Exercises

Sound Wave Vibrations

Section One

1. What starts waves?

2. Where is work being done in a wave?

3. With the rope wave, what moved from partner to partner?

4. What is frequency?

5. What is Hertz?

6. If a swing is vibrating at .5 Hz, how many times does it go back and forth in 1 second?

7. If a yo-yo goes up and down 10 times in 10 seconds, what is its Hertz?

8. If you create a rope wave by moving your hand up and down twice in one second, what's the Hertz of that wave?

Section Two

1. How does energy move?

2. True or false: The particles in a wave move from where the wave starts to where the wave ends up.

3. What is having work done on it in a wave?

4. What are the two types of waves?

5. In which wave do the particles vibrate in the same direction as the wave?

6. In which wave do the particles vibrate perpendicularly to the direction of the wave?

7. What does wavelength mean?

8. What does amplitude mean?

9. Which of the following has the longer wavelength?

10. Which of the following has the larger amplitude?

Resonance Exercises

Section One

1. Which of your body parts function as antennae?

2. Why do I call those antennae?

3. Why do we have two ears?

Section Two

1. Sound travels by waves. Are those transverse or longitudinal waves?

2. Does sound travel faster in air, water, or solids?

3. Why does sound travel faster in the medium you indicated in number 2?

4. Would sound travel faster on a hot day or a cold day? Why?

5. Which travels faster, light or sound?

6. If you see a firework and hear the sound one second later, how far away is the firework?

7. If you see lightning and hear the lightning 10 Mississippis, uh, I mean *seconds* later, how far is the lightning from where you are?

Section Three

1. If sound is a form of energy, what's moving?

2. All sound comes from what?

3. What kind of a wave is sound?

4. What does frequency have to do with sound?

5. What does amplitude have to do with sound?

Section Four

1. What causes sound?

2. What vibrates?

3. What is natural frequency?

4. Why do objects make different noises if they are hit, dropped, or plunked?

5. What three things determine something's natural frequency?

6. What is resonance?

7. If something is vibrating at 30,000 Hz, can we hear it?

8. What happens if energy is continued to be put into something resonating?

Answers to Vibrations Exercises

Section One

1. Vibrating particles of some sort.

2. Work is done by the particles moving a distance against a force.

3. Energy. The particles didn't move from partner to partner and the rope didn't move across the room. Instead, the energy from one person moved in the form of a wave across the room.

4. Frequency is how many times something vibrates in a second. Something that is vibrating quickly is said to have a high frequency, while something that is vibrating slowly is said to have a low frequency.

5. A Hertz is a measure of frequency. One Hertz is one vibration per second.

6. One half a time. The swing would swing forward or backward in one second. It would not go back and forth.

7. The yo-yo's Hertz would be one. One vibration (up and down) per second would be 10 vibrations in 10 seconds.

8. Two Hz and two vibrations per second.

Section Two

1. Energy moves by waves.

2. False. Particles only vibrate. They do not move along the wave.

3. Particles are being moved against a force. Work is being done on them and they are doing work on other particles.

4. Transverse and longitudinal.

5. Longitudinal.

6. Transverse.

7. Wavelength is the distance between two like parts of the wave.

8. Amplitude is the height of the wave.

9. “A” has the longer wavelength.

10. “B” has a larger amplitude.

Answers to Resonance Exercises

Section 1

1. Our antennae are our ears, eyes, and skin.

2. Antennae pick up energy. Our eyes, ears and skin all pick up energy. Our brain then interprets the energy as light, sound or heat. By the way, you may be asking, “What about the nose? Is our nose an antenna”? Not in my opinion. Molecules have to come into the nose and land on smell sensors to register as a smell. Noses detect matter (molecules), not energy.

3. Our two ears, plus our brain allow us to be fairly accurate at knowing where sounds are coming from. The sound will hit one ear before hitting the other and our brain can do the math and figure out from which direction the sound is coming.

Section Two

1. Longitudinal. The waves travel with the medium.

2. Solids

3. The particles are close together. The closer the particles, the faster sound travels.

4. A cold day, since the molecules are closer together.

5. Light is much faster.

6. Sound travels 1000 feet/second, so that firework is 1,000 feet away.

7. Take 10 seconds and divide it by 5. The lightning is 2 miles away.

Section Three

1. Energy is the ability to move something against a force. In the case of sound, molecules are moving.

2. Vibrations. No vibration, no sound.

3. Longitudinal wave.

4. Frequency determines the pitch of the sound. The higher the frequency, the higher the pitch, and the lower the frequency the lower the pitch.

5. The higher the amplitude of the wave, the louder the sound is. Higher amplitude means more energy which means louder sound.

Section Four

1. Something vibrating causes sound. The sound waves are carried from the vibrating thing to your ears by longitudinal waves.

2. Everything! Couches, clams, mobile homes—they all vibrate.

3. The frequency something tends to vibrate at.

4. They make different noises because they vibrate at their natural frequency. When they are plunked, the frequency that they vibrate at causes the sound wave that we hear.

5. Size, weight, and the material of an object determine its natural frequency.

6. Resonance is when something is vibrating at the same natural frequency as something else and causes that something else to vibrate as well.

7. No. Our ears have a natural frequency between 20 and 20,000 Hz. They will not vibrate at frequencies outside that range so we cannot hear something that vibrates at 30,000 Hz. Our ears can only be resonated by vibrations between 20 and 20,000 Hz.

8. If something continues to be resonated by something else, the thing that's being resonated will vibrate more and more. Eventually, unless the energy is stopped or the vibration is slowed, the object being resonated may break. This is how singers can break wine glasses. They can hit a note that resonates the wine glass. As they keep singing, the wine glass vibrates more and more until it shatters!

