

# Investigating Changes in Density

## Focus on Inquiry

The student will collect and analyze data while investigating the effects of different solutions of salt water on chicken eggs.

## Lesson Overview

In this lab, students will practice controlling variables as they learn about the density of water. Students will learn how salt changes the density of water.

<b>Duration</b> 55 minutes	<b>Setting</b> Classroom	<b>Grouping</b> Cooperative groups of 3-4	<b>PTI Inquiry Subskills</b> <b>2.1, 3.1, 5.2, 5.3, 5.8, 7.2</b>
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Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
<b>Engage</b>	10 min	2.1	None	2	Students are engaged in a discussion on whether water has mass, as well as the difference between ocean water and fresh water.
<b>Explore</b>	15 min	3.1, 5.2	None	3	Students discover how different amounts of salt in salt water affect the capability of an egg to float due to its density.
<b>Explain</b>	15 min	3.1, 5.2	None	2	Students discuss findings and further explore their understandings of water density and how salt effects the floatation of eggs.
<b>Expand</b>	15 min	5.2, 5.3, 5.8	None	3	Students simulate what happens to water density in the Dead Sea.
<b>Evaluate</b>	varies	7.2	None	N/A	Evaluation of a lab report can be used to assess understanding.

### Level of Student Engagement

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

## National Science Education Standards – Inquiry



Design and conduct a scientific investigation.  
 Use appropriate tools and techniques to gather, analyze, and interpret data.  
 Develop descriptions, explanations, predictions, and models using evidence.  
 Communicate scientific procedures and explanations.

## National Science Education Standards – Earth Science

Water, which covers the majority of the earth’s surface, circulates through the crust, oceans, and atmosphere in what is known as the “water cycle.”  
 Water is a solvent. As it passes through the water cycle it dissolves minerals and gases and carries them to the oceans.

## Louisiana Grade Level Expectations – Inquiry



Gr. 8, Inquiry GLE#4 – Design, predict outcomes, and conduct experiments to answer guiding questions (SI-M-A2)  
 Gr. 8, Inquiry GLE#6 - Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3)  
 Gr. 8, Inquiry GLE#12 - Use data and information gathered to develop an explanation of experimental results (SI-M-A4)  
 Gr. 8, Inquiry GLE#14 - Develop models to illustrate or explain conclusions reached through investigation (SI-M-A5)  
 Gr. 8, Inquiry GLE#16 - Use evidence to make inferences and predict trends (SI-M-A5)  
 Gr. 8, Inquiry GLE#22 - Compare ocean floor topography to continental topography by using topographic maps (ESS-M-A9)



## **Louisiana Grade Level Expectations Earth Science**

Gr. 8, GLE#24 - Investigate and explain how given factors affect the rate of water movement in the water cycle (e.g., climate, type of rock, ground cover) (ESS-M-A10)

### **Materials List (per group unless otherwise noted)**

- One wide-mouth pint jar filled three-fourths of the way with distilled water (fresh water)
- Gallon milk jug full of distilled water (fresh water)
- Empty gallon milk jug (teacher demo)
- Measuring spoons (1 teaspoon and 1 tablespoon per group)
- Pencil
- Crayon
- Plastic paper clip
- Eraser
- Salt (9 tablespoons per group)
- Paper towels
- One FRESH egg

### **Advance Preparation**

1. Obtain materials listed in the materials list.
2. Set-up each group station with materials.
3. Make sure you purchase fresh eggs for Part 1 of this lesson. Make sure your eggs will float in fresh water prior to the lesson.

### **Other Information**

#### **Learner Objectives**

The learner will:

- create several different solutions of salt water.
- observe and describe the physical characteristics of a fresh chicken egg when it is submerged in the different solutions of salt water.

#### **Prior Knowledge Needed by the Students**

- An understanding of how density is relative to the movement of water in the oceans is beneficial.

### **Procedure**

#### ***Engage***

1. Ask the students, "Do you think water has mass? (Accept all answers). Ask students that say "Yes, water has mass" to explain how they know that to be true.
2. Have one student volunteer pick up an empty gallon milk jug in one hand and pick up the other gallon milk jug full of fresh water. Ask the student, "Which container is heaviest?" "Does this demonstration show you that water has mass?" (This is proof that water has mass).
3. Now ask the students, "How is ocean water different from the water in our lakes, ponds, and streams?" (Accept all answers, e.g., ocean water is salty).
4. "Has anyone been to the beach lately?" "Did you taste the ocean water?" "Does it taste different than lake or pond water?" "If so, what does it taste like?" (Salty).
5. Now have the students speculate what types of objects they think will float in water. Create a three-column chart on the board. In column 1 will record the item name, column 2 will record the student's prediction, and column three will record the test results. Make a list of items on the board in column 1 (examples – pencil, crayon, plastic paper clip, eraser, etc.) and record their predictions for each item in column 2.
6. Ask students, "How can we test your predictions?"
7. Test each item in fresh water and record the results in column 3.
8. Discuss whether their predictions were correct. As students to summarize the results of their investigation.

