

Midterm I
Physics 7C
Fall 1999
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Work all problems. Do not perform any numerical calculation until you have a final boxed algebraic answer. In order to obtain maximum partial credit show all your work clearly. Work the easiest problem first and then move on to harder ones. If you don't understand what is being asked in a problem, ask the proctor for clarification. Good luck.

1. A circular loop of wire can be used to detect electromagnetic waves. Suppose a 100MHz radio station radiates 50kW uniformly in all directions. A) For maximum induced voltage in the loop should the normal to the plane of the loop be oriented parallel or perpendicular to the a line drawn between the station and the receiver? B) What is the maximum rms voltage that could be induced in a loop of radius 30cm at a distance of 10^5 m from the station?
2. A laser beam is incident on a plate of glass of thickness 3cm and index of refraction $n=1.5$. the angle of incidence is 40° . The top and bottom surfaces of the glass are parallel and both produce reflected beams of nearly the same intensity. What is the perpendicular distance d , between the two adjacent reflected beams.
3. An object is 17.5cm to the left of a lens of focal length $f_1=8.5$ cm. A second lens of focal length $f_2= -30$ cm is 5 cm to the right of the first lens. A) Find the distance between the object and the final image. B) What is the overall magnification? C) Is the final image real or virtual? Upright or inverted? Before you solve the problem algebraically, make a ray diagram that indicates the final image .

4. Television viewers sometimes notice that the picture flickers (fades in and out) when an airplane flies across the sky in the vicinity. The flickering arises from the interference between the signal directly from the transmitter and that reflected from the airplane. Suppose the TV set is 36km from the transmitter which broadcasts at 86MHz. The airplane is flying at a height of about 600m above the receiver, toward the transmitter and the rate of oscillation of the picture's intensity is 4Hz. Find the speed of the plane.