Titanic Science

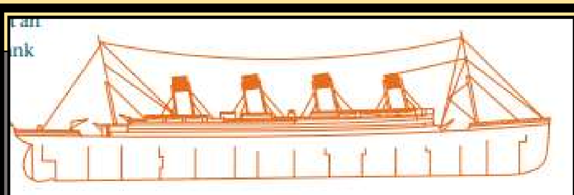
Choose one of the activities:

- Making an iceberg
- Testing water bulkheads
- Experimenting with water pressure

Or, if you don’t have assess to the materials needed for the first three activities, have a go at solving the Titanic Teasers.

Watertight Bulkheads

Background: One of the advanced safety features of the Titanic was the use of "watertight" bulkheads (walls). The lower part of the ship was divided by 15 bulkheads into 16 compartments. In the event of a leak, watertight doors (left) were closed, sealing off the compartment. The ship could float with two of the compartments flooded and would survive with the forward four compartments underwater. When the Titanic was designed, the expectation was that something would make one hole in the side of the ship. Watertight doors would lower, sealing the bulkhead. With waterproof bulkheads extending up through several decks of the ship, a single hole might cause one or two compartments to flood, but the remaining ones would remain dry. While this would increase the weight of the ship, the ship would still displace enough water to allow it to float. No one expected something that would cause an opening or openings to extend through several compartments at one time.



Titanic contained 16 watertight compartments.

At the time that the Titanic sank, most people believed that the iceberg inflicted a continuous 300-foot-long gash down the side of the ship. Only one expert, a naval architect named Edward Wilding, who worked for Harland and Wolff (the builders of the Titanic), believed otherwise. In testimony given in 1912, Wilding asserted that the iceberg damage could have been very small, consisting of a series of small openings, perhaps only three-quarters of an inch wide. He arrived at this conclusion after studying the survivors' testimonies. In his opinion, since the ship flooded unevenly in six compartments, each compartment must have had its own opening to the sea. He held that a gash as long and large as commonly assumed would have sunk the ship in minutes rather than hours. His testimony was ignored by the media and public and people continued to believe that an enormous gaping gash sank the ship. In a 1996 expedition to the ship, scientists used new sonar technology to see through the 45 feet of mud that covered Titanic's bow. Working something like a medical ultrasound, sound waves created an acoustic image of the starboard (right) bow. They found that Titanic's wound was in fact a series of six thin slits, some less than an inch wide. The total area of damage was only about 12 square feet—about the size of a human body, just as Edward Wilding calculated 84 years earlier.

Activity 1

ACTIVITY

Watertight Bulkheads

Continued from previous page...

Grade Levels:
Upper elementary, middle, high

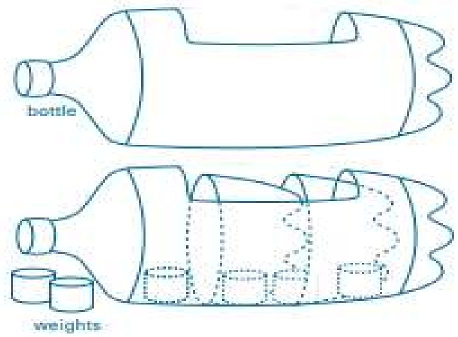
Objective:
Students will understand the purpose of watertight bulkheads in maintaining buoyancy in ships by preserving sufficient displacement so that a damaged ship can still float.

Time:
One class period

Group Size:
Small group (3-4)

Materials:
Three 2-liter soda bottles
Knife or scissors
Dishpan
Duct tape
Weights (fishing weights, clay balls)
Timer

Procedure:



1. Cut the side off a two-liter bottle. Place it on its side with the cap in place. This will be your boat.
2. Add enough weight to the boat so that it floats evenly with the cap half covered by water.
3. Remove the cap. Time how long it takes the "boat" to sink.
4. Dry the boat and weights.
5. Cut the bottoms off two other 2-liter bottles. Insert them into the boat to create watertight bulkheads. Tape them in place.
6. Add the weights from before, spreading them evenly between the 3 compartments.
7. Remove the cap and time how long it takes the boat to sink.
8. Can you figure out a way to keep the boat floating with one compartment flooded?

Activity 1

Iceberg Science

<u>Background on Icebergs</u> The story of the iceberg that sank Titanic began about 3,000 years ago. Snow fell on the ice cap of Greenland. The snow never melted. Over the course of the next forty to fifty years, it was compressed into ice and became part of a glacier—a river of ice. Due to its enormous weight, the glacier flowed toward the sea at a rate of up to sixty-five feet per day. Like the snow that formed it, the glacier ice was fresh water ice. When the glacier reached the sea, huge chunks or slabs were weakened and broken off by the action of rising and falling tides. One of these became Titanic's iceberg. The iceberg slowly made its way down the coast of Greenland through Baffin Bay and the Davis Strait into the Atlantic Ocean. Most icebergs melt long before reaching the ocean. One estimate is that of the 15,000 to 30,000 icebergs produced yearly by the glaciers of Greenland, only one percent (150 to 300) make it to the Atlantic Ocean. Once an iceberg reaches the "warm" water (32-40° F) of the Atlantic, it usually lasts only a few months. Very few icebergs are found south of the line of 48 North latitude. Titanic's iceberg collision took place at approximately 41° 56' degrees North latitude and 50° 14' degrees West longitude. About 7/8ths (87%) of an iceberg is below the water line. No one is exactly sure how large Titanic's iceberg was, but according to eyewitness reports it was approximately 50 to 100 feet high and 200 to 400 feet long. It was tall enough to leave ice chunks on one of Titanic's upper decks.

