Floating or Sinking?

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“Eureka! - I have found it!” – Archimedes, the great Greek scientist’s reaction to discovering water displacement

Overview

Do you know any materials that might float in water? Why do some things float and some things sink? Why do logs and ships float while rocks and people sink? Do you know how to swim? Can you make your body float? This week we are going to experiment with making things float and/or sink. You are going to want to hang on for the ride!

Background Information

Over 2000 years ago, there was a Greek scientist named Archimedes who made a great discovery when he sat down in the bathtub. When he sat down, he discovered that the water rose and almost went over the side of the tub. When objects enter the water, they push the water away or **displace** it. But, he also discovered that water pushes back.
The more water that is displaced, the stronger the water pushes back. Sometimes, like even in the case of large boats, the water pushes an object up even more than gravity pushes that same object down. This upward force that makes materials float is called **buoyancy.**

How come a small metal spoon will sink to the bottom of a pool, but a huge metal ship will float in the ocean? The answer has a lot to do with their **shape**. Two objects can be the same weight and even made up of the same material and one float and one not. Whether or not an object floats has more to do with its density than its weight. **Density** is how tight an object’s weight is packed. A ball of metal is very dense, packed all together. However, a boat spreads its weight out. Air pockets are some of the things that make items less dense.

Designing a ship can be tricky. Engineers need to make a vessel that can still float even through storms and rough seas. Some ships transport oil or grain. Others carry normal passengers or soldiers across the water. Many ships have floors or decks with lots of rooms, kind of like a hotel. In case there was ever an emergency, ships have

lifeboats and life jackets stored on board. Ships have 4 basic sides. The **bow** is the front of the ship. The **stern** is the back of the ship. If you are facing forward, the **starboard** is on your right side, and the **port** is on your left side. For this game, you will need to know the 4 sides of a ship.

If you spill a little bit of water onto a flat surface, you may notice that the water drops find each other and clump together. It almost seems like they are held together or connected by some invisible skin. A force called **surface tension** attracts water molecules to each other**.** This is why some animals are even able to walk on water.

Main Ideas

- When objects enter the water, they push the water away or **displace** it.
- However, the water pushes back. Sometimes, like even in the case of large boats, the water pushes an object up even more than gravity pushes that same object down. This upward force that makes materials float is called **buoyancy.**
- **Density** is how tight an object's weight is packed.
- Water also has density. If an item spreads its weight out, the water can push back enough to make the item float.
- The parts of a ship are the **bow** (front) **stern** (back), **starboard** (right), and the **port** (left).
- A force called **surface tension** attracts water molecules to each other**.**

Materials Needed

- *Ups And Downs: A Book About Floating and Sinking* By Joanna Cole & Bruce Degen
- Several Containers to Hold Water
- A variety of random items of different sizes, shapes and materials
- String or Rubber Bands
- Clay or play dough (optional)
- Rocks
- Paper Clips
- Aluminum Foil

Preparation

1. Read “Background Information” to become more familiar with what causes items to either sink or float.
- Read through *Ups And Downs: A Book About Floating and Sinking* By Joanna Cole & Bruce Degen
2. Prepare questions that you can ask along the way.
3. Make sure that you have all the supplies that you will need for each day’s experiment.

Opening

Do you know any materials that might float in water? Why do some things float and some things sink? Why do logs and ships float while rocks and people sink? Do you know how to swim? Can you make your body float? This week we are going to experiment with making things float and/or sink. How come a small metal spoon will sink to the bottom of a pool, but a huge metal ship will float in the ocean? The answer has a lot to do with their **shape**.

What Shapes Float?

Today, we are going to experiment with which items float and which do not. Before we begin, I want to give you this chart. In one box, draw the item. Then, check whether you think it will float or sink. After making your prediction, go ahead and test out the items. **If possible, you might want to do this experiment outside. Fill up several containers with water (maybe one for every 4-6 kids). Have a variety of random items of different sizes, shapes and materials for kids to test. After students are done testing all their materials, discuss**

Materials: containers for water, a variety of random items of different sizes, shapes and materials, water, and clay (optional), rocks

Make Your Own Ship

Have students collect materials from nature to build their own ship. Provide string and or rubber bands for them to tie their ship together. Can they construct a ship that floats?

(Optional) You could give each group a ball of clay. If they drop the ball into the water, it will sink. But, you can allow them to experiment with changing the shape of the clay until they can get it to float.

Though, the clay has the same weight no matter what its shape. Some of the shapes have less density. Density is how tight an object’s weight is packed.

Which is more dense?

- An apple or lettuce that is the same size?
- Bread or potatoes that are the same size?
- A piece of wood or a rock that is the same size?
- A carrot or a marshmallow that is the same size?

Water also has density. If an item spreads its weight out, the water can push back enough to make the item float. However, if the object suddenly becomes heavier or pushes down too much in one place, the water may no longer be able to hold it up and the object may begin to sink.

Try the What Shapes Float experiment again. One by one, place the items that floated back in the water. This time, try to balance some rocks on the items until they become so dense that they start to sink.

