Teaching Activity: ICEBERGS

Background Information: If global warming actually occurs, in addition to melting polar ice caps, there is a potential for increased formation of large, floating masses of ice called icebergs. An **iceberg** is a great chunk of ice that has broken off from a glacier, or polar ice sheet in Antarctica or the Arctic. Icebergs in the North Atlantic are irregularly shaped and are sharply crested. They are thousands of feet wide, equally as wide and hundreds of feet thick. Icebergs in Antarctica tend to have a flat surface. A single ice berg in Antarctica can cover an area of several miles and may have a thickness of 2,000 feet or more.

Ice floats because it has a density less than that of liquid water. The difference is so slight that almost all of a floating block of ice is below the water line; about 5/6 of the ice berg is submerged. Density is a measurement of mass per unit volume and is defined by the formula: *D= M/V.* Density is expressed in *grams per cubic centimeter (g /cm^3)* because mass is measured in grams and volume in cubic centimeters. It can also be thought of as the ratio of mass to volume. Fresh water at 4 ° C has a density of 1 gram per cubic centimeter. Any object with a greater density will sink at that temperature.

Objective:

- To understand the relationship of ice to water;
- To understand density as the ratio between mass and volume;
- To compute the density of difference quantities of water;
- To understand why ice floats;

Important Terms: Ice cap, melting / freezing, density, mass, volume, g/cm^3, ratio;

Materials: (For each group) **Student Activity Sheets**, 8 small containers (up to 200 ml), 1 balance scale with masses, 1 graduated cylinder, water, access to a freezer;

Procedure:

1. Present the **Background Information** to the class and go over the procedure the day before the actual investigation.

2. Divide the class into small group (2-3).

3. Each group should:
    - Weigh the containers and record that information on the container and on the **Student Activity Sheet** in the appropriate place.
    - Each group should fill the 8 containers with different amounts of water: 25,50,75,100, 125,150, 175,and 200 ml.
    - Measure the weight of the container with the water and record that information on the table in **PART I.**
    - Freeze the water in each container.
    - Record the weight of the frozen container of water and record that information.
    - Compute the difference.
    - Record the information on the table.

4. Student should then graph their result in **PART II.**
    - X-axis = Amount of water in ml
    - Y-axis = Amount of loss (difference) in grams

5. Using a graduated cycling and an ice cube, each group should:
    - Determine the amount of displacement of water when an ice cube is added to the graduated cylinder.
    - Students should fill in the information on the table in **PART III.**

6. Student should then calculate the density for the 8 "icebergs" using the formula for density.
    - Students should record the information on the table in **PART IV.**

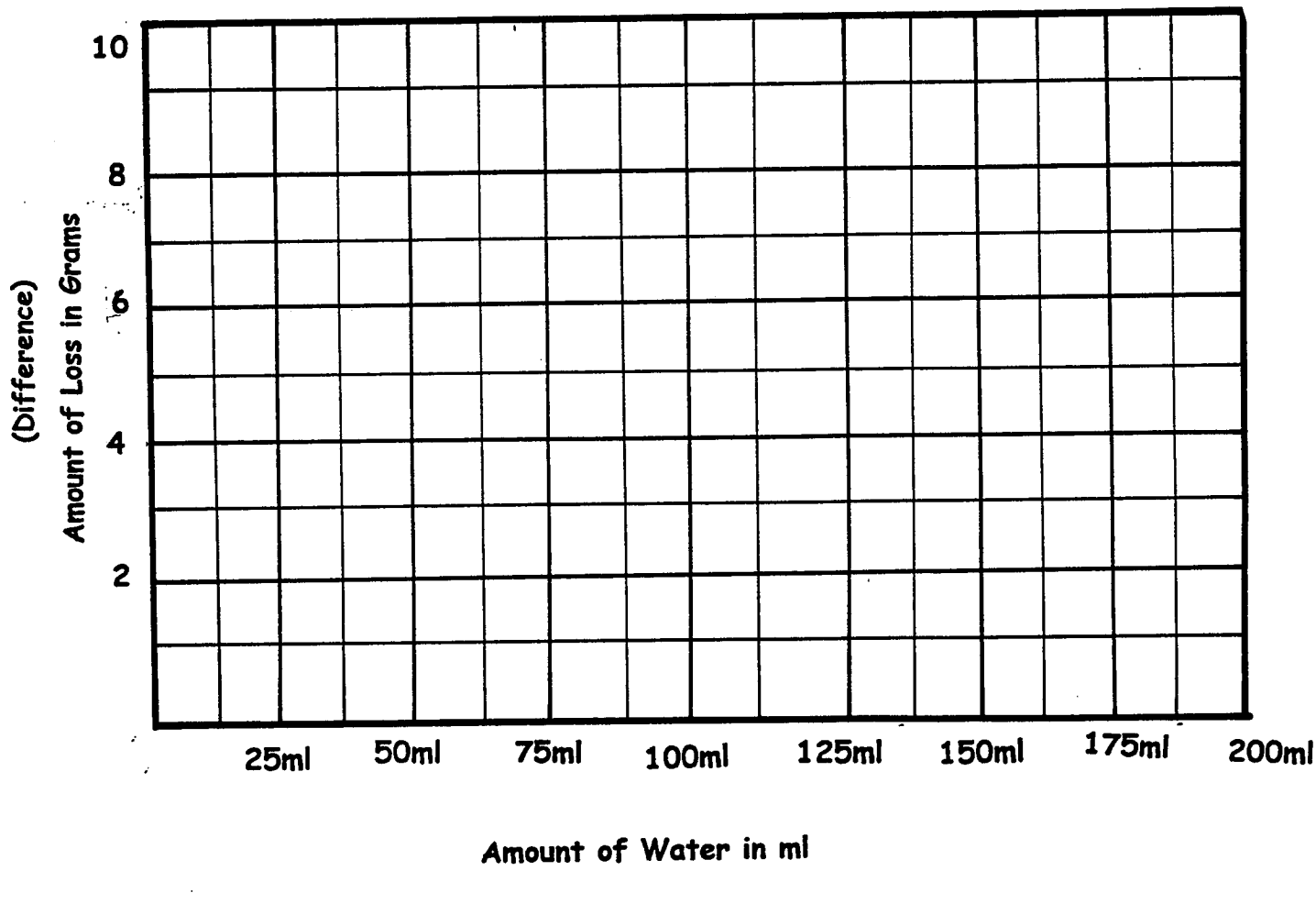
7. When the activity is complete, students should answer the questions in the **ANALYSIS** section.

