AP Physics - Waves and Sound - Beats and Doppler

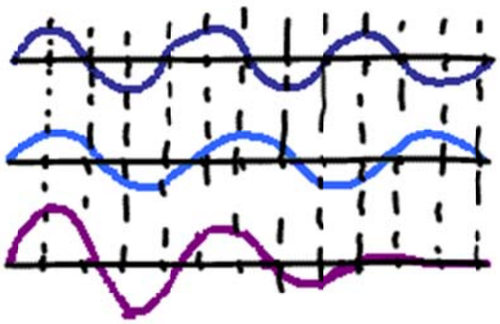
Note Title 2/11/2008

Beating

If you have two sources of waves of slightly different wavelength, the following cool effect happens:

f_1 $\lambda = 2$ spaces

f_2 $\lambda = 2.4$ spaces



← Amplitude Varies!

∴ 2 notes, slightly out of tune, will create a resulting waveform with a varying amplitude.

This sounds like <u>beating</u>.

With a little calculus, you can prove that the frequency of the beating is $f_2 - f_1$.

Doppler Effect

Imagine the sound of a racecar at the speedway. It goes "Eeeeeee.... uuuhhh!" Why?

Doppler Effect!

Doppler Effect - The shift in received frequency of a wave due to relative motion of the source or of the observer.

Received waves spaced far apart: This person hears a lower frequency.

Received waves spaced closely together: This person hears a higher frequency

moving source

$$f_o = f_s\left(\frac{v \pm v_o}{v \mp v_s}\right)$$

f_s = frequency of source

f_o = frequency received by observer

v = speed of the traveling wave

v_o = speed of the observer

v_s = speed of the source

→ Use upper signs for source/observer moving closer together.

→ Use lower signs for source/observer moving farther apart.