

# SAMPLE LESSON PLAN

## COMPANION LESSON PLANS TO “ASK US ANYTHING”

### THE PLIMSOLL LINE

WATER DENSITY HANDS-ON LESSON FOR GRADES 3-12  
(ADJUSTABLE CURRICULUM FOR DIFFERENT GRADE LEVELS)

#### OBJECTIVES

In conjunction with the OHPRI YouTube video **ASK US ANYTHING: The Plimsoll Line**, students will:

- Develop a greater understanding of the purpose and importance of the Plimsoll Line.
- Develop a greater understanding of water density and how it affects the load on a ship.
- Use critical thinking to determine how to load a ship prior to its voyage.
- Use basic measurement and calculation

#### MATERIALS NEEDED

- Water
- Salt
- Measuring cup (example: Pyrex 2-cup baker’s measuring cup)
- Calculator
- 1 large spoon
- 1 black permanent marker
- 1 red permanent marker
- 1 large bowl, pot, or basin (8 cup or larger is best)

#### ADDITIONAL MATERIALS FOR GR. K-2 ONLY:

- Tub toys (such as floating boat, duck, etc.)

#### ADDITIONAL MATERIALS FOR GR. 3-12 ONLY:

- Masking Tape
- Ruler
- Scissors
- Aluminum foil
- 25-50 items to be used as a load. (example: ½ inch nuts [can be found at your local hardware store], pennies, game board pieces)

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# LESSON PLAN

## PROJECT PART A: (Gr. 3-12) CREATE YOUR BOAT

(Gr. K-2 skip to PROJECT PART B)

**Step 1:** Cut a 11 in. x 7 in. rectangle out of aluminum foil. Fold the sides up 2 in. to create your hull. Make sure you have folded up to the same height around the edges of your boat. Note: this is an example measurement - you may find that a different size boat works better for you. (Example: if your boat is wider than your bowl, you will need to make your boat smaller so that it can float in your bowl of water).

**Step 2:** Use the masking tape to reinforce your corners as well as the full length and width of your boat. Note: this is very important, especially at the corners where water can seep in.

**Step 3:** Calculate the volume of your hull. Using your ruler, take centimeter measurements of the length, width, and height of your hull. Record these measurements. Then, using your calculator, calculate the volume of your hull.

$$\text{Length} \times \text{Width} \times \text{Height} = \text{Volume.}$$



## PART B: DETERMINE HOW MUCH WEIGHT YOUR BOAT CAN HOLD IN FRESH WATER.

**Step 1:** Using your measuring cup, add seven cups of water to your large bowl.

**Step 2:** Place your boat (Gr. K-2 - toy boat, duck, etc) into your bowl.

**Step 3:** (Gr. K-2 skip to PART C) One at a time, carefully add your load item, such as your ½ inch nuts, to your aluminum foil boat. Load the nuts one at a time until your boat sinks. Example: if your boat sinks with 30 nuts, you know that your boat can hold 29 nuts.

**CHALLENGE #1:** If you know the weight of your load item (example: check the packaging of your ½-inch nuts): calculate how much weight your aluminum boat holds.

**CHALLENGE #2:** If you don't know the weight of your load item, weigh it using a kitchen scale! Then complete challenge #1.

**CHALLENGE #3:** If your boat can hold 29 nuts in fresh water, how many do you think it will hold in salt water? Why?

## PART C: DETERMINE THE FRESHWATER PLIMSOLL LINE

**Step 1:** Take your red permanent marker and while your boat is floating in the water, mark a dot or line on the outside of your boat right where it hits the water.

**Step 2:** (Gr. 3-12) Record how much weight your boat can hold in fresh water. Example: In fresh water, my boat can hold 29 nuts.

Congratulations, you have determined the weight your boat can hold in fresh water! In the OHPRI Plimsoll Line video, we learned that different types of water have different densities. That is why the Plimsoll Line must be used on a ship. Let's try it out for ourselves!



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## PART D: CHANGE THE DENSITY OF YOUR WATER.

**Step 1:** Remove your boat from the water and remove the load items from your boat. Dry your load items.

**Step 2:** Add 1 cup of salt to your bowl. With your large spoon, stir the water to evenly distribute the salt.

**Step 3:** Place your boat into your bowl.

**Step 4:** (Gr. 3-12) Repeat Step 3 from Project Part B.

**Step 5:** Observe. Does your boat still hit the water at your marked dot/line? (You should notice that your boat in the salt water bowl sits a little higher on the water than it did before you added the salt. This is because salt water has a greater density)

## PART E: DETERMINE THE SALTWATER PLIMSOLL LINE

**Step 1:** Take your black permanent marker and while your boat is floating in the water, mark a dot or line on the outside of your boat right where it hits the water.

**Step 2:** (Gr. 3-12) Record how much weight your boat can hold in salt water. Example: In salt water, my boat can hold 35 nuts.

Congratulations, you have determined the weight your boat can hold in salt water!

### GRADES K-2 REFLECTION:

- Why is our tub toy floating higher in the water now?
- What did we do to the water?
- What does this mean?
- Vocabulary: density, buoyancy

## (GRADES 3-12) PART F: CRITICAL THINKING

If you are going on a trip from an area with salt water to finish your trip at a dock in fresh water, how should you plan to load your boat?

## (GRADES 3-12) PART G: HISTORY OF THE PLIMSOLL LINE

- Who was Samuel Plimsoll?
- What was his first job?
- What was his motivation for creating the safe load line?
- What was the title of his piece of work published in 1872?
- Why did Plimsoll call members of the House “villains”?
- What was his relation to William Vernon Harcourt?
- Why did he have an interest in cattle-ships?

### EXPANSION:

Map a trip from Newport, RI (salt water) to a fresh water destination. Example: you are bringing a ship filled with goods to Richmond, VA.

