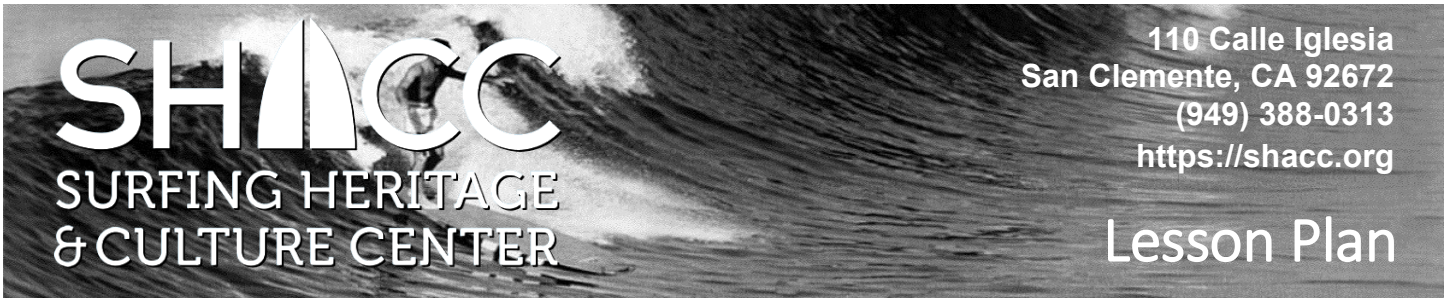


Topics

Archimedes Principle, buoyancy, and surfboard performance

Grades

6-12

Duration

45-60 minutes

Materials

- SHACC Student Journal (also available online)
- Pencil or pen, ruler
- Chromebook (optional-Google Classroom)
- Handout: "Tom Blake and the Search for Speed"
- Clay (50 grams per group. Plastilina Non-Hardening Modeling Clay)
- Pennies (75 per group)
- Small 'tubs' or bowls to float clay boats and source of water.

Standards

CCSS

- CCSS.ELA-LITERACY.RH.6-8.1
- CCSS.ELA-LITERACY.CCRA.W.1
- CCSS.ELA-LITERACY.SL.8.4

NGSS

Practices:

- *Engaging in Argument from Evidence*
- *Obtaining, Evaluating, and Communicating Information*

Crosscutting Concepts:

- *Cause and Effect*
- *Patterns*

Title: *"Tom Blake and the Search for Speed"*

Focus Question

- How and why did making a surfboard lighter improve its performance?

Objectives/Outcomes

- Students will learn about legendary surfboard innovator Tom Blake and his contributions to the evolution of the surfboard.
- Students will explore the physics concepts of buoyancy, displacement and Archimedes' Principle by completing hands-on activity "Tom Blake and the Search for Speed".
- (Optional) Students will visit SHACC and tour evolutionary timeline

Vocabulary/historical figures

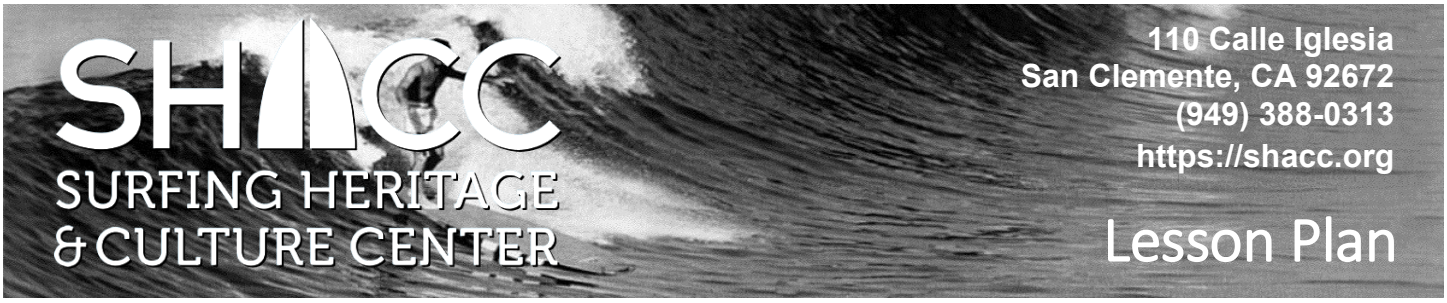
- Innovation, olo, Archimedes' Principle, buoyancy, displacement, force, Tom Blake

