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Seeing Sound

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Introduction

Making sound visible is a useful activity in teaching students the concepts that sound is caused by vibrating objects and that different sounds are caused by different types of vibration. This particular activity makes it possible to see the sounds produced by observing a vibrating, metal plate. As the plate produces sound it vibrates violently in some areas and not at all in other regions. If a small amount of very fine sand or poppy seed is sprinkled on the plate as it vibrates, the seeds will move to areas where vibration is minimal and form distinct distributional patterns on the surface of the plate. The patterns thus formed are called Chladni figures after their discoverer, Ernst Chladni.

Materials

1 brass plate approximately 12 x 12 x 1/16 inches, with edges smoothed and corners slightly rounded. Brass sheets may be found at hardware stores or sheet metal dealers.

1 Thermos bottle cork.

1 card of bias binding tape obtained at a sewing shop.

1 box of powdered commercial rosin obtained from a hardware store.

1 package of poppy seeds obtained from a grocer or seed supply house.

Procedure

1. Clean the brass plate with soap and water or polish with a commercial cleaner.

2. Cut the cork so that three pieces approximately ¼ inch square are available. It is important that the pieces of cork are of the same thickness so that when the cork pieces are placed under the plate, the plate will remain level.

3. The three pieces of cork should be arranged so that the two front pieces are about 1½ inches from the front edge and sides of the plate. The rear cork should be positioned 1½ inches from the center of the rear edge of the plate.

4. Cut a piece of bias tape about 12 inches long and rub it with powdered rosin.

5. Holding the tape between the thumb and forefinger of each hand, pull until the tape is tight, and then stroke the smooth side of the tape downward against the edge of the plate. Note the location of the point being stroked when a tone is produced. Continue to stroke this point with a long, smooth motion until a mode of vibration is reached that will make a visible pattern when poppy seeds are placed on the plate. It is very important that the tape be stretched tightly between the hands and be held perpendicular to the plate when stroking. After each stroke, pull the tape away from the plate and allow the plate to vibrate briefly before it is stroked again. Another method of causing the plate to vibrate is to make a simple bow from a plastic rule and the bias tape.

Discussion

Observations will reveal that patterns formed in association with high pitch or frequency are intricate and delicate with narrow spaces between the lines of seeds. The patterns caused by low rates of vibration or frequency are formed with large spaces bounded by thick, heavy lines of seeds. Plates made of other metals will show that different materials produce different patterns. Brass was used in this exercise because of its pleasing sound quality.

The patterns produced by the vibrating plate can be preserved by spreading rubber cement over the entire face of a paper and inverting the paper on the plate. The cement will pick up the seeds and preserve the pattern for later use in making comparisons or measurements. Another method of preserving the patterns is to use clear contact paper to pick up the seeds and then placing it on a sheet of colored paper with the seeds between the colored paper and the contact paper.

To demonstrate that sound travels through the air, sprinkle cork dust or other fine powder on the table below the Chladni plate and place the plate in its normal sounding position. Strike the plate with a wooden mallet or screw driver handle. After striking, remove the plate and observe the wave patterns

in the powder beneath the plate. This demonstration indicates that the air below the plate transmitted sound from the vibrating plate to the powdered surface below the plate. For other ideas, read the reference below from which this article was adapted.

Reference

Protheroe, D. W. 1968. Making sound visible. *Science and Children* 5(7): 19-21.

Editorial note:

Ernst Chladni, a German physicist, was born in 1756 and died in 1827. His education was originally in law but when his father died he pursued his natural interests in science and music. As a result of his interest he began to investigate sound waves mathematically. Chladni was the first to work out the quantitative relationship governing sound transmission and thus became the father of the modern science of acoustics.

Chladni figures fascinated audiences in Paris in 1809 and Napoleon had the demonstrations repeated at a command performance. Chladni invented a musical instrument called a euphonium and he also collected meteorites. Chladni was one of the first scientists to insist that meteorites fell from the heavens.

Booklets entitled, *Hi-Ho Projects*, filled with activities such as in this article can be obtained from the ISEA, Attention: Dick Sweeney, IPD Specialist. The booklets were prepared by the author for use in the ISEA Mobile In-Service Training Labs.

Environmental Science Units

Additional information concerning the following teaching units may be obtained from the Minnesota Environmental Sciences Foundation, Inc., 5400 Glenwood Avenue, Minneapolis 55422.

	Grade Levels
Photography for Kids	(4-8)
Going Snowing	(3-8)
Making Snowshoes	(4-12)
Seeds to Cereal	(1-6)
Where are the Animals	(3-8)
Aquatic Study	(7-12)
Interdependence in the Environment	(K-6)
Environmental Education Activities	(1-6)

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