Labs: Trigonometry Based Physics Part I

EXP 13 – Pre-Lab

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PRE-LAB on Waves Instructions:

Comment [O1]: 100 points total, 10 points per problem

Print out these pages. Feel free to refer to the lab instructions and other materials, your physics textbook, other students, etc. to help you to ponder, understand, and work out answers to the following question(s). Attach additional pages to show your work and reference item numbers on your attached pages.

PRE-LAB Questions:

1) Attach separate page and reference the item number for this question and questions that follow. Explain the relationship:
   a) Between wave speed, wavelength, and period?
   b) Between wave speed, wavelength, and frequency?
   c) Between period and frequency?

Comment [O2]: 3 points per part

2) You observe 10 cycles in 23.7 sec. Find the following showing all work on a separate page referencing the item number.
   a) Period?
   b) Frequency?

Comment [O3]: 5 points per part

3) How do you produce a standing wave in any material? Attach a separate page explaining and reference the item number.

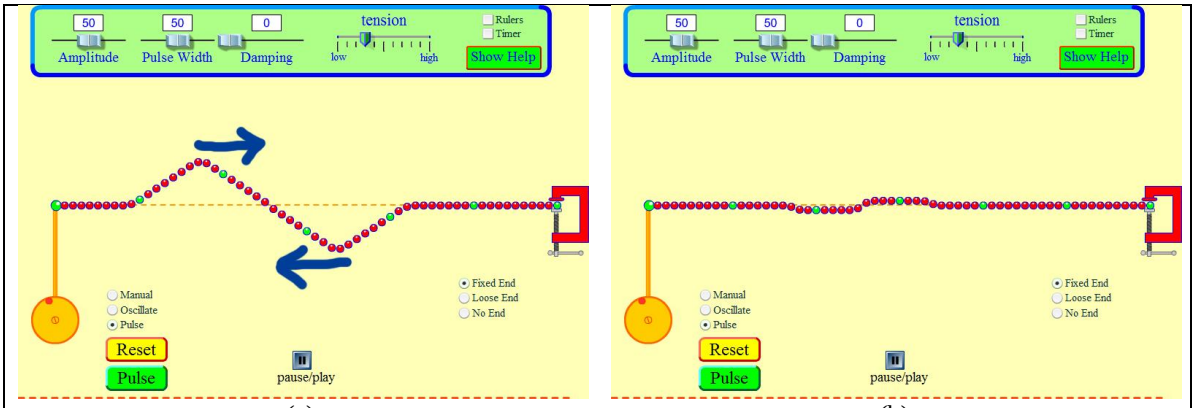
Comment [O4]: 10 points per Bloom's, 2 points each for knowledge, comprehension, application, synthesis, and critical thinking (evaluation).

4) Explain how the wavelength of a standing wave in a string is related to the properties of the string on a separate page referencing the item number.

Comment [O5]: 10 points per Bloom's, 2 points each for knowledge, comprehension, application, synthesis, and critical thinking (evaluation).

5) A standing wave can be thought of as a wave traveling to the right and a wave traveling to the left interfering both constructively and destructively. Do this using phet simulations (http://phet.colorado.edu/sims/wave-on-a-string/wave-on-a-string_en.html) or with a rope, slinky, or spring? In the case of a real object a camera helps and in the case of the phet simulation you can do "print screen" from your computer. A free program, virtual dub, does screen capture if you prefer movies. By the way, here's my phet screen shots just before the two waves traveling in different directions meet and just as the destructively interfere Explain and discuss your exploration with phet, slinky, rope, etc. on a separate page and referencing this item number.

Comment [O6]: 10 points per Bloom's, 2 points each for knowledge, comprehension, application, synthesis, and critical thinking (evaluation).



(a) (b)

Figure 13P.1 – Screen shots of phet simulations of wave pulses. (a) Just prior to collision with right, downward pulse traveling to the left per the arrow shown and left, upward pulse traveling to the right as shown by arrow. (b) Shows when pulses intersect – for a split second the wave is almost flat. The programs that produced these screen shots can be found at http://phet.colorado.edu/sims/wave-on-a-string/wave-on-a-string_en.html and many more simulations are at http://phet.colorado.edu.

6) Research what we mean by nodes and antinodes. Attach additional pages and reference this item number.
7) Research what we mean by normal modes and resonant frequencies (AKA harmonics). Attach additional pages and reference this item number.
8) Make a sketch showing the difference between the first, second, third, and fourth harmonics in a stretched string. Note the first harmonic and fundamental frequency are the same. Attach a separate sheet and reference the item number.
9) A string of length L = 1.2 m is attached at one end to a wave oscillator, which is vibrating at a frequency f = 80 Hz. The other end of the string is attached to a mass hanging over a pulley as shown in the diagram below. When a particular hanging mass is suspended from the string, a standing wave with two segments is formed (Figure P13.2). When the weight is reduced by 2.2 kg, a standing wave with five segments is formed. What is the linear density of the string? Show work on a separate page referencing the item number.

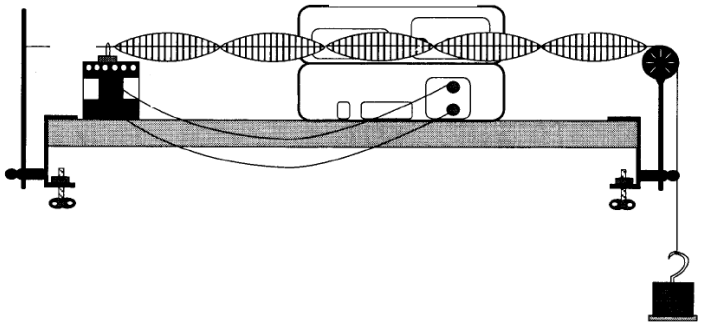


Figure 13P.2 – Diagram of wave oscillator, string, pulley and mass. This picture show five segments, however it is only 2.5 wavelengths.

10) A standing wave is formed in a string as pictured in Figure 13P.2. If a standing wave with two segments is formed when the frequency is 60 Hz, and the hanging mass and string length are kept constant, what frequency would be required to produce a standing wave with 7 segments?

Comment [O7]: 10 points per Bloom's, 2 points each for knowledge, comprehension, application, synthesis, and critical thinking (evaluation).

Comment [O8]: 10 points per Bloom's, 2 points each for knowledge, comprehension, application, synthesis, and critical thinking (evaluation).

Comment [O9]: 10 points – 2 points accurate sketch, 1 point equation, 1 point title, 2 points axis titles, 2 points axis scales, 2 points axis units

Comment [O10]: 10 points per SOLVE

Comment [O11]: 10 points per SOLVE