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\textsuperscript{nd}, 3\textsuperscript{rd}, and 4\textsuperscript{th} 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\textsuperscript{nd} 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 on 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.