

Your Class ID

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3 Numbers	3 Letters

PHYSICS 2220

Spring Semester 2005  
Exam 1  
Monday, 31 January 2005  
1:30 PM - 2:20 PM

Closed Book  
Equation Sheet Permitted (Unmarked)  
Calculators Permitted

Question 1. A thin metal wire has a mass of 3.75 g and a length of 83 cm. This wire is attached to a violin such that the length between the two supports is 61.5 cm.

a) Calculate the wavelength of the fundamental, the 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> harmonics of standing waves on this wire.

b) Draw the standing wave pattern for third harmonic on this wire.

c) What velocity would this wire need to have a 2<sup>nd</sup> harmonic frequency of 440 Hz?

d) Calculate the frequency of the fourth harmonic.

e) What is the magnitude of the tension in the wire?

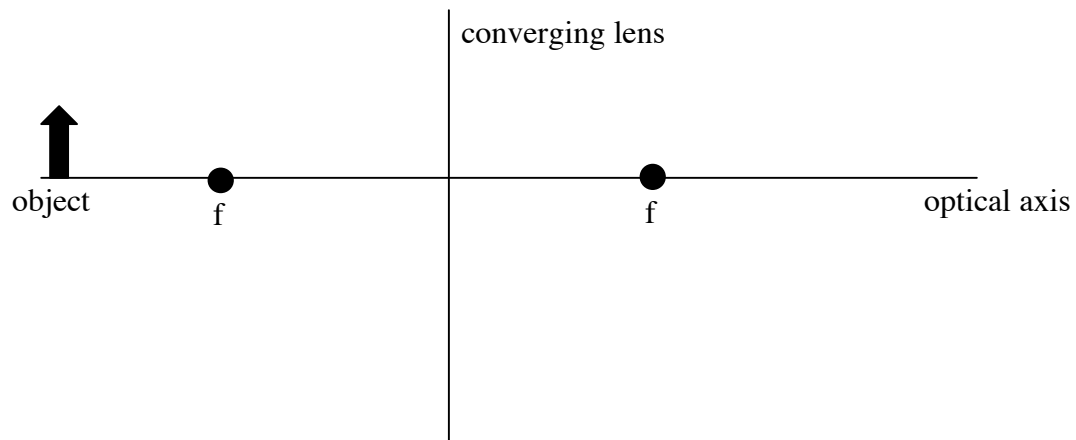
Question 2. A Young's double slit experiment has a slit spacing of 0.3 mm. The viewing screen is 2.73m from the slits. A neon helium laser of wavelength 633nm shine son the slits and generates an interference pattern on the screen.

a) Calculate the distance of the  $m = 4$  bright fringe from the straight through  $m = 0$  fringe.

b) If now a blue light is used whose wavelength is 488 nm calculate the distance for the  $m = 4$  fringe from the straight through,  $m = 0$  fringe.

c) Each slit had a width of 0.02mm calculate the full width of the central bright region of the diffraction pattern associated with such a slit when red light at 633nm is used.

Question 3. Lens and ray optics



- a) Sketch the lens.
- b) From the top of the object draw the following 3 rays:  
Ray 1 parallel to the optical axis  
Ray 2 intersects thin lens at the optical axis  
Ray 3 passes through the near focal point  
You need to continue these three rays beyond the lens, taking into account the effect of the lens, to form an image.
- c) The lens has a front radius of 10 cm and a second surface of radius 15 cm. Determine the correct sign for  $R_1$  and  $R_2$  and then using the lens make an equation given that  $n = 1.57$ . Calculate the focal distance.
- d) The object is located 15 cm in front of the near focal point. Calculate the image location.
- e) The object has a height of 1.7 cm. Calculate the magnification and hence the height of the image.