- **physics.hallym.ac.kr/education/wave/music/teachgde.html**
  This "What Makes Music?" teacher's guide is part of an online exhibit at the Franklin Institute, with pages designed to teach students how sound is made, how it travels and how it is heard.
- **www.soundamerica.com/**
  This site contains hundreds of sounds available to download and play from your computer.
- **asa.aip.org/acou_and_you.html**
  "Acoustics and You" is the Web site of the Acoustical Society of America. It shows different possible careers in acoustics.

Suggested Print Resources

- Brain, Marshall. *How Stuff Works.* John Wiley & Sons, Hoboken, NJ; 2001.
- Eichelberger, Barbara. *Constructions for Children.* Dale Seymour Publications, Upper Saddle River, NJ; 2001.
- Isadora, Rachel. *Listen to the City.* Putnam, New York, NY; 2000.
- Lafferty, Peter. *Eyewitness Books: Force & Motion.* DK Publishing, New York, NY; 2000.
- Macaulay, David. *The New Way Things Work.* Houghton Mifflin, New York, NY; 1998.

TEACHER'S GUIDE

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TEACHER'S GUIDE

Sound

Grades 3–6

Journey to Mammoth Island, a whimsical place where investigating scientific principles is always an adventure. Olive, a young girl, assisted by the Island's mammoth population and a visiting inventor helps the locals discover why and how machines work. Science facts are clearly demonstrated, giving kids an opportunity to see how important everyday machines are linked together by the science that drives them. Students come to see that science is a way of organizing information about the world, explaining why things work the way they do and allowing us to predict what might happen in new situations.

This guide provides a brief synopsis of the program, background on the science concepts presented, discussion topics, additional activities, vocabulary and suggested print and Internet resources.

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Program Summary

In *Sound*, the inhabitants of Mammoth Island learn how sound energy travels in waves. While herding their mammoths towards fresh pasture through a maze of canyons, someone sneezes and the sound reverberates, startling the timid mammoths and causing them to run away! A visiting inventor explains that sounds are caused by the movement of molecules — what scientists refer to as vibrations.

When any sound reaches the ear, the energy travels down the ear canal. At the other end of the ear canal, the sound waves hit the eardrum and cause it to vibrate. In the inner ear, the tiniest bones in the human body pick up the vibrations and pass them to the cochlea. From there they are turned into electrical signals and are transmitted along the auditory nerve to the brain — that's when we actually hear the sound!

Our world is full of all kinds of sounds! When sound waves hit a solid object, such as a wall of a canyon, they bounce back. This is called an echo.

Thinking about how our ears translate sound leads a bright young Islander, Olive, to create a microphone. When the microphone is plugged in, any sound waves that reach it cause an internal diaphragm to vibrate just like an eardrum. This causes the electrical components inside the microphone to create an output signal. Instead of an auditory nerve, the microphone transmits its signal along a wire to an amplifier. An amplifier uses the signal from the microphone to regulate the flow of a much stronger electrical current from a battery or an electrical outlet. This stronger current then drives a loudspeaker to reproduce the original sound!

After the Islanders create a primitive microphone, amplifier and loudspeaker, they use their new devices to send out a loud trumpeting mammoth call, and the lost herd reunites and travels on to greener pastures.

Glossary

The following words are included for teacher reference and for use with students to extend the subject matter in the show.

atoms — The tiny particles that make up all matter.

eardrum — A very durable and tightly stretched membrane inside the ear that vibrates when it receives sound energy; that energy is then sent to the brain and interpreted.

echo — The repeating of a sound caused by reflection of sound waves off a surface.

effort — The force applied to get work done.

energy — The ability to do work.

force — A push or a pull on an object that causes a change in motion.

medium — The material through which a wave travels.

megaphone — A cone-shaped device that focuses sound waves in one direction.

microphone — A device that receives sound and makes it louder.

pitch — The frequency of vibrations per second. The human ear cannot detect the frequency of very high (fast) and very low (slow) pitched sounds.

(Continued)

reflection — The bouncing of sound waves back to the source.

reverberation — The repetition of a sound caused by reflection of sound waves.

sound — Energy that travels from a moving (vibrating) object through the particles of a medium. Without vibrations, there cannot be sound.

wave — A vibration that moves energy from one place to another.

work — To move or change something. Doing work takes energy. When you use force to make something move, you are doing work.

vibrate — To move rapidly back and forth.

volume — The loudness of a sound; a measure of how much energy is in the sound.

Pre-viewing Discussion

- What is sound? How does sound travel?
- What is an echo?
- How are sound waves like ripples in a pond?

Follow-up Questions & Activities

- Have students investigate making and hearing sounds using tuning forks, combs, musical instruments and other classroom items. Encourage them to feel the vibrations produced when these items are placed on or near different objects, like a wooden table, a bowl of water, and the air. Have them write down their observations.
- Have students construct "tin-can telephones." Be sure to have the string pulled tightly between the two cans. Have students discover why the string needs to be pulled tightly and explain.
- Have each student blow up a balloon and release the air first without constricting the neck of the balloon, then when the neck is elongated by stretching it, and finally when it is partially restricted by two fingers. Listen to the differing sounds.
- Have students try to explain pitch, volume, rhythm, music and noise by listening to recorded sounds and looking at corresponding graphs of sound waves.
- Have students investigate sound waves using various musical instruments. Challenge them to arrange a few common instruments in order from those that make low frequency sounds, like a tuba, to those with high frequency sounds, like a flute.

Suggested Internet Resources

Periodically, Internet Resources are updated on our Web site at www.LibraryVideo.com

- **www.sasked.gov.sk.ca/docs/elemsci/gr3uiesc.html#act5**
  This Evergreen Curriculum site is an excellent resource designed to promote an understanding of sound with many activities, experiments and lessons geared towards elementary students. ***(Continued)***