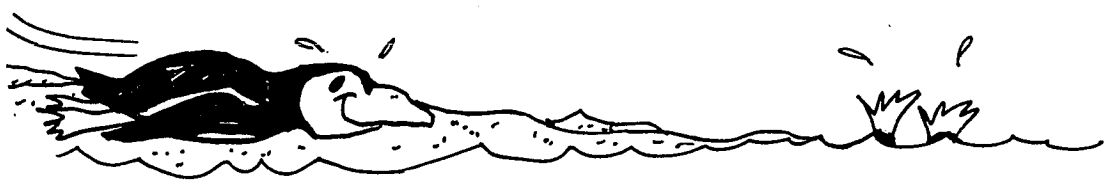
Student Activity Sheet #1: ICEBERGS

PART I: OBSERVATION/COMPUTATION

	A	B	C	D	E	F	G	H
WEIGHT OF CONTAINER (g)								
AMT. OF H_2O	25 ml	50 ml	75 ml	100 ml	125 ml	150ml	175ml	200 ml
TOTAL (g)								
WGHT.FROZEN (g)								
DIFFERENCE (g)								

PART II: GRAPHING





Student Activity Sheet #2

PART III: ICE CUBE / WATER DISPLACEMENT

ICEBERG	A	B	C	D	E	F	G	H
MASS (g)								
Water depth without ice cube								
Water depth with ice cube								
DIFFERENCE								
DENSITY (g/cm^3)								

NOTE: DENSITY = Mass / Volume (D= M/V)

PART IV: CALCULATING DENSITY OF ICEBERGS

ICEBERG	MASS (g)	VOLUME (cm^3)	DENSITY (g/cm^3)
A		25	
B		50	
C		75	
D		100	
E		125	
F		150	
G		175	
H		200	

PART V: ANALYSIS

1. What kind of water are icebergs made of? _____

2. What is the density of freshwater? _____

3. Describe the difference between Arctic and Antarctic icebergs. _____

_____

_____

_____

_____

Student Activity Sheet #3

4. Why did you weigh the 8 containers at the start of the activity? _____

_____

_____

_____

5. Explain what density is. _____

_____

_____

6. Would the density of water be different on the moon? Why? _____

_____

_____

_____

7. If an iceberg measured 50 ft x 200 ft by 1500 ft, what would its volume be?

_____

8. What part of the total volume (ft^3) of the iceberg in #7 would be above water?

_____

8. Does ice float? Why? _____

_____

9. Does an amount of water when frozen weigh the same as when liquid? _____

10. What do you think happens to the salt in sea water when it freezes?

_____

_____

_____