

Help, I'm Sinking! – Penny by Penny

MATERIALS

Heavy Duty Aluminum Foil

Pennies

Clear Tape

Clear Plastic tub

Paper Towels

Clear Container/Tub to hold water

WHAT YOU'LL LEARN!

Fundamentals of

- Buoyancy
- Engineering
- Surface Area
- Displacement/Weight

You will design your own boat!

You can modify your design to see how to hold more pennies!

COOL BOAT BUILDING LINKS!

[EXTREME ENGINEERING: Building a Navy Ship](#)

[Sea Perch](#)

[Boat Word Search](#)

How come a ship made of steel can float, but metal screw sinks like a rock when thrown into water?

BOUYANCY HISTORY:

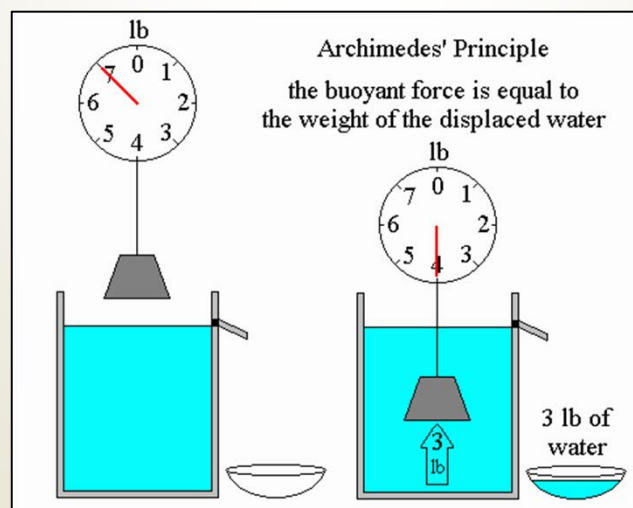


Legend has it that Archimedes (a mathematician) noticed that when he climbed into a soaking bath the water level would go up. *Have you noticed this when climbing into your bath at home?*

Archimedes realized that solids denser than water would be lighter when immersed in a fluid due to the weight of the water displaced. *This is why you feel lighter in water than walking on the ground.*

King Hieron II of Syracuse had a problem. He worried that his crown makers were charging him the price of a solid gold crown, but making his crown out of a mixture of silver and gold (which costs less than solid gold).

Luckily, the King and Archimedes were friends. Archimedes used his knowledge of water displacement to determine if the King's crown was actually made of solid gold.



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TERMS TO KNOW!

Buoyancy: the power of supporting a body so that it floats; upward pressure exerted by the fluid in which a body is immersed.

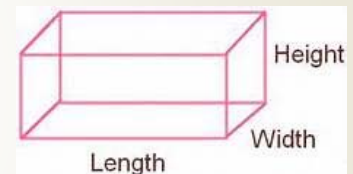
$$\text{Buoyancy} = \text{weight of displaced fluid}$$

Density: a material's mass per unit volume; different materials usually have different densities.

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

Volume: the amount of space, measured in cubic units, that an object or substance occupies.

*Volume is calculated by the shape of an object; irregularly shaped objects can be difficult to calculate.



$$\text{Volume of a rectangular prism} = \text{length} * \text{width} * \text{height}$$

