The Specifics of Sound

Sound is a form of energy that travels in waves created by vibrations. Sound begins when an object vibrates. Those vibrations cause nearby air to vibrate producing sound waves. These waves travel to your ears, where your brain interprets them as sound.

Sound moves from place to place anywhere there is matter. Sound can travel through solids, liquids, and gases. It travels at different speeds through these mediums, depending upon how closely packed the molecules of a substance are (density) and how easily the substance changes shape when a force is applied to it (compressibility or elasticity). The greater the density is, the less responsive neighboring particles are and the slower sound waves travel. This might suggest that sound travels more quickly through gases than through solids. However, compressibility or elasticity plays an even greater part in determining the speed of sound. Although the molecules in solids are tightly packed, solids do not easily change their shape under force. As a result, sound travels fastest through solids. Gases are much easier to compress, so sound travels slowly through gases. In liquids, which are denser than gases but less dense than solids and somewhat compressible, sound travels at an in-between speed.

Write a letter in the blank to match each substance with the speed at which sound would travel through it.

1. ___ a wooden desk
2. ___ air
3. ___ water

   A. fast
   B. medium
   C. slow

Complete the sentences below with information from the chart.

<table>
<thead>
<tr>
<th>Material</th>
<th>Speed (meters per second)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>344</td>
</tr>
<tr>
<td>Concrete Block</td>
<td>3650</td>
</tr>
<tr>
<td>Empty Aluminum Can</td>
<td>5100</td>
</tr>
<tr>
<td>Water</td>
<td>1450</td>
</tr>
<tr>
<td>Wood Telephone Pole</td>
<td>3850</td>
</tr>
<tr>
<td>Steel Flag Pole</td>
<td>5200</td>
</tr>
</tbody>
</table>

4. How much faster does sound travel through water than through air?

   _______________________

5. About how many times faster does sound travel through water than through air?

   _______________________

6. About how many times faster does sound travel through steel than through air?

   _______________________


   _______________________

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Did You Hear That?

There are many ways to measure sound. You are probably familiar with the musical scale—do, re, mi, fa, sol, la, ti, do. Each note is higher than the one before it. The musical scale is made up of sounds with a different pitch. **Pitch** is the highness or lowness of a sound. Pitch depends on how many times the air vibrates in a second. The number of vibrations, or back-and-forth motions, per second is called the **frequency**. Frequency is measured in hertz. A **hertz** is one vibration per second.

The faster an object vibrates, the higher the pitch. The slower an object vibrates, the lower the pitch. The human voice can make sounds that range in frequency from around 85 to 1,100 hertz. The range of frequencies a human ear can hear is around 20 to 20,000 hertz. Some animals can hear sounds that humans cannot hear. That is why, for example, there are special whistles used to call dogs. These whistles make sounds at frequencies well above the range of human hearing. Some animals also make sounds that humans cannot hear.

Sound waves move away from their source and travel in many different directions. The loudness, or **volume**, of sound decreases the farther you move away from the source. We can measure volume in units called **decibels**. Volume is determined by amplitude, or the height of the sound waves. As amplitude increases, loudness increases. A sound of zero decibels is the starting point of human hearing. A sound of over 140 decibels may damage human ears. Listening to very loud music for long periods of time can permanently reduce a person’s ability to hear.

Write letters in the blanks below to match each sound word with its definition.

1. _____ the number of vibrations per second
2. _____ determined by amplitude of sound waves
3. _____ measurement of the loudness of sound
4. _____ highness or lowness of a sound
5. _____ frequency is measured by this

A. volume
B. pitch
C. hertz
D. decibels
E. frequency

Draw lines to match each sound with its average number of decibels. **Remember that the louder a sound is, the greater its number of decibels.**

6. a vacuum cleaner
7. a jet
8. the rustle of leaves
9. normal conversation
10. Describe the difference between pitch and volume.