Unit: Oscillations and Waves

I. Oscillatory Motion: Amplitude, Frequency, and Velocity
   a) Mass on a spring
   b) Pendulums

II. Traveling Waves
    a) Types and properties
    b) Frequency, Velocity, and Wavelength

III. Sound
    a) Intensity vs. distance
    b) Doppler effect

IV. Superposition
    a) Addition of Waves
    b) Standing Waves (strings and pipes)
    c) Beats
Notes:
1. $\Delta P_{\text{max}}$ happens when $\Delta s = 0$.
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A jet plane passes over your head in horizontal flight. When it is straight above you, the sound seems to come from a point behind the plane in a direction inclined 30° from the vertical. The speed of the plane is:

a) the same as the speed of sound
b) half the speed of sound
c) three-fifths the speed of sound
d) 0.866 times the speed of sound
A particular molecule in a sound wave is traveling at its maximum speed. What can be said about the pressure on this molecule?

a) It is at a maximum.
b) It is at a minimum.
c) It is in between the max and min.
d) More information is needed.
You are standing 1m away from a lawn mower and hear the engine at an intensity of 100dB. If you move away so that you are 10m from the lawn mower, what will the new intensity be?

a) 99dB
b) 98dB
c) 80dB
d) 10dB
e) 5dB
f) 1dB
An automobile horn sends out waves in air 2.2 ft long. If the speed of sound is 1100 ft/sec, what is the frequency of the automobile?
You are in a train station and hear a long train whistle. You notice that the frequency is initially a high pitch but, over time, becomes a low pitch. What has happened?

a) The train has moved closer to the station.
b) The train has traveled past the station.
c) The train has moved away from the station.
d) The train whistle must be able to make different sounds.
You are driving 30m/s. Two horns blow at 600Hz: one by a pedestrian standing behind you, the other by a car moving head-on at 40m/s.

What are the two frequencies you hear?
A police car going 80mi/hr in pursuit of a motorist doing 70mi/hr has its siren on and is emitting a steady 440Hz. What frequency will be heard by the pursued driver?
Excel Superposition Demo
\[ r_2 - r_1 = 0 \]
\[ r_2 - r_1 = 0 \]
\[ r_2 - r_1 = n\lambda \quad \text{for} \quad n = 0, 1, 2, 3, \ldots \]
\[ r_2 - r_1 = n(\lambda/2) \quad n = 1, 3, 5, 7, \ldots \]
\[ r_2 - r_1 = n\lambda \quad n = 0, 1, 2, 3, \ldots \]

\[ r_2 - r_1 = n\lambda/2 \quad n = 1, 3, 5, \ldots \]
Two speakers, placed 10m apart, emit frequencies of 550Hz. The diaphragms of the speakers are in phase with each other. If you start at one speaker and walk toward the other one, how far apart are the positions of silence?
Two speakers sit 6m apart. The speakers are in phase and play the same frequency of 30Hz. We know that there will be a max volume exactly between them (3m from each). What is the position of the next max volume (closest to the middle)?