

College Physics w/Calculus II PHY 2502
Chapter Exam #3

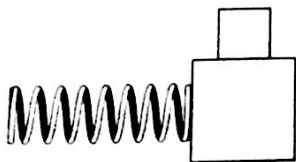
Chapters 14, 20, 21

Due: 17 July 2014

Name: _____

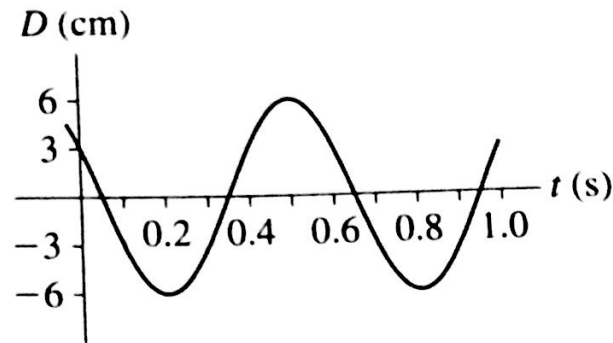
Instructions: For each question identify all equations and show all intermediate steps in arriving at your answer. The instructor reserves the right to deduct points even though you have the correct answer if you DO NOT show your work. Neat work is a must. If I cannot read your work, it's wrong. Use separate sheets of paper for each problem that does not fit, clearly marking each page with the problem number and your name.

1. In the figure below a 1.5 kg mass is riding on top of a 5.0 kg mass as it oscillates on a frictionless surface. The spring constant is to 45 N/m and the coefficient of static friction between the two blocks is 0.50. What is the maximum oscillation amplitude for which the upper block does not slip?



2. In a science museum, a 110 kg brass pendulum bob swings at the end of a 15.0-m-long wire. The pendulum is started at exactly 8:00 A.M. every morning by pulling it 1.5 m to the side and releasing it. Because of its compact shape and smooth surface, the pendulum's damping constant is 0.010 kg/s. At exactly 12:00 noon, how many oscillations will the pendulum have completed and what is its amplitude?

3. This is a history graph at $x = 0$ m of a wave traveling in the negative x -direction at 2 m/s.
- What is the wavelength?
 - What is the phase constant of the wave?
 - Write the displacement equation for this wave.



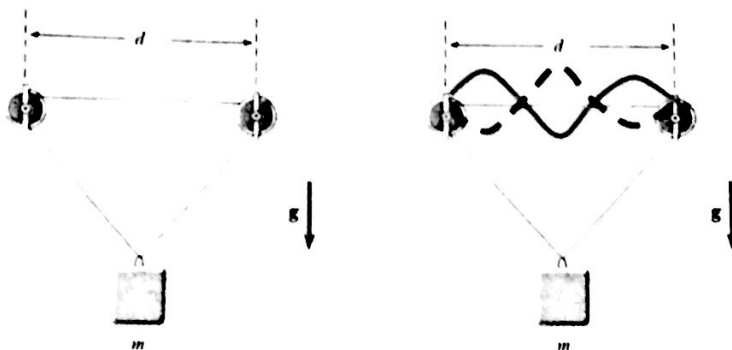
History graph at $x = 0$ m
Wave traveling left at 2 m/s

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4. A physics professor demonstrates the Doppler effect by tying a 600 Hz sound generator to a 1.0-m-long rope and whirling it around her head in a horizontal circle at 100 rpm. What are the highest and lowest frequencies heard by a student in the classroom?
5. Wavelengths of light from a distant galaxy are found to be 0.5% longer than the corresponding wavelengths measured in a terrestrial laboratory. Is the galaxy approaching or receding from the earth? At what speed?
6. A heavy piece of hanging sculpture is suspended by a 90-cm-long, 5.0 g steel wire. When the wind blows hard, the wire hums at its fundamental frequency of 80 Hz. What is the mass of the sculpture?

7. A 12.0-kg object hangs in equilibrium from a string with a total length of 5.00m and a linear mass density of $\mu = 0.0010 \text{ kg/m}$. The string is wrapped around two light, frictionless pulleys that are separated by a distance of $d = 2.0 \text{ m}$.

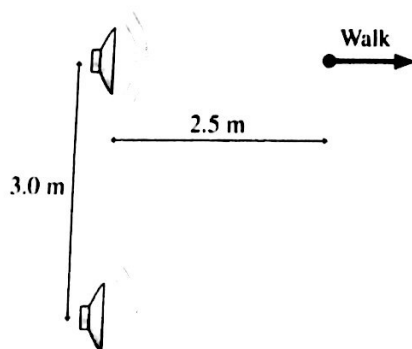
- Determine the tension in the string.
- At what frequency must the string between the pulleys vibrate in order to form a standing wave with 3 antinodes?



8. A sheet of glass is coated with a 500-nm-thick layer of oil ($n = 1.42$).

- For what *visible* wavelengths of light do the reflected waves interfere constructively?
- For what *visible* wavelengths of light do the reflected waves interfere destructively?
- What is the color of reflected light? What is the color of transmitted light?

9. You are stand 2.5 m directly in front of one of the two loudspeakers shown in figure below. They are 3.0 m apart and both are playing a 686 Hz tone in phase. As you begin to walk directly away from the speaker, at what distances from the speaker do you hear a *minimum* sound intensity? The room temperature is 25°C .



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10. Two lasers with very nearly the same wavelength can generate a beat frequency if both laser beams illuminate a photodetector with a very fast response. In an experiment, one laser's wavelength has been stabilized at 780.54510 nm. The second laser starts with a longer wavelength that is slowly decreased until the beat frequency between the two lasers is 98.5 MHz. What is the second laser's wavelength?