Model: Simple Harmonic Motion

Act 8.1.1 A Review of Simple Harmonic Motion (~90 min)

Learning Goals:

- To interpret the mathematical expression $y(t) = A \sin(2\pi t/T + \phi)$
- To understand how this expression describes the motion of an oscillating object
- To understand the meaning and function of the fixed phase constant, ϕ

Model: Plane Waves

Act 8.1.2 What Exactly is a Wave? (~50 min)

Learning Goals:

- Clearly establish how a wave differs from an oscillation
- Becoming familiar with the independent parameters of waves and what determines their values
- Understanding polarization of waves
- For harmonic waves, understanding why wavelength is a dependent parameter

General Announcements

- Read the SHM Supplement and the first portion of the Course Notes on Waves (both found on the course web page).
- Download and print the Course Notes if you want a hard copy. They will not be sold at Navin's or the Bookstore.
- Be sure to regularly check the course web page for announcements regarding quizzes, etc.

For scenarios 1) and 2), answer the following questions:

i) Exactly what is oscillating in the medium?

ii) Exactly what is moving that makes this a wave (note: this is distinct from i) above).

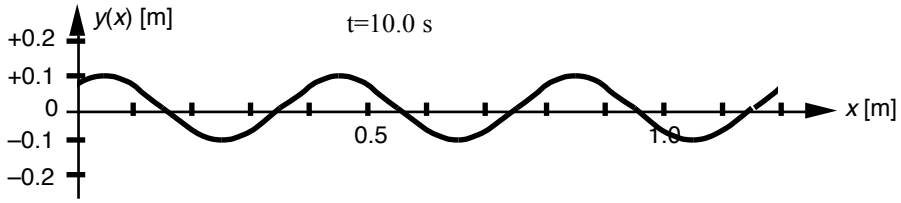
iii) Exactly what determines the wave speed? The amplitude? How could you change these?

1) (Application) Answer i, ii, and iii to describe both (a) a 2-D wave on the surface of water created by dropping in a stone and (b) a continuous harmonic wave caused by a swimmer bobbing up and down.

2) (Application) Answer i, ii, and iii for to describe a 3-D sound wave created by a person playing a flute.

3) (Application) Explain the difference between the motion of air molecules caused by the wind at the beach to the motion of the air particles caused by sound waves created by the pounding surf in language that someone who has never taken physics could understand.

4) (Solidification) A machine tugs sideways on a horizontal elastic rope with a frequency of 5 Hz. A graph of the transverse displacements of this rope wave at ***t* = 10.0 s** as a function of position is shown below.



(a) Sketch a graph of displacement as a function of position for ***t*=10.2 s**.

(b) What is the velocity of waves on this rope?

(c) If the frequency of the machine tugging on the rope is doubled to $f = 10$ Hz:

i. What is the new wavelength of waves on this rope?

ii. What is the new velocity of waves on this rope?

iii. How does the above graph change to reflect this new frequency?

(d) If the wave travels along the rope which is connected to a thinner rope, which of the following changes as the wave moves onto the new rope?

i. Period

ii. Wave speed

iii. Wavelength

5) (Introduction) ***EXPLORATION:***
Go to the Physics 7C course webpage and load the applet called "SHM Wave Machine." You should now be faced with the rather imposing equation:

$$y(x, t = 0s) = 25m * \sin(\frac{2\pi * 0s}{6s} + \frac{2\pi x}{160m} + 0 * 2\pi) + 0m$$

Your goal is to enter DL 2 with a useful description *in your own words* of every part of the equation. Make sure that your investigation includes the following:

(a) Before starting the applet, change each of the slider bars. Note both how the equation changes and how the graph changes (or does not change).

(b) Start the animation. As it is running, change each of the slider bars.

(c) Let the animation run for a few seconds, then pause it. With the animation paused at a time other than t=0, change each of the slider bars.