LAB 1 Laboratory Activity

Sound Waves and Pitch

Sounds are produced and transmitted by vibrating matter. You hear the buzz of a fly because its wings vibrate, the air vibrates, and your eardrum vibrates. The sound of a drum is produced when the drumhead vibrates up and down, the air vibrates, and your eardrum vibrates. Sound is a compressional wave. In a compressional wave, matter vibrates in the same direction as the wave travels. For you to hear a sound, a sound source must produce a compressional wave in matter, such as air. The air transmits the compressional wave to your eardrum, which vibrates in response to the compressional wave.

Compressional waves can be described by amplitude, wavelength, and frequency—the same as transverse waves. The pitch of a sound is related to the frequency of a compressional wave. You are familiar with high pitches and low pitches in music, but people are also able to hear a range of pitches beyond that of musical sounds. People can hear sounds with frequencies between 20 and 20,000 Hz.

Strategy

You will demonstrate that sound is produced by vibrations of matter.
You will vary the pitch of vibrating objects.

Materials

4 rubber bands of different widths but equal lengths
cardboard box, such as a shoe box or cigar box

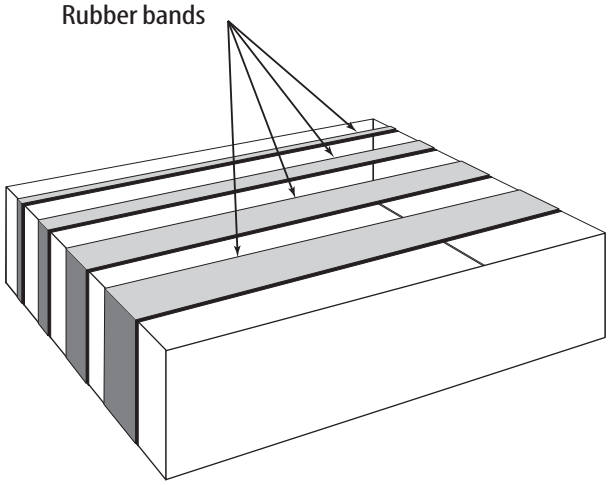
Safety Precautions

Safety goggles should be worn throughout the experiment.

Procedure

1. Stretch the four rubber bands around a box as shown in Figure 1.

Figure 1



2. Pluck the first rubber band, allowing it to vibrate. Listen to the pitch of the vibrating rubber band. Predict how the pitches of the other rubber bands will compare with this pitch. Record your prediction in the Data and Observations section. Pluck the remaining rubber bands. Record your observations about the variation in pitch.
3. Remove three rubber bands from the box. Hold the remaining rubber band tightly in the middle with one hand. Pluck it with the other. Move your hand up and down the rubber band to increase or decrease the length of the rubber band that can vibrate. Predict how the pitch will change as you change the length of the vibrating rubber band. Pluck the rubber band for each new length and record your observations of the length of the vibrating rubber band and pitch.

Laboratory Activity 1 (continued)

Data and Observations

1. Prediction of variation in pitch of sounds produced by rubber bands of different widths:

2. Observation of changes in pitch with varying thickness of rubber bands:

3. Observation of changes in pitch with varying length of the rubber band:

Questions and Conclusions

1. How does length affect the pitch of sound produced by a vibrating object?

2. How does the width of a rubber band affect its frequency of vibration?

3. Based on your results, how would you expect the pitch of sound produced by a vibrating string to be affected by the length of the string?

Strategy Check

_____ Can you demonstrate that sound is produced by vibrations of matter?

_____ Can you vary the pitch of vibrating objects?