

SOUND VIBRATIONS

From *Science in a Nutshell*



Westminster College

INTRODUCTION:

Our world is filled with many different sounds. These sounds may range from the soft rustling of leaves to the loud, annoying noises of automobile horns and from the rhythmic beat of a rock and roll band to the spontaneous laughter of friends.

As you do the activities in this **Science in a Nutshell™** mini-kit, you will discover how sounds are made and what causes the differences in the sounds you hear. You will also investigate how sounds travel through different materials and which materials help to muffle loud or annoying sounds.

As you discover the science behind sound, you will talk through a string telephone, play a tune on a box banjo, observe “sound waves” traveling across the floor and in water, and even hear what sounds like the chimes of Big Ben.

BACKGROUND:

Sound is produced when something *vibrates*, or moves back and forth rapidly. These vibrations cause the molecules in the air surrounding the vibrating object to vibrate also. The vibrating molecules of air then cause neighboring molecules of air to vibrate, producing a chain reaction of vibrating molecules called a *sound wave*.

When sound waves reach our ears, small bones in the inner ear start to vibrate. Nerves in the ears send messages to our brains, where the sound is interpreted.

Sound waves can travel through solids, liquids, and gases. They travel more easily through dense materials because the molecules of dense materials are closer together. For this reason, sounds travel better through solids than through liquids and better through liquids than through gases.

The speed at which an object is vibrating is called its *frequency*. The frequency of a vibrating object determines the *pitch* (highness or lowness) of the sound. High-frequency vibrations produce sounds with a high pitch (for example, squeaks and squeals). Low-frequency vibrations produce sounds with a low pitch (like foghorns and bass drums).

The normal human ear can hear sounds with frequencies between 20 and 20,000 vibrations per second. Animals such as dogs, dolphins, and bats can hear sounds above or below this range of normal human hearing.

Musical instruments provide excellent examples of the principles of sound. The pitch of the sound produced by a stringed instrument is determined by the length, tightness, and thickness of a string. In a wind instrument, longer columns of air produce sounds that have a lower pitch. Generally, longer, thicker materials vibrate more slowly, producing sounds that have a lower pitch.

The volume, or loudness, of a sound depends upon four things: the amount of energy used to make the sound; the distance the listener is from the sound source; the surface area of the vibrating source, and the material through which the sound waves travel.

Very loud sounds can damage your ears. You can protect them by wearing devices that are made of materials that muffle, or *insulate*, your ears from loud sounds. Materials that are soft or have a rough uneven surface generally make the best sound insulators.

Now, put your scientists hat and get ready to have fun doing these scientific investigation. Be sure to share your discoveries about sound with your friends!

As you explore properties of sound in these activities, record your observations carefully in your journal. Scientists enter data in their journals so that they can look back and compare results and so that other scientists can repeat their experiments.