

Unit 2 Lesson Plan developed for Grade(s) 6-8

Title: Exploring the Albedo Effect of Ice and Water

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Applies to Lesson(s) 4 from <http://cimss.ssec.wisc.edu/climatechange/>

Objective:

Students will understand the differences in the Albedo Effect of ice and ocean water after exploring the temperature changes when ice/snow and blue water are exposed to sunlight.

Total Time Expected: 2-3 days

Overview:

Students will fill 3 clear plastic cups with water. One will be frozen solid, one will have half the amount of water, frozen solid, and then covered “blue” water and the last one will have blue water only. Thermometers will be used to measure the temperature changes of each cup when they are put in direct sunlight for at least 30 minutes. The blue water will be chilled in the refrigerator until needed.

Sequence:

- Students will discuss their ideas about how the temperatures might change in each of the cups mentioned above and talk about changes they might see in the cups with ice in them.
- Students will prepare the blue water and the ice in the cups to be used the following day.
- Students will fill the cups and take them outside in direct sunlight or put them in a window with direct sunlight. They will record the temperature of the water in the 3 cups and write down their observations about how the 2 cups with ice are changing.
- Discussion will follow to share the data collected and to try to figure out why the temperature changes were so different and to discuss the differences in the melting of the ice in the 2 cups.
- Connections will be made to the sea ice and the changing temperature of the arctic ocean waters. The Albedo Effect will be discussed and supported by the data collected.

Supplies or references required:

- 3 clear plastic cups
- water
- blue food coloring
- thermometers
- definition of Albedo Effect
- facility or equipment to freeze water
- Black permanent marker

National Science Standards addressed:

A. Science as Inquiry - Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.

M.A.1 Abilities necessary to do scientific inquiry

- c. Use appropriate tools and techniques to gather, analyze, and interpret data.
- d. Develop descriptions, explanations, predictions, and models using evidence.
- e. Think critically and logically to make the relationships between evidence and explanations.
- f. Recognize and analyze alternative explanations and predictions.
- g. Communicate scientific procedures and explanations.

B. Physical Science - Physical science focuses on science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

M.B.3 Transfer of Energy

- b. Heat moves in predictable ways, flowing from warmer objects to cooler ones, until both reach the same temperature.
- c. Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection).
- f. The sun is a major source of energy for changes on the earth's surface.

D. Earth and Space Science - Earth and space science focuses on science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

M.D.1 Structure of the earth system

- j. Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.

Related URLs or recommended reading:

Jet Propulsion Lab, Climate Time Machine

<http://climate.nasa.gov/ClimateTimeMachine/ClimateTimeMachine.cfm>

Nothern Hemisphere Snow Cover

<http://cimss.ssec.wisc.edu/climatechange/observations/lesson4/activity1.html>

Albedo Effect of Ice and Water

Equipment:

- 3 clear plastic cups
- blue food coloring
- water
- thermometers
- freezer
- black permanent marker

Procedure:

Day 1

1. Fill a clear cup 2/3 full with water. Mark the water level with a permanent black marker and label this cup #1.
2. Fill a clear cup 1/3 full with water. Mark the water level with a permanent black marker and label this cup #2.
3. Place these 2 cups in a freezer until frozen solid
4. Fill several gallon jugs with water and add blue food coloring until the water is the color of "ocean" water. If should only take a few drops in each gallon. Place the gallon jugs in the refrigerator.

Day 2

1. Remove the cups from the freezer and the blue water from the refrigerator.
2. Fill the third cup 2/3 full with blue water. Mark the water level with a black permanent marker and label this cup #3. Try to make it as close a possible to the level in cup #1.
3. Add blue water to cup #2 to 2/3 full and mark the water level in the cup. The ice will probably float to the top, so make sure that the WATER level is marked, not the ice level.
4. Put a thermometer in each cup and take the cups outside into the sunlight or put them in a window in direct sunlight.
5. Record the temperature of each cup and note observations of changes in the appearance of the water or the ice at 3-minute intervals. A data chart has been provided.
6. After 30 minutes, (60 minutes if you have longer class periods) bring everything back to the lab tables and complete the activity.

Day 3

Discussion of the data colleted and connection to the Albedo Effect and Ice/Snow cover and ocean water and the temperature changes.

Time	Cup #1 Temp	Cup #2 Temp	Cup #3 Temp	Observations
0 minutes (Initial Temps)				
3 minutes				
6 minutes				
9 minutes				
12 minutes				
15 minutes				
18 minutes				
21 minutes				
24 minutes				
27 minutes				
30 minutes				