Name: Date: Period:

Sound Stations

1 Section 20.1 : The Nature of Sound

Read Section 20.1 (pp. 375-376)

1. How are sound waves produced?

2. What type of wave is a sound wave?

3. Define the following terms:
   (a) pitch

   (b) infrasonic

   (c) ultrasonic

4. What sorts of materials cause sound to travel more quickly? Why?

2 Function Generator and Speaker

1. Adjust the frequency and the amplitude. Describe what you notice about the sound.

2. Start the frequency very low (2 Hz or smaller). Slowly increase the frequency until it starts to sound like a tone. This is the point at which the sound stops being *infrasonic*. Write down this frequency.

3. Start the frequency very high (Above 40,000 Hz). Slowly decrease the frequency until you can hear it. This is the point at which the sound stops being *ultrasonic*. Write down this frequency. When you are finished, **please make sure to turn the amplitude all the way down so it doesn't bother your classmates**.

3 Sections 20.5-20.6 : Forced Vibrations and Resonance

Read Sections 20.5 and 20.6 (pp. 382-383)

1. Define the following terms:
   (a) forced vibration

   (b) natural frequency

   (c) resonance

2. Explain how resonance relates to a kid on a swing.

3. Make your own sounding board! Hit a tuning fork against the table. Then place it stem-side down on the table and listen to what happens. Use your definition for "forced vibration" above to explain what is happening here.

4 Resonance Tube

1. Hit the tuning fork against the table to generate a tone. Hold it over the resonance tube. Keep changing the length of the resonance tube until you hear the sound get louder. What is happening and why?

2. Look at your definitions from Station 3. What do you think you are changing when you change the length of the tube?

3. Now, turn on the function generator. Gradually change the frequency. Pay attention to what happens to each of the three metal sheets. Explain why you think that they don't all resonate at the same time.

5 Practice Problems

Sound waves are just a special case of waves. But everything that we've learned about waves is still true, especially the equation $v = f\lambda$. Use that equation to answer the following question:

1. A sound wave travels through air at with a frequnecy of 1000 Hz and a wavelength of 0.343 m. What is the speed of sound through air?

2. A certain tuning fork vibrates at a frequencey of 440 Hz.
   (a) What is the wavelength of sound as it travels through air (in which the speed of sound is 343 m/s)?

   (b) The tuning fork is then submerged in water (in which the speed of sound is 1500 m/s). What is the wavelength of the wave produced in the water?

6 Generating Acoustic Beats

You will define the term "acoustic beats" at the next station. But, in the meantime, let's experience what beats are.

1. There are two tuning forks in front of you. One has adjustable weights. Make sure each of the weights is lined up with the indented line on the tuning fork. Hit each tuning fork. They should sound the same.

2. Now, change the frequency of the adjustable tuning fork slightly by lowering one of the weights by 1-2 centimeters. Play both tuning forks again. Explain what you are hearing.

3. This "throbbing" or "wobbling" you are hearing is called "acoustic beats." Move the weight even further and play the tuning forks. You should notice that the "throbbing" changes frequency. Does it shift to a higher frequency or a lower frequency?

4. To explain why beats occur, take a look at the two pendulums hanging at your station. They are different lengths, which means they have different periods and different frequencies. Set them both in motion and watch what happens. Do they ever look like they are in sync? Do they ever look like they're out of sync?

Name: Date: Period:

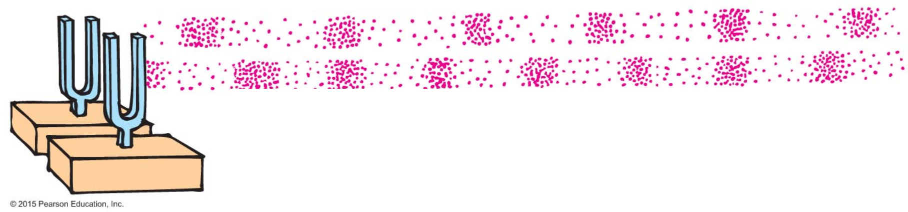
7 Section 20.8 : Beats

Read Section 20.8 (pp. 385-386)

1. What are "*beats*"?

2. In experiencing beats, why does the sound switch from loud to soft to loud to soft?

3. Look at the diagram below (Figure 20.21 from the textbook). Label the regions of constructive and destructive interference.



4. Draw your own beats! Draw two bunnies hopping forward. One bunny jumps forward 3 cm each hop; the other bunny jumps forward 4 cm each hop. Circle the locations where the bunnies are '"in sync."