

Chapter 7 Properties of Sound Waves

In this chapter, students apply their knowledge of the properties of longitudinal waves to sound waves—wave phenomena that cannot be observed directly. The topics of transmission, speed, intensity, hearing, reflection, diffraction, refraction, interference, and the Doppler effect are discussed in a straightforward way, with the emphasis on applications. A variety of demonstrations, investigations, and activities provide interest and challenges.

BACKGROUND INFORMATION

The wine glass in Figure 1 was shattered when a nearby loudspeaker emitted high-amplitude sounds at the resonant frequency (or one of the resonant frequencies) of the glass.

ADDRESSING ALTERNATIVE CONCEPTIONS

Many people, especially young people, are not aware of or do not care about the dangers of loud sounds. Students should be made aware that listening to extremely loud music causes an accumulated deterioration of hearing, and perhaps contrary to their current opinion, their hearing *is* something they will care about when they are older.

Related Background Resources

The following multimedia resources are available from Boreal Laboratories (www.boreal.com or 1-800-387-9393):

- *Physics Explorer*, CD-ROM by LOGAL; *Waves*: #74207-01 (about \$150)
- *Multimedia Sound*, CD-ROM #74071-00 (about \$160); *Teacher's Guide* #74071-01 (about \$70)
- *Waves and Sound*, VHS video #70400-10 (about \$60)
- *Waves and Vibrations*, CD-ROM #744408-00 (about \$140)

The following multimedia resources are available from the American Association of Physics Teachers (www.aapt.org/catalog):

- *Audioscope: The Science of Sound*, CD-ROM(Windows) #NSW-17 (about US\$100)
- *Ztek Film Collection* (includes *Waves*), DVD series #ZK-02 (about US\$200)

Nelson Web site:
www.science.nelson.com
for specific Web links

PLANNING

Suggested Time

Try This Activity—3 to 5 minutes

Reflect on Your Learning—10 to 15 minutes

TEACHING SUGGESTIONS

- Begin by discussing the Reflect on Your Learning questions on page 236, and have the students record their answers for the Review (page 274). Next, perform the demonstrations in the Try This Activity on page 237.
- Discuss the unique photograph on page 237.

Try This Activity

- Set a water-filled beaker close to a student who has a good sense of humour. Strike a low-frequency tuning fork, and ask the students to listen and observe closely. Insert the tips of the vibrating prongs into the water in such a way that the nearby student will not forget that vibrations create sound. Try not to get yourself or your student too wet!

TRY THIS ACTIVITY

Vibrating Tuning Fork

- The aims of this activity are to illustrate that a source of sound is a vibrating object, the vibrations are usually too fast to be directly observed, and another object is needed to detect sound vibrations.

BEFORE

Teacher Preparation

Time: 3 to 5 minutes

Materials and Equipment:

For the class demonstration you will need
a low-frequency tuning fork
a Styrofoam cup
a rubber hammer
a pith ball

Safety and Disposal:

- No safety precautions are necessary.

Assessment:

- Assessment is not required for this introductory activity.

Student Preparation

- No preparation is required.

DURING

- Distract the students by telling them about the sounds they hear coming from the tuning fork.

AFTER

- Discuss the students' observations and opinions.

Extensions/Modifications:

- You can strike the tuning fork on the rubber heel of a shoe.