FLOAT

Density of object < Density of fluid

SINK

Density of object > Density of fluid

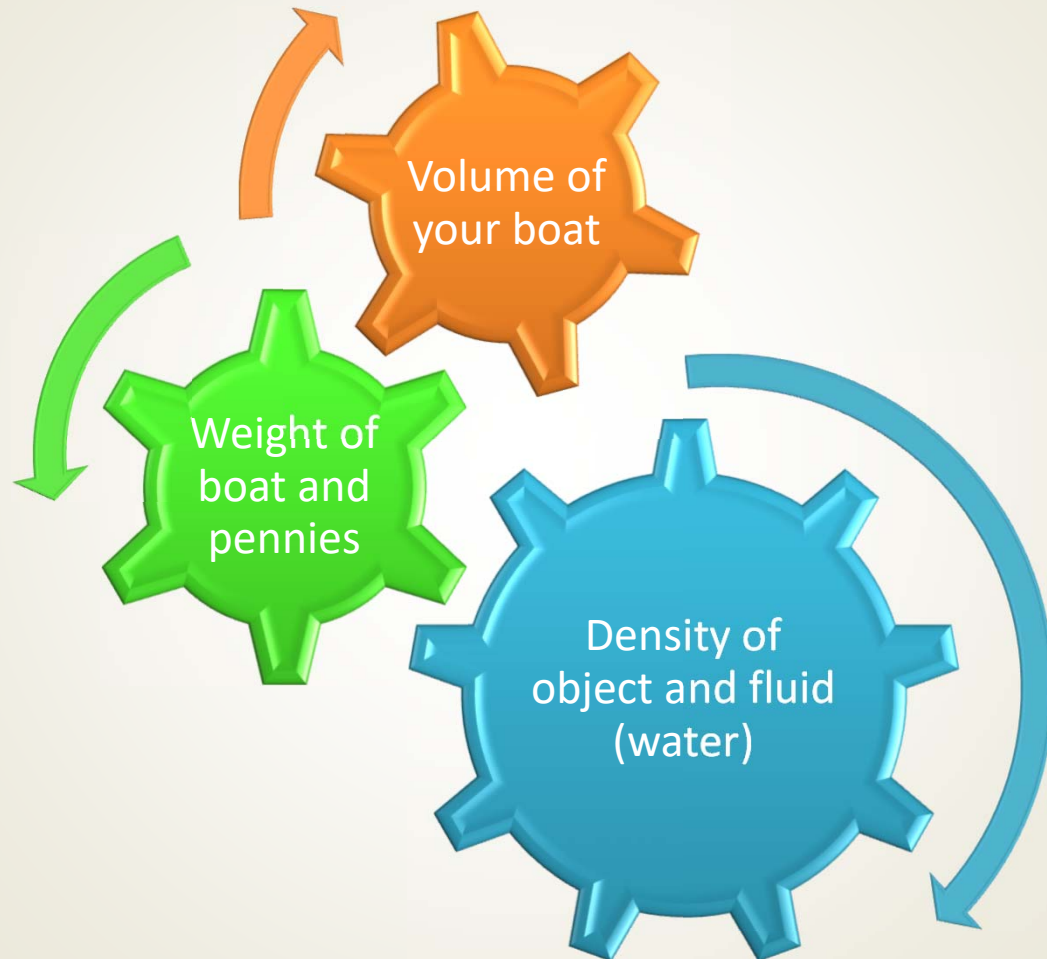
SUSPEND

Density of object = Density of fluid

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THINGS TO THINK ABOUT WHEN DESIGNING YOUR BOAT!



CREATE A HYPOTHESIS

Experiment	Guess # of pennies	Actual # of pennies
Initial Boat		
Redesigned Boat 1		
Redesigned Boat 2		

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INSTRUCTIONS

Preparation

1. Lay out all material
2. Fill the tub with water
3. Cut a piece of heavy duty aluminum foil (30 cm x 30 cm).
4. Design your boat!

Construction

5. Construct the boat using only one piece of 30 cm x 30 cm aluminum foil and tape if desired.
6. Measure the size of your boat: length, width, height
7. Approximate your surface area using the equation for a rectangular prism
8. Record information:
 1. Name of your boat
 2. Data to calculate the surface area
 3. Predict how many pennies your boat will hold

Test Time!

9. Float your boat in the water.
10. Slowly add pennies to your boat.
11. Once water enters the boat, or if any part of the boat touches the bottom of the tank, stop
12. Record information on worksheets
 1. Number of pennies your boat held before it sank
 2. Observations – any surprises? Did it work like you expected?
 3. Improvements – do you think you could design the boat different to hold more pennies?
13. Make changes to your boat based on your observations, can you get it to hold more pennies

ANALYZE

14. Using software like Excel, plot your results of surface area vs number of pennies.

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SOURCES OF INFO



Always check with a parent or guardian before researching or visiting websites online!

Sources:

- <http://quest.nasa.gov/aero/planetary/archimedes.html>
- www.dictionary.com
- http://en.wikipedia.org/wiki/Archimedes%27_principle
- http://www.sciencebuddies.org/science-fair-projects/project_ideas/Aero_p020.shtml#background
- <http://en.wikipedia.org/wiki/Density>
- <http://dictionary.reference.com/browse/volume?s=t>