Outline

- Students will read story "SURFING'S FIRST APP" in their SHACC Student Journal about Tom Blake. (story also attached)
- Pass out worksheet and read background information on the lab together with the class.
- Go over directions with students, break into groups of 2-3 and pass out materials (*clay, pennies, and small tub or bowl*). Students will have approximately 30 minutes to work with the clay and test out their designs.
- Have students demonstrate their designs and determine which design floated the most pennies.
- Teacher mediated discussion on which design was best and why.
- (Optional) Students will tour the SHACC surfboard timeline and observe Tom Blake's board designs and accompanying stories detailing this time period either in person or virtually.

Assessment

1. Student engagement and participation.
2. Completion of Clay boat and competition
3. Completion of worksheet (Tom Blake and the Search for Speed)



BACKGROUND READING:

"Surfing's First APP" by Craig Lockwood

California: 1927

- Tom Blake watches craftsmen building hollow, plywood-covered spar-and-rib airplane wings in a small aircraft factory.
- Surfing's still a little-known sport, an unexplored territory. Except in Hawaii, few know how to surf. Boards are heavy and clumsy. But Blake's a visionary. He knows that before surfing can progress, it has to be re-invented.
- Blake applies what he's just seen. Using hand-tools and waterproof glue, he shapes a hollow airplane-wing style surfboard—weighing *less than half* of typical 95-pound redwood planks.

1932: Blake submits his design for a U.S. Patent

- Blake's ingenious re-application of aircraft technology to surfboards——acts like a smartphone "app"——radically reducing previous burdens of weight and length.
- But there's an unforeseen benefit.
- In the 1930s, America's largest cause of accidental death is drowning.
- Blake, a nationally ranked swimmer with lifeguarding experience, realizes his lightweight surfboards make ideal rescue platforms. Any surfer in the water using a Blake board can save a life.
- Blake, with Santa Monica lifeguard Pete Peterson, and Herb Barthels of the American Red Cross, develop surfboard rescue techniques. Lifeguard services begin adding Blake's boards to their inventories of lifesaving equipment.

1938: Popular Mechanics Magazine

- Blake's plans are published and available for .50¢
- With basic tools and a few dollars worth of materials, anybody can build one.
- Kids in high school wood-shops start making their own.
- Tom Blake's "app" has opened a door to surfing's future.