ACTIVITY

Making an Iceberg

The National Science Education Standards

Physical Science:
Properties and changes of properties in matter

Earth and Space Science:
Properties of earth materials

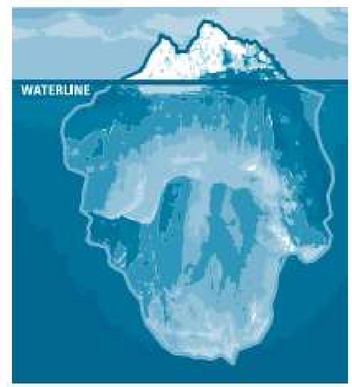
Grade Level:
All

Objective:
Students will realize that the majority of an iceberg is located below the surface of the water

Time:
Overnight preparation, 30 minutes in class

Group Size:
Classroom demonstration

Materials:
Balloon—9 inch or larger
Water
Salt
Freezer
Scissors
Ruler
Clear aquarium
For middle school and high school students, Wax pencil and Graph paper



Procedure:

1. Fill a balloon with salt water. Tie the end of the balloon to seal the water inside.
2. Put the balloon inside a plastic bag and leave the bag in the freezer overnight.
3. Remove the balloon from the freezer and use the scissors to carefully cut away the balloon.
4. Put the iceberg in an aquarium filled with fresh (tap) water and observe. How much of the ice is below the water? How much is above? Use the ruler to measure how much is above and below the water line, measuring to the top and bottom of the iceberg. What percent of the iceberg is below the surface (about 87%). Where is the widest point of the iceberg—above or below the water line (below).

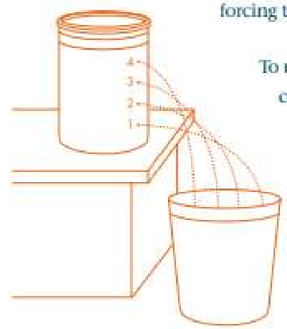
Activity 2

Water Pressure

Activity 3

<u>Background:</u> Modern naval architects used a computer model to analyse the sinking. They calculated that immediately after Titanic struck the iceberg, water began rushing into her hull at a rate of almost 7 tons per second. Although the holes in Titanic were small, the high pressure 20 feet below the water line would have forced water into the ship faster than through a fire hose. • 11:40 pm—Titanic strikes the iceberg • 12 midnight—Titanic has taken on 7,450 tons of water and the bow is starting to sink • 12:40 am—One hour after impact. Titanic has taken on 25,000 tons of water • 2:00 am—Titanic is flooded with 39,000 tons of water, forcing the bow underwater and heaving the stern into the sky

forcing the bow underwater and heaving the stern into the sky



To understand how quickly water pressure increases with depth, conduct the following experiment.

Procedure:

1. Punch or drill four holes in the container.
2. Place pieces of tape over the holes.
3. Fill the container with water. Ask students to make a prediction—what will happen when the tape is removed? Will the water stay in? Will it come out of all the holes equally?
4. Place the container above a sink or dishpan.
5. Remove the tape. What do you observe? (The water will shoot out the holes. The water pressure at the top of the container is less, so the water doesn't shoot out as far. The water pressure at the bottom is greater, causing the water to shoot out further.)

The series of openings in *Titanic's* side included ones just below the water surface and some 20 feet down. Which would flood fastest due to water pressure? (The lower ones) There is an appreciable difference in the water pressure between the top and the bottom of the container, a distance of only a few inches. The difference between the pressure at the top of the ocean and twenty feet down is considerably more.

Titanic Teasers

Or you could try out these three Titanic Teasers which count as one activity.

Titanic Teasers

Do all 3 teasers as an activity

1

Dished up on a seabed

Look at the picture of the dishes found on the seabed. Study how they are stacked. Suggest a way in which the dishes remained perfectly stacked instead of being scattered by the force of the water.

2

Cork Pressure

A number of champagne bottles sank with the Titanic. As they fell, the air between the cork and the liquid was compressed (squashed) by the pressure of the water outside.

What do you think the bottles looked like **when they were raised?**

a) The corks had been pushed inside the bottle
b) The bottles had exploded
c) The corks had been pushed out of the bottles

Titanic Teasers

Preservation of Objects

3

At the bottom of the ocean it is cold; there is no light and the oxygen levels are low. This means that objects rot and rust at a slower rate.

- Soft organic material, such as food, and clothing made of wool, is at greater risks from fish and bacteria. Leather disintegrates more slowly than cotton and wool.
- Marine worms bore holes in anything wooden.
- Material such as metal and ceramic (china) deteriorates more slowly than organic material.
- Steel and iron are weakened by bacteria and rust more quickly than bronze.
- Glass survives the best.

Using the information above, list the following items in order in which you would expect them to deteriorate most quickly.

a) Champagne bottle
b) A loaf of bread
c) A solid bronze bench frame
d) A steel fork
e) A wooden shelf
f) A leather shoe