PHET Sound Simulation

Purpose – To explore sound (a longitudinal wave) and how it can be modeled as a transverse wave

Obtain computer with PHET software on it. Get headphones if possible and plug into sound port.

Open PHET simulations and find Sound and Waves simulations.

Open the simulation called "Sound". There are 5 tabs.

Open the one called listen to a single source.

1. What is the affect of changing the frequency of the tone generated?

2. What is the affect of changing the amplitude of the tone generated?

3. Using the slide bar as a rough ruler, and the frequency set to 100, how low in amplitude (%) can you still hear the tone?

4. Using the slide bar as a rough ruler, and the frequency set to 1000, how low in amplitude (%) can you still hear the tone?

5. Do you have better "high end", or "low end" response with your ears?

Open the panel called "Measure"

1. Using a experiment of your own design, measure the speed of sound. Record any data you obtain here.

2. Based on the speed you measured above, how long would it take for you to hear thunder if you observed lightning and it was seen to be 1620 meters away?

Open the panel called Two Source Interference

1. What do you suppose the light and dark bands on the "sound" emanating from the speaker represent? Enable Audio, change to Listener mode, not Speaker mode!

2. Move the head of the listener up and down. What do you note about the locations where the waves intersect? Is there a location in which you hear less sound? What do you think is happening? Don't forget that sound is due to a change in local pressure.

Open the panel called "Interference by Reflection"

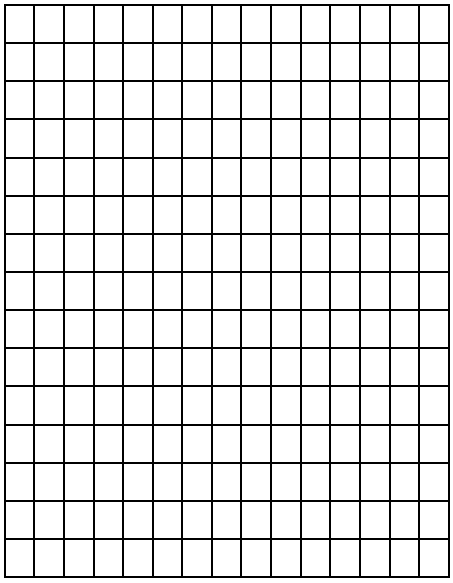
1. Explore the affect of changing frequency on the reflected wave angle. Is there any affect?

2. Explore the affect of wall angle and wall position on interference pattern. Can you draw (roughly) a set up that shows interference that would not allow you to hear a certain frequency? In the space below show the speaker, the wall angle, the wall position, and a location where you think the sound would "drop out" due to reflection.

Open the simulation of Listen with varying Air Pressure

1. **Leave the pressure set to 1 atm. Adjust the amplitude of the sound (at a fixed frequency), what do you notice? Make sure you're in listener mode!**

2. **Adjust the pressure down, and record the relative loudness at 5 data points. Make up your own scale (for loudness), and record the loudness (y-axis) versus pressure (x-axis). Make a rough plot of the data here. What do you think the relationship is?**

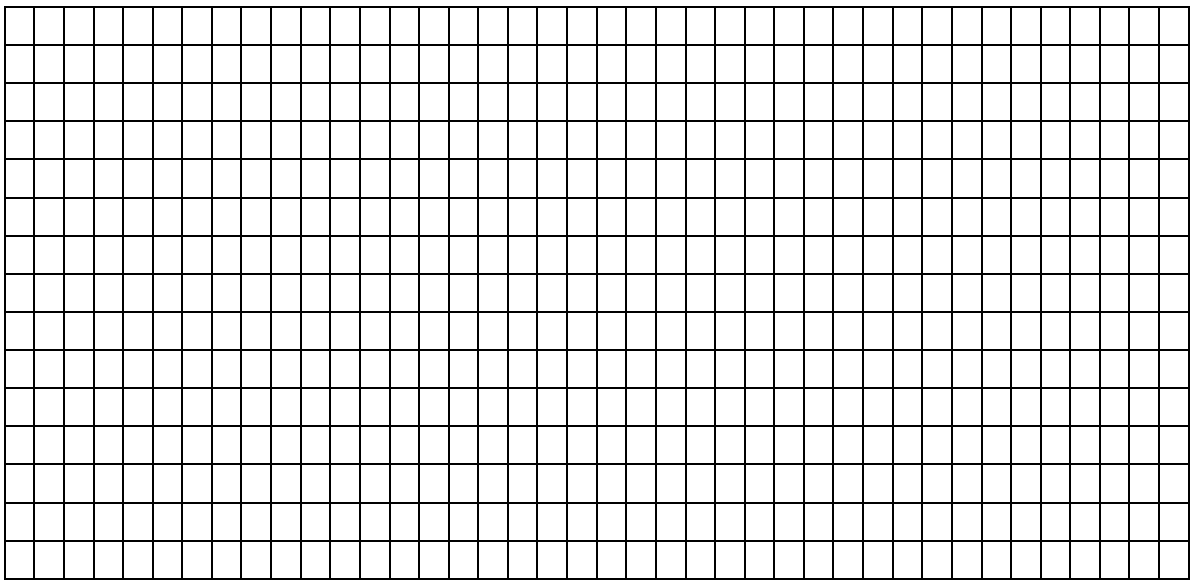


Go back to the main screen on the Simulations. Choose the Fourier Series simulation

Choose the discrete tab

1. Listen to the main tone. What is the affect of adding small amounts of the harmonics (overtones?)

2. For a basic simulation, with up to four harmonics, draw below each wave form and the summary wave form. Use different pens/pencils to represent the different waves (label them).



3. What can you say about the regions where the waves have the same phase (are on the same side of the y-axis)? How do they add up in the summary wave? Show a point on the summary wave and label this "constructive".

4. What can you say about the regions where the waves have opposite phase (are on opposite sides of the y-axis, or are shifted). How do they add up in the summary wave? Show a point on the summary wave and label this "destructive".

Open the "Wave Game" – Play the game, and see how high a level you can go before you can't match the wave. How high did you make it? Comment here on what you learned in trying to match the wave form.