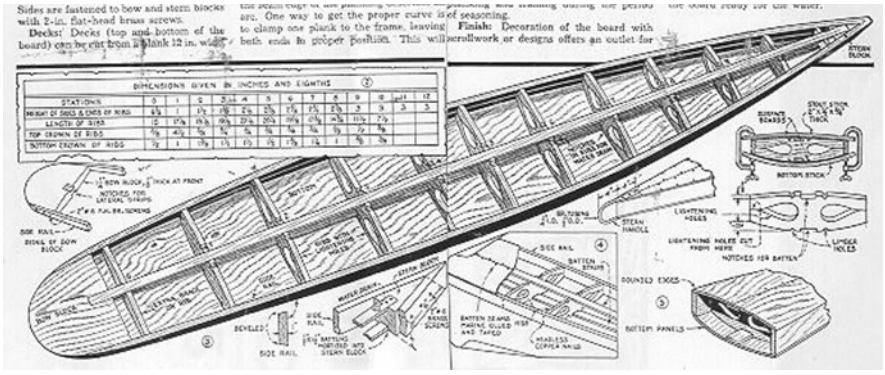
Name _____ Date _____

Tom Blake and the Search for Speed

OCEAN AWARENESS PROGRAM

Background: Throughout the evolution of surfing and surf craft design, there are few innovators that had such a lasting impact on the sport of surfing than **Tom Blake**. As a ten year old boy in rural Wisconsin in 1912, Tom first 'caught the bug' for surfing after watching a newsreel clip of Hawaiian surf-riding. Eight years later Tom and had a chance meeting with surfing legend and recently crowned Olympic swimming champion **Duke Kahanamoku** on his way to back to Hawaii after the Antwerp Olympic Games in 1920. This first meeting encouraged Tom to eventually move to Southern California where he would became a champion swimmer and lifeguard. It was here that Tom again met Duke who was then lifeguarding at the beaches of Santa Monica in Southern California. Finally in 1924, Tom Blake got to visit Hawaii for himself and very quickly embraced its rich cultural heritage and especially the art of ***he'e nalu*** (*surfing*).

While helping to restore several ancient Hawaiian olo surfboards at Hawaii's' Bishop Museum in the late 20's, Tom also began to design boards with similar shapes but using a hollow body construction in order to reduce weight and increase speed. This design was later patented and plans were available in Popular Mechanics Magazine in 1937 which allowed anyone to build a surfboard for themselves. Tom Blake first got the idea years earlier when he watched workers at an aircraft company building plywood covered spar-and-rib airplane wings which made them much lighter. With this innovation, Tom created a series of lighter-weight racing paddle boards which he set numerous records based on the original ancient Hawaiian ***olo*** shape. At the first annual Pacific coast Surfriding Championships in Corona Del Mar In 1928, Tom Blake won riding his hollow and lighter olo-inspired design.



In addition to redesigning faster and more maneuverable boards, Tom Blake also continued to innovate and create the first sail board, first full length book on surfing, first fin on a surfboard, surf racks, water housings for cameras, develop lifeguarding rescue techniques, and built the first aluminum "torpedo" rescue buoy.

Your Goal: In this activity you will explore what is known as the "**Archimedes' Principle**" which was discovered in 200 BC by Greek inventor and scientist, Archimedes. ***The Archimedes' Principle states that any object immersed in a fluid is acted upon by an upward, or buoyant, force equal to the weight of the fluid displaced by the object.*** In short, that means it will float more weight before it sinks and would therefore float a little higher in the water. This improved both the speed of paddling and the overall maneuverability of Tom's modern version of the ancient Hawaiian olo.

The challenge: Your job will be to design a boat that will float in water and hold the most amount of weight (pennies). You will be given a measured amount of **clay (50 grams)**, a **container of water**, and **pennies**. You will have approximately 30 minutes to work with the clay and test out your designs. At the end of that time you will be asked to demonstrate in front of the class the number of "weights" (pennies) the boat can hold. Rewards will be given for the most weight floated, longest boat, and most innovative. When you have completed the competition, answer the questions below.

Conclusion questions:

1. Draw a **design** of your boat below. Give dimensions in cm (length, width, and height)

2. How many pennies did your boat hold? How many did the winning boat hold?

3. What characteristics seemed to produce the "best" boat (hold most weight)?

4. Primitive peoples must have made their boats of wood. Could they have conceived of an iron ship? We don't know. The idea of floating iron might have seemed strange. Using what you have leaned today; explain how a boat made of iron could float.

5. The Greek philosopher Archimedes (third century B.C.) discovered an interesting principle concerning the relationship between **buoyancy** and **displaced** liquid. It is stated as follows:

Any object immersed in a fluid is acted upon by an upward, or buoyant, force equal to the weight of the fluid displaced by the object.

This relationship is called ***Archimedes' principle***. Using this relationship, explain why the winning boat was able to hold up the most weight. (*If you don't know the meaning of the words buoyancy or displaced, look them up in Goggle before you begin*).