FLUBBER FLOWS

Overview

Children use Flubber to investigate how a solid can flow! They predict and model the properties of glaciers, view images of advancing glaciers, and create their own Flubber flow!

Type of Program

☑Facilitated hands-on experience
☐Station, presented in combination with related activities
☐Passive program
☑Demonstration by facilitator

Activity Time

30 minutes

Intended Audience

Families or other mixed-age groups, *with supervision for younger children*
School-aged children ages 8-9
Tweens up to about age 13

What's the Point?

- Glaciers are one example of how Earth's global environment changes — and is changed by — the local environment.
- Under the right conditions — under high pressure — ice, the solid form of water, flows.
- In a valley glacier, friction between the ice and the walls and floor of the valley it is flowing down causes the base and edges to flow more slowly than the center.
- Malleability (pliability) and viscosity (how much a liquid resists flowing) are properties of matter.

Facility Needs

- ☐ Optional: 15–20 chairs arranged at the table(s) for groups or families to sit together
- ☐ A digital media player (such as a computer) and access to the Internet to display images of glaciers during the activity

Materials

For the Facilitator

- ☐ Materials for one recipe of Flubber (for each group or the facilitator to use):
  - ☐ 1 cup of white glue
  - ☐ Optional: 5 drops of green or blue food coloring
  - ☐ 1 ¼ cup *warm* water

- ☐ 2 teaspoons of Borax
- ☐ Measuring cups
- ☐ Measuring spoons
- ☐ 2 mixing bowls
- ☐ *Brief Facilitation Outline* (below)

Flubber looks like taffy, but is *toxic* and should *not* be ingested. Young children should do this activity *only under supervision.*

For Each Group of 3-6 Children or the Facilitator to Use as a Demonstration

- ☐ 1 softball-sized amount of Flubber, mixed beforehand using the materials listed above
- ☐ 1 (20" x 30") or larger pieces of foam core or heavy cardboard
- ☐ 1 pint-sized Ziploc bags
- ☐ 1 permanent markers
- ☐ 1 pair of scissors
- ☐ 1 ruler
- ☐ 1 pencil or pen
- ☐ 1 timer or watch or a clock
- ☐ Optional for older children: 1 thermometer AND ☐ 1 protractor

Supporting Media

Books

The Glaciers Are Melting!
Donna Love, Sylvan Dell Publishing, 2011, ISBN: 1607181266
Love brings an environmental issue to young readers through this fresh take on the story of Chicken Little.

Glaciers
Sandy Sepehri, Rourke Publishing, 2008, ISBN 1600445446
Children ages 4–8 will enjoy this exploration of what glaciers are and where they are found.

Glaciers
Sally M. Walker, Lerner Publications, 2007, ISBN: 0822567377
What glaciers are, where they exist, how they form and move, how they sculpt Earth's surface, and how they influence life, for children ages 9–12.

Videos

"Glaciers," Dragonfly TV
http://pbskids.org/dragonflytv/show/glaciers.html
Children will enjoy exploring the Juneau Ice Field from the perspective of the young hosts, Deborah and Brittani. Appropriate for ages 8 and up.

NASA's Climate Reel
http://climate.nasa.gov/imagesVideo/climateReel
This collection of videos and visualizations of climate change cover the four main Earth parts or systems explored in *Discover Earth*: water, ice, air, and life. Different videos may appeal to various ages.

Visual Aids
Timelapse
http://world.time.com/timelapse
View the changes to Columbia Glacier, Alaska, since 1984. Use the "Explore the World" search tool to watch changes in other locations across the globe.

Glacier Photograph Collection
http://nsidc.org/cryosphere/glaciers
The National Snow and Ice Data Center (NSIDC) archives a collection of historical photos of glaciers, primarily in Alaska, but also in the Pacific Northwest and Europe. Search for "repeat glacier photography" to find historical and contemporary images of the same glacier.

Preparation

Six months before the activity
- Prepare and distribute publicity materials for programs based on this activity. If possible, build on the children's knowledge by offering multiple science, technology, engineering, art, and mathematics (STEAM) programs. See the STAR_Net resources listed at http://community.starnetlibraries.org/resources for ideas.
- Plan to adapt the activity to be your own combination of demonstration and hands-on experimentation.
- If young children may be present, plan to provide supervision.

The day before the activity
- Mix ¾ cup warm water, 1 cup of white glue, and 5 drops of blue or green food coloring, and set aside.
- Separately mix together ½ cup of warm water and 2 teaspoons of Borax until the Borax is dissolved.
- Combine the two mixtures and work it through your hands for several minutes until a consistent texture forms. Drain excess water, and work into a ball.
- Store the Flubber in a Ziploc bag.

Tips for Working with Flubber
- Using gloves to work with the Flubber may make it more difficult. It really is not as sticky as you might think!
- Flubber may be stored for several weeks in air-tight baggies. Simply rework some warm water into the Flubber to return it to the desired consistency.

