Title: Glaciers and Icebergs

Grade Level: 5th

Objectives:
Students will be able to:

- Identify the differences and similarities between a glacier and an iceberg;
- Recall the density of water and ice;
- Observe several properties of water;
- Relate how global warming may increase the sea level.

Rationale or Purpose:
This lesson will demonstrate several properties of water and bring awareness of what global warming may do to the sea level.

Source:
"Live at the Exploratorium" video
http://www.youtube.com/watch?v=JhVDi3nIevI

Lesson Duration: 1 hour

Materials needed:
For each student:

- Two large beakers (any size will do, the bigger the better)
- Water
- Ice
- Lamp
- Thin wooden stir bars or popsicle sticks
- Pictures of some glaciers, Antarctic ice sheets, and icebergs (great source of pictures from the National Oceanic and Atmospheric Administration: http://www.arctic.noaa.gov/gallery.html)
- Observation and instruction sheet.

Science TEKS:
Grade 5:
(11) Science concepts. The student knows that certain past events affect present and future events. The student is expected to:
(A) identify and observe actions that require time for changes to be measurable, including growth, erosion, dissolving, weathering, and flow.

Background Information:
A **glacier** is a large body of ice that is formed on land, and then moves in response to gravity and melting. Glacial ice is the largest reserve of fresh water on Earth. Although glaciers are mostly found in Greenland and Antarctica, which

are located at the Earth's poles. Glaciers are slowly moving masses of ice which are formed by the accumulation and compaction of snow.

An **iceberg** is a large piece of freshwater ice that has broken off from a snow-formed glacier or ice shelf. Icebergs float on open water.

The **density** of pure water ice is around 0.91 grams per milliliter (g/mL), and the density of sea water is around 1.025 g/mL. Therefore, the ice will float on top of the water. Around 90% of an iceberg's mass will be under the water! The underwater portion of the iceberg can be difficult to surmise from looking at what is visible above the surface. However 10% is floating on top of the water since it is around 10% less dense than the water. This has led to the expression "tip of the iceberg", generally applied to a problem or difficulty, meaning that the visible trouble is only a small manifestation of a larger problem.

An **ice sheet** is a mass of glacial ice that covers surrounding terrain and is greater than 50,000 km^2 (19,305 $mile^2$). The only current ice sheets are in Antarctica and Greenland. Ice sheets are bigger than ice shelves or glaciers. Masses of ice covering less than 50,000 km^2 are termed an **ice cap.** An ice cap is similar to a glacier in that it will break off into oceanic icebergs. Ice caps break off and form icebergs more frequently since they are smaller than ice sheets.

The **Antarctic ice sheet** is the largest single mass of ice on Earth. It covers an area of almost 14 million km^2 and contains 30 million km^3 of ice. Around 90% of the fresh water on the Earth's surface is held in the ice sheet, and, if melted, would cause sea levels to rise by 61.1 meters.

In the south pole's East Antarctica, the ice sheet rests on a major land mass, but in West Antarctica, the ice sheet is in places more than 2,500 meters below sea level. So, if the East Antarctica ice sheet melts, the sea level will rize greatly since the ice sheet is on land, but if the West Antarctica ice sheet melts, the sea will not rise as much as the East ice sheet since some of it is already on the water. Why? When ice is on the water, it displaces the same amount of mass as the water. So when the ice melts, it does not raise the sea level! The ice on the land, however, will. Recently people are watching these ice sheets because they are receeding faster than ever due to global warming.

Procedure:

1. Tell students that today they are going to distinguish between two large bodies of ice by using properties of water. For pre-assessment, ask your students if they know what an iceberg is.
2. Distribute some pictures of icebergs so the students know what they look like. Ask the students to list out some characteristics they are seeing in the pictures of icebergs.

3. Now, ask the students if they know what a glacier is. Also pass out the pictures of glaciers and ask them to list characteristics as well.
4. Ask the class to compare the differences between the iceberg and the glacier, based on appearances.
5. Tell the students that today they will do a little experiment to see what happens when these ice bodies melt.
6. Pass out the observation/instruction sheet to the students.
7. The students will now follow the sheet and do the experiment. Also ask them to fill in the sheet as they go through the experiment and remind them about a quiz afterwards.
8. Once everybody is done, discuss with the students what they have just observed.
9. Now relate these examples to the ice sheets in Antarctica and how this may cause the sea level to rise due to global warming (especially note the information about the West Antarctic ice sheet). The teacher may want to draw a diagram of the ice sheet and how it might be both in the water and land.
10. Ask students to turn in their data sheets and complete a quiz.

Name: _____

How Does Ice Affect the Sea Level?

Procedure:

1. Gather all materials needed.
2. Choose one beaker and fill it up with water. (Not all the way full, but almost full.)
3. Fill the same beaker with chunks of ice until the water level is all the way to the top of the beaker.
4. Which type of ice body did you just model?

5. What percentage of the ice is above the sea level? What percentage is below?

6. What is the significance of how much percentage of the ice is floating?

7. Now use the other beaker and fill it up all the way to the top of the beaker just as it is in the other.
8. Place two or three wooded sticks across the top of the beaker.
9. Place some chunks of ice on the sticks.
10. Which type of ice body did you just make?

11. Now turn on the lamp so the ice will start to melt.
12. What does the lamp represent?

13. Why did we fill the water to the top of the beaker even though there is not any ice in it?

14. Write down your observations here while the ice melts.

15. Is the water level rising in either beaker? If so which one?

16. Explain why the water level is rising or not rising for each beaker experiment.

Name: _____

Quiz

1. What percent of the ice is floating above seal level for an iceberg? Why?

2. In which type of ice body does the sea level rise?

3. What is the difference between the West Antarctic Ice Sheet and the East Antarctic Ice Sheet?

4. Write in your own words what is an Ice Sheet, a glacier, and an iceberg?

5. Why are people or geologists concerned about what is happening to the ice sheets of Antarctica? You may use the back of this paper to answer.