BROOKLYN CHILDREN'S MUSEUM

School Adventure Program
Do the Wave
Pre-visit and Post-visit Activities

Dear Teacher,
We are excited about your upcoming visit to the Brooklyn Children's Museum, the world's first museum for children! We are looking forward to working with you and your students during your visit. The enclosed pre/post-visit materials are provided to help you prepare your students for participating in and getting the most out of the workshop. It includes learning concepts, vocabulary, discussion questions and activities that you can use before your introduction to the **Do the Wave** program. In addition, we have included post-visit activities that will help you to reinforce and extend the learning back in the classroom.

If you have any questions about your visit or these materials, please contact Group Reservations at (718) 735-4400, extension 118. We look forward to working with you.

Do the Wave
How many "waves" can you think of? From singing to doing the wave at a baseball game to swimming in the ocean, waves have a lot in common. Students will participate in a number of wave demonstrations and see how waves are in motion all around us.

Meets NYC Science Scope and Sequence Standards
- *Grade 2*, Unit 2 Forces and Motion: Change the direction of objects by pushing and pulling using blocks, ramps, cars, and balls. PS 5.1b, PS 5.1c
- *Grade 3*, Unit 2 Energy: Sound energy pitch (frequency); vibrations; volume; how sound travels through solids, liquids, gases; noise pollution. PS 4.1a,b,c; PS 4.1d,g
- *Grade 4*, Unit 3 Properties of Water: Observe, describe, and explore the physical properties of water. PS 3.1a,b; PS 3.1c,d,e

During the program your students will:
1. Try out tuning forks.
2. Experiment with waves using a Slinky™.

Learning Components
1. Compare sounds to determine low vs. high pitch, low vs. high volume
2. Predict how the shape of a wave would change if pitch or amplitude was changed
3. Describe how ocean and sound waves are similar and different
4. Describe how a model helps us study how something works when the real thing is too small, complicated or invisible
5. Devise an experiment to investigate a question the student has asked.

Vocabulary Words
Model: A detailed representation of something we can't see so that we can study that something more clearly.
Pitch (frequency): How high or low a sound is (how many vibrations happen in a second)
Vibrations: Quick movements back and forth
Volume (amplitude): How loud or soft a sound is (how high the sound wave is)

Discussion Questions

What are some different waves you have seen? Describe a fun time you had with a wave.
How are waves in a swimming pool different from waves in the ocean?
Music is science too! What is your favorite song that doesn't have any words? What do you like most about the sound of that music? Are there special instruments or kinds of sounds that you tend to like in music? What about those sounds appeal to you?

Pre-Visit Activities

1. **Go on a Sound Safari**
   - A. Take a walk outside to somewhere the students can sit quietly for several minutes just listening to all the sounds outside. Street sounds, park sounds, whatever you have available.
   - B. As kids sit quietly for 5-10 minutes, sometimes with their eyes closed, have them write down or draw all the different sounds they hear—bugs, trains, cars, airplanes, birds, everything.
   - C. Go back to the classroom and write each sound on a card or sticky note.
   - D. Have kids group sounds in different ways—how loud they are, how high or low pitched, how often they heard them, how close they think the sound was.
   - E. Discuss how students ranked the sounds and see if they find any patterns between the sound source and its volume, pitch, proximity, etc.

2. **Make a musical instrument**

   Feel your vocal cords vibrate while you sing a song – something as simple as "Row Your Boat" will work. Not only can you feel the vibration of the cords, but you can feel the thyroid cartilage in your throat (called "Adam's Apple in males) move up and down to change the tension in your vocal cords. The cartilage moves down for lower notes. Now make some vocal chords you can experiment with:
   - A. Stretch a rubber band over a paper cup so the band traverses the opening of the cup. Use a straw to blow on the rubber band and make it vibrate.
   - B. Try a rubber band with a different width. How does this band sound different from the first? Pull the rubber band tighter. Does tightness change the note that the band plays? Try the same band over a different sized cup. Does this change the sound?
   - C. See if you can make an instrument that will play a short song using your rubber band cup.

