ExplorationWorks!
An Interactive Museum of Science & Culture
at the Great Northern Town Center

"GOOD VIBRATIONS"
THE SCIENCE OF SOUND

TEACHER PRE-VISIT PACKET

EXHIBIT HIGHLIGHTS

Vibrations are all around us. Some we are aware of, but many we are not. The "Good Vibrations" exhibition, created at the Discovery Center of Idaho, uses a variety of clever ways to bring the world of vibrations to life. Many of the exhibit stations focus on how vibrations result in sound, but not all of them. For example, the "Visible Vibrations" table allows visitors to control the modulation of vibrations through different shapes of metal plates. When sand is placed on those plates, the patterns that emerge are amazing as well as beautiful.

"Organ Pipes" lets visitors control both the very large bellows to create air flow, and control the combination of "pipes" that make a variety of strange and wonderful sounds. You will imagine a train coming down the tracks when you blow the multi-chambered train whistle, or feel like you are in church listening to a pipe organ with combinations of the single chamber pipes. And, by controlling the intensity of the pressure that is applied to the bellows, you also control the volume and tone of the sound coming from the pipes.

For sheer amazement, the exhibit component that will leave you wondering, "how does it do that?" will be the "Bite-A-Phone". You may be reluctant to actually bite on an exhibit with your teeth, but that is how it works! Also, you may wonder how that can be sanitary? ExplorationWorks requires that a clean straw be placed on the exhibit rod after each use, so that you will not be sharing your bite experience with anyone else.

Have you and your students have ever admired street musicians and their ability to make music from just about anything, from garbage cans to stair railings? Now you too can slap out your favorite tune on the "Slap-A-Phone". By just using a pair of flip-flops as your drumsticks, and slapping them on the PVC pipes you CAN make your own music!

These and many more fun, engaging and educational experiences await you at ExplorationWorks, during the run of "Good Vibrations", from January 14th through mid-May, 2010!

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MONTANA SCIENCE STANDARDS ADDRESSED BY THIS EXHIBIT:

Science Content Standard 2: Students, through the inquiry process, demonstrate the knowledge of properties, forms, changes and interactions of physical and chemical systems.

Benchmark End of Grade 4 (when testing occurs):
3. Identify the basic characteristics of light, heat, motion, magnetism, electricity, and sound.
4th Grade Essential Learning Expectations:
F. Describe and list examples of a wave.
G. Describe the relationship between a vibration and a sound wave.
H. Model wave motion (up and down, back and forth, speed)
Essential Vocabulary: wave, vibration, sound, motion, speed, frequency, volume, pitch, wavelength, amplitude

Benchmark End of Grade 8 (when testing occurs):
3. Describe energy and compare and contrast the energy transformations and the characteristics of light, heat, motion, magnetism, electricity, sound and mechanical waves.
5th Grade Essential Learning Expectations:
C. Explain how sound is produced, transmitted, and received.
D. Describe how sound can be changed.
E. Design and construct instruments that produce sound.
Essential Vocabulary: frequency, amplitude, pitch, wavelength, vibration, tension, medium, transmit, instrument

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SOUND INFORMATION

Sound is a wave. A wave is a transmission of energy by a series of vibrations. Sound cannot travel in a vacuum; it must travel through matter. Sound travels through matter in compression waves. Each molecule of matter passes the vibrations on to the next molecule. Sound travels through solids, liquids and gases. Sound travels fastest through solids because the molecules in solids are close.
Here are some other interesting facts about sound:

1. Sonar is a system that uses transmitted and reflected sound waves to learn how far away an object is. Sonar is used for measuring ocean depth, and bats also use sonar to locate food and travel in the dark.
2. When sound waves are trapped or are not able to travel any further, they are absorbed.
3. Sound waves that pass through a material are transmitted.

4. Frequency = pitch.
5. Close waves = high pitch/Far apart waves = low pitch.
6. Short pipe or tight strings on instruments = high vibrations.
7. Long pipe or loose strings on instruments = low vibrations.
8. Volume is measured in decibels.
9. Sound travels slower than light.
10. Resonance is when the air in a stringed instrument starts to vibrate along with the strings.
11. Morse code uses short and long taps of a metal transmitter to represent the letters of the alphabet.

PRE-VISIT DISCUSSION

- What is sound? How is sound produced?
- What is an echo and how is it produced?
- What are the differences between "noise" and "music"?
- What are the different TYPES of musical instruments? (Aerophones, Chordophones, Idiophones, Membranophones).

Aerophones make sounds by pushing air through a vessel, usually a cylinder. Chordophones make sounds when tightly stretched strings are vibrated. Idiophones are made from materials that naturally make pleasant or interesting sounds. Membranophones make sounds when a stretched membrane vibrates, usually after it is hit. Can you draw examples of each type?

- Is there sound in outer space?
- Why is it quiet after a heavy snowfall?
- Can you make a musical instrument from 3 items found on your desk?

POST-VISIT DISCUSSION

- Review and amend any of the above discussion items.
- What did students learn from their visit to "Good Vibrations"?
- Try some of the sound experiments found at these sites:

  http://scifiles.larc.nasa.gov/text/kids/D_Lab/acts_sound.html The NASA Science Files Kids: Dr. D's Lab "Sound" Activities.
  http://smm.org/sound/nocss/activity/top.html The Science Museum of Minnesota

  http://philtulga.com/MSSActivities.html

  Or, try the one below!

Make a Kazoo

Purpose: This investigation explains that energy is needed to produce sound and illustrates that sound vibration can be seen, heard, and felt.

Materials

- cardboard tube (paper towel or bathroom tissue)
- wax paper
- rubber band
- sharpened pencil
- notebook paper

Procedure

1. Cut out a square of wax paper 2-1/2 inches by 2-1/2 inches and place it over one end of the cardboard tube to create a lid. (Be careful not to apply too much pressure to the cardboard; it may cave in or bend.)
2. Wrap the wax paper over one end of the tube and secure the wax paper tightly with a rubber band.
3. Put the open end of the kazoo to your mouth and hum a tune. Feel the other end of the tube (kazoo) while you are humming.
4. Think about the following questions: What happens when you hum into the tube? Why does your voice sound different? How does the loudness of your voice increase?
5. Record observations on notebook paper by using the format below.

My Prediction	What I Did	Actual Results	Questions

6. Use a sharp pencil to poke a hole in the center of the tube, through the wax paper.
7. Place the tube end without the wax paper over your mouth and hum.
8. Record your observations again.
9. Explore on your own and record your findings.

What's Happening?

Sound is a form of energy because it makes matter (solid, liquid, and gas molecules) vibrate. Vibrations are felt as sound is created; for example, when you hum into your kazoo. Sound waves move in all directions. If an object such as wax paper or your hand is placed in front of the tube, the sound will be partially absorbed and will sound softer and muffled. When the air hole is open, the sound waves are able to travel freely, and the sound seems louder than when the finger covers the hole.