LUMS School of Science and Engineering
PHY201 Modern Physics – Assignment # 3

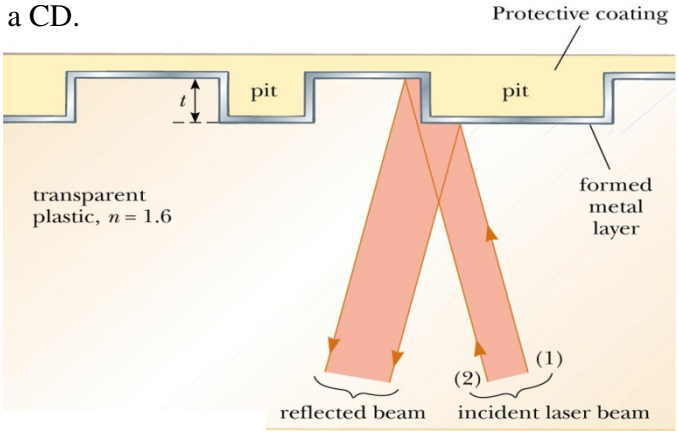
Q.1 Sound coming from two separate loudspeakers is readily heard to interfere. Why is not possible to demonstrate interference of waves coming from two separate light sources?

Q.2 In the two-slit experiment what would happen to the pattern on the third screen if one of the slits is covered up?

Q.3 Simplify $f(t) = \sin \omega t + \cos \omega t$ using a trigonometric identity that you certainly know. Then make a plot of $f^2(t)$ from $t = 0$ to $2\pi / T$. Repeat for $f(t) = \sin \omega t + \frac{1}{2} \cos 2\omega t$.

Q.4 In a double slit experiment, green light of wavelength 550 nm illuminates slits that are 1.5mm apart. The screen is 2 m away. What will be the separation between the dark fringes?

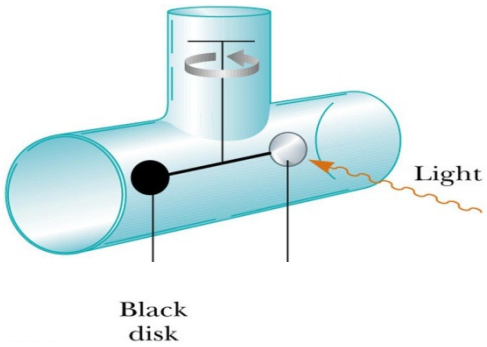
Q.5 A compact disc player uses a laser to reflect light from the metal layer deposited on a protective coating. When the light reflected from both segments is combined at the receiver, interference from the two waves results. We can therefore whether there is "one" or "zero" at that point on a CD.



Answer the following:

a) A CD has about 700 MB (megabytes) recorded upon it. Give a rough estimate of how much area is needed for one byte.

b) For a byte to be detected by interference using a green light laser, what should be the approximate depth t of the pit?



Q.6 With reference to the diagram above, suppose that light illuminates both the mirror and the darkened plate. On which will the force be greater? To answer this, ask on which plate is the change of momentum greater and then relate this to Newton's Law which states that force is rate of change of momentum.

Q.7 In order to remove an electron from a certain metal, it is necessary to give at least 2.2 eV energy to the electron. What should be the minimum frequency of a beam of light to ensure that photoelectrons are emitted? What if the frequency is larger than this? Where will the energy go?

Q.8 A laser pulse of green light at 550 nm puts out 2 joules of energy in 1 millisecond. How many photons does the pulse have? What if it is blue light?