Read *Ups And Downs: A Book About Floating and Sinking* By Joanna Cole & Bruce Degen

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Shipwreck Game

Ships have 4 basic sides. The **bow** is the front of the ship. The **stern** is the back of the ship. If you are facing forward, the **starboard** is on your right side, and the **port** is on your left side. For this game, you will need to know the 4 sides of a ship.

Take the students to a gym or open field or courtyard. Have them face one direction. This is the way our ship is moving. We call the front the bow. Have them point to the bow. Do this with all 4 sides of the ship. In this game, you call out a side of the ship. The students all run there. The last student to arrive sits out, until you are left with one winner. If time permits, you can them play again. As the teacher, you can call out "bow", "stern", "starboard", or "port". If this is easy for the students, you can also say "All Hands on Deck" where in they all come to the center and "Man Over Board" where they dive off the ship or out of the center of the play area. (Note: It sounds complicated, but they catch on really fast and love it.)

Further Exploration

If you spill a little bit of water onto a flat surface, you may notice that the water drops find each other and clump together. It almost seems like they are held together or connected by some invisible skin. A force called **surface tension** attracts water molecules to each other**.** This is why some animals are even able to walk on water.

Experiments with Surface Tension

You can perform this experiment outside or you can place the glass in one of the containers and perform it inside. Fill one glass all the way to the very top with water. Keep dripping more water in until it can hold no more. Have students predict how many paper clips can be dropped into the water, before they displace the water and it spills over. Then, one by one, count each paper clip as you gently place it in the glass. You will be surprised how many fit before it overflows. You may even notice the water bulging slightly above the edge of the glass. The surface tension of the water is trying hard to keep all the water together.

Materials: One or more glasses filled to the top with water, paper clips

Walking on Water

A force called **surface tension** attracts water molecules to each other**.** This is why some animals are even able to walk on water. In this experiment, you are going to make your own water striders.

You will need three paper clips and three small rectangular pieces of foil. Cut two small slits into the two longer sides of the rectangle. Fold the foil around the paperclip. Where you made the slits will form three legs on either side of the paper clip. Feel free to color your water walkers. Place your walkers on a tissue and gently lower it until it hits the surface of a bowl of water. The tissue will sink, but the insects should stay on top of the water, held up by the water's surface tension. Optional: If you drop a little soap into the center of the water walkers, they will dart away from each other because soap breaks up water tension. Note: You can perform this experiment without the aluminum foil.

Materials: Bowl of water, 3 paper clips, aluminum foil, a tissue

Discuss how people float or swim in water. Discuss some safety rules children should follow when they are around water.

Wrap Up

- Have students discuss how ships work and play the Shipwreck Game.
- Have students experiment with surface tension, seeing if they can make the insects walk on the water.
- Have students explain to a friend what makes something float or sink.
- Name a variety of items. Have students brainstorm whether they would float or sink.
- Discuss water safety guidelines and how humans can learn to float and/or swim.

Signs of Success

The student will…

- Demonstrate engagement and curiosity by performing the floating and surface tension experiments.
- Describe what they have seen or done, explain what they still want to try, and make predictions for outcomes for new ideas.
- Come up with floating or surface tension experiments of their own that they would like to try.
- At least 3 out of 4 times, make correct predictions about whether an item will float or sink.

Other Books to Explore

Floating & Sinking By Amy S. Hansen
Floating & Sinking by Jack Challoner
Who Sank the Boat by Pamela Allen
A Drop Of Water: A Book of Science and Wonder by Walter Wick
Did a Dinosaur Drink This Water? (Wells of Knowledge Science) by Robert E. Wells
All the Water in the World by George Ella Lyon
National Geographic Readers: Titanic by Melissa Stewart
Busy Boats (Amazing Machines)by Tony Mitton
Peppa Pig and the Muddy Puddles by Candlewick Press

Pennsylvania Educational Standards

Reading 1.2.3 A, D, E
1.6.3 A, B
1.8.3 A, B

NRC National Science Educational Standards
Content Standard A: Science as Inquiry
Content Standard B: Physical Science

AAAS Benchmarks for Science Literacy
12A Values and Attitudes
12D Communication Skills

Sample Schedule For Making It A Week Long Unit

Day 1:
Introduce Archimedes and his theory of water displacement and buoyancy.
What Shapes Float Experiment with worksheet
Discuss what makes items float or sink.

Day 2:
Make Your Own Ship Experiment
Discuss the concept of Density.
Retry the What Shpaes Float Experiment, this time increasing the density by adding rocks until the items start to sink
Read *Ups And Downs: A Book About Floating and Sinking* By Joanna Cole & Bruce Degen

Day 3:
Discuss how ships float and the different jobs and parts of a ship.
Play the Shipwreck Game.

Day 4:
Review the parts of a ship and why ships float.
Surface Tension Experiment

Day 5:
Walking on Water Experiment
Review all that we have learned this week about why thinks sink or float and surface tension.

Floating vs. Sinking Worksheet

Draw the Item	It Will Float!	It Will Sink!
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