

FLOAT A BOAT: Applications of Density

FRAMEWORK

I. Scientific and Engineering Practices 1, 4, 6

II. Cross-Cutting Concepts 2, 6

III. Disciplinary Core Ideas PS 1, ETS 1

SKILLS/OBJECTIVES

- Learn the concept of “density”
- Learn how density factors into flotation
- Design and build a boat which floats in water of various densities
- Define “capacity” (Capacity = number of pennies -1)

MATERIALS

- Aluminum Foil
- 3 Large plastic bins per group
- Cups (for adding salt and cornstarch)
- Pennies
- Salt
- Cornstarch
- 15- 20 Worksheet and pencils
- 15 -20 Popsicle sticks
- Scrap paper
- 15- 20 Scissors
- 1 Electric fan per group
- For all activities and demos
- With needed amounts assuming 15-20 kids

NOTES

- Students should be divided into groups of 3-5 with one mentor leading each group
- The mentor should provide assistance and facilitate discussion around the questions in the activity sheet
- At the end of the activity, mentors should ask students why they think the changes in capacity occurred.

BACKGROUND

- Density = weight/volume
- Density describes how **much stuff (matter) is packed into any space**. The more dense it is, the more matter there is in the object.
- Different objects have different densities. For example, Styrofoam is very light, while a brick is very heavy. Even if we get a piece of Styrofoam and a piece of brick which are the same size, the brick will be much heavier. Why is that? Because it is more dense.
- Things with lower densities have the ability to float in liquids with higher densities.

Activity #	Density Dance
Materials	Kids and their bodies
Worksheet	no

- **Ask the kids if anybody knows what density means.**
- Density describes how closely packed molecules are in a substance.
- **Have everybody stand up and jump in place.**
- **Move everybody in very close together and explain that they are now in a “very dense” formation.**
- **Move out a little bit, describing that formation is “medium dense.”**
- **Have everybody disperse more, calling that state “not dense.”**
- **Call out various states, having the kids create the three different types of density.**
- **Reinforce the fact that the number of people aren’t changing, but the space between them is; the same amount of stuff is being put into a smaller space**

Activity #	Building boats
Materials	<ul style="list-style-type: none">○ Aluminum Foil○ 3 Large plastic bins per group○ Cups (for adding salt and cornstarch)○ Pennies○ Salt○ Cornstarch○ 15- 20 Worksheet

	and pencils ○ 15 -20 Popsicle sticks ○ Scrap paper ○ 15- 20 Scissors ○ 1 Electric fan per group
Worksheet	yes

- Boats can float because they are less dense than water.
- **Do you remember the difference between very dense and less dense? How can you make a boat less dense than water?**
- **Crush up a piece of foil and hold it up. Also hold up a flat piece of foil.**
- **Which one is less dense?** The flat one is less dense because it has a larger volume (is bigger and wider)

1. **Fill each plastic bin with water. Add salt to one bin, and a salt and cornstarch mix to another. Leave one bin with water only**
2. **Using one sheet aluminum foil, design a boat that floats in your lake.**
3. **Test the capacity of your boat by placing the boat in the WATER ONLY adding pennies to the boat one by one until the boat sinks. When your boat sinks, count the number of pennies in the boat.**

Capacity = number of pennies -1

4. **Record capacity on the data table.**
5. **Now test the capacity of the boat in salt water and cornstarch water. Is the capacity different? Why would it change? How does salt affect density?**
6. **Repeat steps 3, 4, and 5 with a sailboat this time, using the fan to provide wind.**

Conclusions

- Density = weight/volume
- Density describes how **much stuff (matter) is packed into any space**. The more dense it is, the more matter there is in the object.
- Boats can float more easily on denser water (water which contains salt or cornstarch)
- Density is a property of all kinds of mass. What is a dense solid? What is a dense liquid?

Name:_____

Boat Design:



	Boat 1 Capacity (number of pennies)	Boat 2-Sail boat Capacity (number of pennies)
Fresh Water		
Salt Water		
Salt + Cornstarch Water		

Which is the most dense (circle one):

1. Salt water
2. Fresh water
3. Salt + cornstarch water

Why do you think the changes in capacity occurred?