#### ***Explore/Explain***



#### Part 1:

1. Break into cooperative groups of 3-4 and have students gather the materials necessary for this part of the lesson. Remind students to be careful handling their eggs, as well as mindful of their jar filled with distilled water.
2. Ask students to raise their hand if they predict the egg will float? Will sink? Record their votes on the board.
3. Have each group gently place the egg in the fresh water. Did their egg float? (Note – the eggs should **not** float. Be sure your eggs are **fresh!**). Record the data on the board.
4. Discuss why some objects float and some objects do not.
5. Introduce the word **density** to the class. Objects with less density than water will float (Ex., cork, plastic). Objects with density greater than water will sink (Ex., A rock, coin).
6. Discuss why their eggs did not float using the term density.
7. Remove the eggs from the water.

#### Part 2:

1. Ask students, “What will happen when salt is added to the water? Will there be any changes? If so, explain what the changes are.” Discuss.
2. Tell each group that they must keep the amount of salt they will place in their jars a secret. Divide the number of groups evenly, where half the groups place  $\frac{1}{2}$  ounce (3 teaspoons) of salt in their jar and the other half of the groups place  $\frac{1}{4}$  ounce ( $1\frac{1}{2}$  teaspoons) of salt in their jars.
3. Students can place their designated amount of salt into their jars filled with water. They should mix the salt and the water using the measuring spoon.
4. Gently add the egg back to the water. (Groups with  $\frac{1}{2}$  ounce of salt in their water jars should see their eggs float. Those groups with  $\frac{1}{4}$  ounce of salt should see their eggs sink).
5. Ask the students to again discuss why some groups’ eggs floated while other groups’ eggs did not. Bring up the word density again. Note - The mixture that contains  $\frac{1}{2}$  ounce of salt simulated seawater. (Each gallon of seawater contains approximately  $\frac{1}{4}$  pound of salt or 35 grams of salt per kilogram of ocean water. By adding salt, the water becomes heavier and denser than fresh water and the egg. That is why it is easier for us to float in the ocean than in a pool or lake.)
6. Remove the eggs from the jar carefully. Allow all groups whose eggs did not float to add a  $\frac{1}{4}$  ounce of salt to its jar so that all groups have the same amount of salt in the water.

#### **Expand**

1. Have all groups add 4 additional ounces (8 tablespoons or 24 teaspoons) of salt to their mixture. They should stir it with their measuring spoons until all the salt dissolves.
2. Have the students predict what they think will happen to the egg now. Record possible answers on the board.
3. Gently add the egg to the water.
4. Ask students, “Is there a difference in how the egg floats in this water compared to the other water with  $\frac{1}{2}$  ounce of salt in it?” (The egg should float higher in the salt water mixture.) Let students give explanations for why the egg is floating higher.
5. Tell the students that by adding more salt to their mixture they were simulating the amount of salt that the Dead Sea has, which is nine times greater than regular sea water.
6. Would it be harder to swim in a pool filled with salt water or fresh water? Explain. (*It would be easier to swim in a pool filled with salt water because they would much less dense than the salt water and therefore would float higher in the water.*)

#### **Evaluate**

1. Students can create a lab report that contains their predictions, observations, and answers to questions posed for assessment.

#### **Blackline Master**

None

#### **Supplementary Resources**



**PBS Zoom Activities from the show:**

<http://pbskids.org/zoom/activities/sci/waterdensity.html>

Water Density activity: Did you know that you can make water denser?

<http://pbskids.org/zoom/activities/sci/whatsmoredense.html>

Water Density activity: What is denser?

**NOVA Teachers**

[http://www.pbs.org/wgbh/nova/teachers/activities/2402\\_titanic.html](http://www.pbs.org/wgbh/nova/teachers/activities/2402_titanic.html)

Titanic's Lost Sister activity: To investigate how differences in temperature affect the density of water.

**Enchanted Learning**

<http://www.enchantedlearning.com/subjects/ocean/Salty.shtml>

All about Oceans and Seas.

**The Hydrologic Cycle**

<http://cobweb.ecn.purdue.edu/~epados/ground/src/cycle.htm>

From the Agricultural and Biological Engineering at Purdue University.

**Office of Naval Research: Science and Technology Focus**

<http://www.onr.navy.mil/focus/ocean/>

An abundant amount of information, cool facts, and images on oceans is provided on this website.