

# Ship's Log

## Amazing Cape Cod Regatta Challenge: BOAT BUILDING

Sailor's name: \_\_\_\_\_

After exploring the websites and completing the Investigations in the Catboat Crew CATegory: BOATBUILDING, answer the following. You can use words or diagrams.

### VIDEOS

1. What is buoyancy? (5pts) **how well something floats or sinks**

2. What is density? (5pts) **the amount of mass ("stuff inside") an object has relative to its volume ("space inside") or how compact the object is**

3. Explain how a bowling ball is more dense than a basketball. (10pts)

**A bowling ball is solid on the inside. A basketball is filled with air. The material inside the bowling ball is packed more tightly together. Even though the two balls are approximately the same size (have the same volume), the bowling ball sinks in water while the basketball floats.**

4. Why did the water level rise in the bathtub when Archimedes took a bath? (10pts)

**When Archimedes got in the tub, his body moved some of the water out of the way (displaced). The water had nowhere to go but up and its level rose.**

5. What does "displace" mean? (5pts)

A) to make fun of

B) **to cause to move from (an object's) usual place**

### TOTAL POINTS:

\_\_\_\_\_ out of 100

85-100pts 1<sup>st</sup> Mate  
70-85pts Helmsman  
55-70pts Deckhand

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6. If an object is heavier than the weight of the water it displaces, what happens to that object? (5pts)

- A) it floats                      B) **it sinks**

7. What 2 main design features of cruise ships allow these massive boats to float? (5pts)

- A) **they are large and hollow**                      B) they are small and solid

8. Extend your thinking! Based on your answer to #7, **explain why** the *Syracusia* or a cruise ship floats instead of sinks. (Hint: Remember, if an object is more dense than the water it displaces, or moves out of the way, the object will sink.) (15pts)

**Since both large ships were mostly hollow inside, their densities were less than that of the water they displaced. The ships are also very large, which means they displace a lot of water. The density of the water that is displaced is greater than the density of the ships, so it will cause them to float.**

9. As a boat builder, would you want your boat to be more or less dense than the water it displaces? Explain your thinking. (10pts)

**The boat should be less dense. If it was the same or nearly the same density, the boat would float exactly or near the water line. This would not make for safe travel on water. Depending on the size and purpose of the boat, it would need to float in the water with a certain amount of the boat above and below the water line. This is why some boats use water to act as ballast to flood sections of the boat. The extra water changes the overall density of the boat and lets the captain control how much of the boat rides above the water.**

## INVESTIGATIONS

1. What happened when you placed the foil ball into the water? A) it sank B) it floated
2. What happened when you placed the boat into the water? A) it sank B) it floated
3. The foil ball/pennies and the boat/pennies were approximately the same mass (5pts)  
A) true B) false

4. How did the density of each foil/penny combination affect (influence) your results? (10pts)

The foil ball is more dense than the boat with the pennies. In the ball, the pennies are stacked together and the foil wrapped tightly around them with little air, causing it to sink. The foil boat has both a larger volume and there is more air surrounding the pennies and foil so it floats.

5. What happened when you carefully placed your foil ball on the boat with the pennies?  
A) the both floated B) they both sank

6. Put it all together! Based on what you learned about buoyancy, why is the foil boat able to stay afloat with both its mass and the added mass of the foil ball (which, remember, by itself, the foil ball sank)? Think about it...it's like an anchor. Throw it overboard and it sinks to the bottom. Hoist it to the deck and does it make your boat sink? (15pts)

The foil boat is able to float with both its mass and the mass of the foil ball because its density is still less than the water it displaces. The bottom of the foil boat is large and the inside mainly hollow—it has a greater volume. It is able to float both its original mass and that of the foil ball. This is similar to an anchor. When an anchor is thrown overboard, it sinks. When it is hoisted back on board, it does not cause the boat to sink with it. The density of the boat is less than the density of the water it displaces.