Physics 380H - Wave Theory   Homework #01

Fall 2004   Due 12:01 PM, Monday 2004/09/20

[35 points total]

"Journal" questions:
– What are your goals for the course? What are your expectations for the course?
– Any comments about this week's activities? Course content? Assignment? Lab?

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1. Send me (jbeda@trentu.ca) an e-mail message from your trentu.ca account, with a subject of "380H–HW–01"   [5]

2. Sign onto WebCT and post a message in the discussion forum "General social discussions". [5]

3. Put your name and email address and phone number inside your texts and on your calculator and anything else you might misplace - it will not prevent theft, but it will allow anyone who finds your stuff to have a chance of returning it.   [0]

4. For an open flask of volume V and neck length l, with a cross sectional area A, containing air of density ρ, vibrating as sound in the neck, the equation for SHM of the air is:

$$\rho A l \ddot{x} + \frac{\gamma \rho A^2}{V} x = 0.$$

   What is the angular frequency ω of the sound?   [5]

5. For a small object of mass m, swinging on a string of length l, show that the period of oscillation is

$$T = 2\pi \sqrt{\frac{l}{g}}$$

   by applying Newton's laws to arrive at the SHM equation. What approximation must be made?   [10]

6. (From Towne P1-1. pg 17) Which of the following are solutions to the one-dimensional wave equation for transverse waves on a string? Why or why not?   [10]

   a) $x^2 - 2cxt + c^2 t^2$ b) $10 \left(x^2 - c^2 t^2 \right)$ c) $\sigma x^2 + T t^2$

   d) $\sqrt[3]{\sin \left[(x - ct)^3 \right]}$ e) $2x - 3ct$ f) $10 (\sin x)(\cos ct)$

Headstart for next week, Week 02, starting Monday 2004/09/20:
– Read Chapter 1 "Waves" in "Simple Nature" by Crowell
– Review the use of complex numbers and sinusoidal functions, Towne, Appendix I
– Read Chapter 1 "Transverse Waves on a String" in "Wave Phenomena" by Towne
– – Section 1-1 "Introduction"
– – Section 1-2 "Derivation of the wave equation"
– – Section 1-3 "Solution of the one-dimensional wave equation"
– – Section 1-4 "Wave propagation velocity on a string"
– – Section 1-5 "The most general solution to the one-dimensional wave equation"
– – Section 1-6 "Kinematics associated with the waveform"
– – Section 1-7 "Description of a sinusoidal progressive wave"
– – Section 1-8 "Initial conditions applied to the case of a string of infinite length"
– Read Chapter 2 "The Acoustic Plane Wave" in "Wave Phenomena" by Towne, omit 2-6
– – Section 2-1 "Definition of the variables"
– – Section 2-2 "Derivation of the wave equation"
– – Section 2-3 "The velocity of sound"