3. **Take home an ocean wave:** http://tlc.howstuffworks.com/family/science-projects-for-kids-weather-and-seasons2.htm
   - A. Fill a plastic soda bottle about 2/3 of the way with water. Add blue food color to the water and swirl.
   - B. Fill the remainder of the bottle with clear mineral oil. Fill it all the way so that no air remains when the bottle is capped.
   - C. Set the bottle down horizontally, and you'll see a layer of oil on top with a layer of blue water underneath it. Tilt the bottle from side to side slowly, and watch the wave flow.
   - D. Tilt one side up before the wave reaches it to see the wave crash on shore and reverse directions.
   - E. Add-on: experiment with objects with different buoyancy – beads, sand, shells – to see if they'll sink, float on the water, on the oil or hover at the interface between the water and oil.

Extend the Learning

1. **Tsunami demo**: http://www.discoveryeducation.com/teachers/free-lesson-plans/dynamic-earth.cfm
   - A. Tell students they are going to do a demonstration to show how earthquakes affect sea waves. Students will work in teams of two or three. Direct each team to fill a rectangular plastic box or aluminum lasagna tray halfway with water and place the box on a sturdy tabletop.
   - B. Affix a ruler inside the box with the numbers showing so students can measure wave height. Have a student from each team lightly strike the tabletop with a rubber mallet on the table's front edge (aligned with the narrow edge of the rectangular box). Team members should observe the water and draw pictures of the waves they see in the box.
   - C. Instruct students to repeat the procedure two more times, lightly striking the table on its top, then on one of the side edges of the tabletop. Each time, students should observe the waves in the box and

draw what they see, labeling their drawings "front," "top," and "side," according to where the table was struck with the mallet.

D. Have the kids compare and contrast the waves that they saw produced depending on where the table was struck. What were the ways in which they differed? How much did they differ? Which kind of wave do they think would be the most destructive?

E. So far, you have demonstrated what happens in the open ocean for a tsunami. What happens when the waves hit the shore? Have the students brainstorm how to build an island at one end of the tub—blocks, sand, clay, paper houses or animal toys, etc. Then have them try their tsunami demo again. How did the damage to their island compare with each kind of wave? What could they do to protect their island inhabitants? Try out some of their suggestions, perhaps in an even larger classroom plastic tub.

2. **Make a jug band:** http://familyfun.go.com/crafts/bottled-music-710430/

A. Give each team of students a set of eight 20-oz. plastic soda bottles, preferably from the same manufacturer (a recycling bin near your vending machines at school can often gather a supply quickly).

B. Have the kids number their bottles one through eight. Their task is to create a set of eight bottles that can play a scale.

C. Have kids blow across the tops of their empty bottles to hear the sound the bottle makes and help them perfect their playing technique. Provide them with a starter note that they can work from. You can do this with a musical instrument or by starting them all off with the first bottle together.

D. Each team should have a pitcher or other convenient source of water, plus a measuring tool marked with one ounce increments for filling their bottles. They don't have to be exactly accurate since they'll be playing by ear, but they may find a pattern if they pay attention to the measurements, so it's worth giving them the chance to be accurate. Each team should fill bottle #1 with about 7oz. of water for the base of your musical scale.

E. Once the teams think they've got their scale together, they should try playing them for another team as a double-check.

F. For added fun, invite the kids to each choose a line from a song to play ("Row Your Boat" or "Twinkle Twinkle" are good starters, but they can get ambitious if they like. See if another team can guess which song the team is playing.

A cheat sheet for the instructor:

Do -- 7 ounces	So -- 16 1/2 ounces
Re -- 9 1/2 ounces	La -- 17 1/2 ounces
Mi -- 12 1/2 ounces	Ti -- 18 1/2 ounces
Fa -- 14 ounces	Do -- 19 ounces

ADDITIONAL READINGS

For Teachers

Waves: The Electromagnetic Universe by Gloria Skurzynski
National Geographic 2001

For Students

*Waves: From Surfing to Tsunami***.** Drew Kampion. Gibbs Smith, Publisher. 2005

Water Dance Written and illustrated by Thomas Locker. Harcourt Brace 2002

PORTABLE COLLECTION SUITCASES (Rented from BCM)

Rental fee: $100.00 for two weeks. Please contact Group Reservations at (718) 735-4400, extension 118.