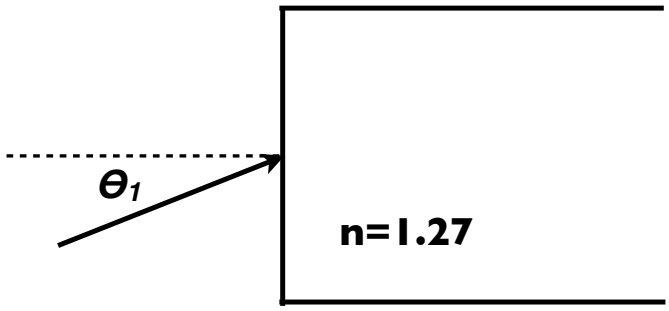
1) C **5 points**

If I let this beam fall perpendicularly on a perfectly reflecting piece of paper having twice the diameter of the laser beam and a mass of 1.50 mg. What acceleration does the laser beam give to the paper?

2) 25 points

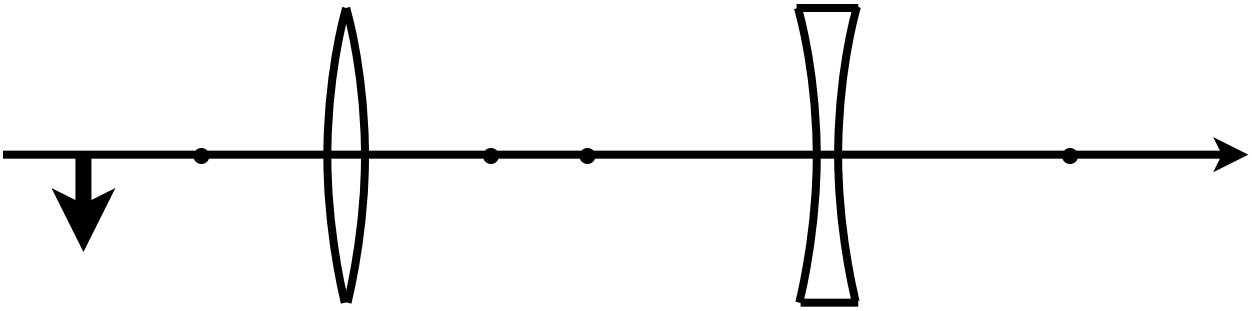
The figure below depicts the investigation of a new type of optical fiber with index of refraction $n = 1.27$. A laser beam is incident on the flat end of the straight fiber in air.

What is the maximum angle of incidence Θ_1 if the beam is not to escape from the fiber?



3) (30 points)

Two lenses are set up as shown in the scale diagram below. The focal length of the converging lens is 150 mm, that of the diverging lens is 250 mm, and they are 500 mm apart. The object shown is 270 mm to the left of the converging lens.



3) A 15 points

On the diagram above, draw as many primary rays as you need to find the position of the image of the converging lens and the final image as viewed from the right.

3) B 15 points

Use the lens equation and the magnification equation and find the exact position of the image and the exact lateral magnification for the approximate findings above.

4) **(15 points)**

Polarized light is emitted from a laser and is then passed through a polarizer. The polarizer is nonadjustable and has it's polarization direction oriented 90° with respect to the polarization direction of the laser light.

4) A **10 points**

A second polarizer is placed between the laser and the original polarizer. What orientation of the second polarizer will allow the most laser light through the original polarizer?

4) B **5 points**

If the laser puts out light with intensity I_O, what is the maximum intensity of light that makes it through the first polarizer when the second polarizer is adjusted as in Part A)?