

Physics 7c
Fall 2000
Midterm 1
R. Packard

Name: _____ SID _____

Work any four (4) problems. They are weighted equally. If you don't understand the question ask the proctor for clarification. Do not perform any numerical work until you have a "boxed" algebraic answer. Do a dimension check on you final answer. First answer the questions you can do easily leaving time at the end for the questions you are less sure of.

1. _____

2. _____

3. _____

4. _____

5. _____

Total _____

1. The Mount Palomar telescope has a 200 inch diameter objective lens. Suppose we use it to view a double star located 4 light years away (the distance light travels in one year). What is the minimum distance (in meters) between the two stars if we can just resolve them in the telescope using light of wavelength 550nm.
2. Consider a double slit arrangement where the separation $d=0.3\text{mm}$ and the distance to the screen $L=1\text{m}$. The slits are illuminated with visible light. The space between the screen and the slits is filled with water $n_w=1.33$. A sheet of transparent plastic ($n_p=1.5$) of thickness $t=0.05\text{mm}$ is placed over the upper slit. As a result the central maximum of the interference pattern shifts upward a distance y . Find y . Use a small angle approximation: $\sin\theta \approx \theta$ $\tan\theta \approx \theta$

3. An object is 17.5cm to the left of a converging lens of focal length $f_1=8.5\text{cm}$. A second lens of focal length $f_2= -30\text{cm}$ (this is a diverging lens) 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 (or diagrams) that indicates the final image.
4. It is possible to levitate a spherical glass bead in a vertically upward directed laser beam. If the bead mass m is $2 \times 10^{-6}\text{gm}$, and its density $\rho=0.3\text{gm/cm}^3$, what power, P , laser beam will support the bead? Assume the laser beam diameter $d= 2\text{mm}$ and that the bead reflects the laser light. For simplicity assume the light is all reflected directly downwards.
5. A small object located at depth $d=2\text{m}$ below the surface of a lake is viewed from the space above the lake from an angle of 45° . At what depth does the object appear to be below the surface. Assume the index of refraction of water is $4/3$. Make a sketch showing at least two rays.