Activity

1. **Challenge the children to consider the question, can a solid material, like ice, flow?**

2. **Explore the Flubber and its properties.** Invite the children to touch the Flubber, roll it around in their hands, and try to break it. Discuss their observations. Through conversation, guide the children toward the conclusion that the Flubber is very viscous (thick), and malleable (bendy), and it can break. Predict whether or not they can make Flubber flow — or change shape — and how fast it might flow.

Use discussion to help children start to think about their prior experiences with water and build new understandings about oceans and their influence on weather and climate
In our experiences liquids change shape to fill the container holding them. Solids maintain their shape. Liquids tend to flow; solids tend to break.

If the children describe the Flubber with words like mushy and gooey, add that these are words that describe Flubber's viscosity. **Viscosity** is the measure of a fluid's resistance to flow. The more *viscous* a substance the stiffer it is and the more that it will resist flowing.

Flubber is very **malleable**, meaning it is very pliable, or bendy.

Under stress — if the children pull hard enough and fast enough, the Flubber will break or **fracture**.

3. **Invite the children to create a model of a glacier.** Have the children follow these steps:
   a. Form the Flubber into a 5-inch by 6-inch rectangle.
   b. Carefully place the Flubber at the top center of the foam core board.
   c. Draw a line across the Flubber center with a marker.
   d. Prop up the board— lengthways — against a wall, with the bottom of the board one foot from the wall.
   e. Predict whether or not the Flubber will change over time and how quickly or slowly it might do so.
   f. Wait 10-15 minutes.

For older children, measure and time the flow of Flubber. Use a thermometer and protractor to test variables such as the temperature of the Flubber or angle or roughness of the board across which it flows.

4. **Consider images of glaciers and discuss the children's observations.** Return to the Flubber within 10-15 minutes.

Ice is a solid. However, under pressure and over long periods of time, it flows. Glaciers and ice

sheets slowly move.

Glaciers can form anywhere that snow falls and stays (accumulates). Enough snow must fall that it accumulates over time, and does not go away in the summer. Eventually the light snow flakes get compacted as they get buried under more and more snow — they become ice. As more and more ice accumulates, it eventually begins to flow. In the case of glaciers, they often flow down a mountain valley.

About 98% of Antarctica is covered by giant sheets of ice and glaciers. Markers marking the geographic South Pole are stuck in the ice sheet. The geographic South Pole does not change position; it is always located in the same place. Yet every year, a new marker has to be put into place to mark the spot. The movement of the ice sheet over the south geographic pole carries the markers away from the geographic South Pole.

5. **Invite the children to use a ruler to measure changes in the Flubber and discuss how the middle of the mark (and the middle of the Flubber flow) advanced down the board.** Compare their observations to their earlier predictions. Help the children make the connection between their Flubber flows and glaciers.

6. **Consider images of retreating glaciers** and invite the children to note that front edges (or noses) appear to be going backwards. Discuss how Earth's global climate is changing.

Glaciers never go backwards! They always flow "forward" with gravity, regardless of if they are growing or getting smaller. When glaciers accumulate mass faster than they lose it through ablation (melting or sublimation of ice), they grow and their leading edge(s) advances. When they lose mass faster than they accumulate snow, their mass decreases and their leading edge(s) retreats.

7. **Conclude.** Summarize that, like ice, Flubber is a solid that flows very slowly. Encourage the children to make use of related library and community resources to learn more about how to take care of the local environment — and help the Earth!

Correlation to Standards

National Science Education Standards

Grades K–4

Science as Inquiry - Content Standard A

Abilities Necessary to do Scientific Inquiry

- Use data to construct a reasonable explanation.

Understanding About Scientific Inquiry

- Scientific investigations involve asking and answering a question and comparing the answer with what scientists already know about the world.

- Scientists use different kinds of investigations depending on the questions they are trying to answer. Types of investigations include describing objects, events, and organisms; classifying them; and doing a fair test (experimenting).
- Scientists develop explanations using observations (evidence) and what they already know about the world (scientific knowledge). Good explanations are based on evidence from investigations.

Physical Science - Content Standard B
Properties of Objects and Materials

- Objects have many observable properties, including size, weight, shape, color, and temperature. These properties can be measured using tools, such as rulers, balances, and thermometers.
- Materials can exist in different states — solid, liquid, and gas.

Earth and Space Science – Content Standard D
Properties of earth materials

- Earth materials are solid rocks and soils, water (and ice), and the gases of the atmosphere. The varied materials have different physical and chemical properties.

Grades 5–8
Science as Inquiry - Content Standard A
Abilities Necessary to do Scientific Inquiry

- Develop descriptions, explanations, predictions, and models using evidence.
- Think critically and logically to make the relationships between evidence and explanations.

Physical Science - Content Standard B
Properties and Changes of Properties in Matter

- A substance has characteristic properties, such as density, a boiling point, and solubility, all of which are independent of the of the amount of sample.

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