Density and Our Oceans

Environmental Study of Water - Mathematics

Essential Question	*How does salinity and temperature affect the density of our oceans?*
Outcomes	By the end of this module students will be able to: ● Define what density means. ● Explain how to calculate density using the formula. ● Describe how density is relevant to our lives. ● Define how density can help us understand why things sink or float ● Convert our knowledge to identify unknown objects using density calculations ● Determine the volume of an irregular solid object using water displacement. ● Explain how salinity and temperature affects our oceans ● Determine the annual rate of change of our sea levels ● Identify the factors that influence the rise in sea level and how that affects our environment and its population
Standards	**Math Content Standards** **D.3.8** Recognize volume as an attribute of solid figures and understand concepts of volume measurement. **D.3.10** Relate volume to the operations and solve real-world and mathematical problems involving volume. **G.6.2** Apply concepts of density based on volume in modeling situations. **Science Assessment Targets** **Pc.2** Physical and Chemical Properties, changes in state and density **ELA Standards** **W.6.1** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience.

	R.4.6 Analyze how a particular sentence, paragraph, chapter, or section fits into the overall structure of a text and contributes to the development of ideas. **R.3.9.** Determine the meaning of words and phrases as they are used in a text.
STEM Focus	**□ Science □ Technology □ Engineering x Mathematics**

Before you begin this Air Science lesson:

- **Go to File > Make a copy**
- **Change the name to: <your name> Water Math**
- **Begin working in your document**

Read the left-column to learn more about water in our environment, then on the right-column complete the reflections or activities.

Engage

More than 70% of earth is covered by water.

The ocean is the largest solar energy collector on earth! Increasing ocean heat content is raising global sea levels because water expands when it warms!

Activity: Think

Why do you think increasing temperature and rising sea levels is a problem?

Explain:

Click here to access padlet where you will explain your answer to the activity question.

Explore

Watch the *Legend of Archimedes and the Golden Crown* (9:10) click on the crown.

Activity: Reflect & Respond

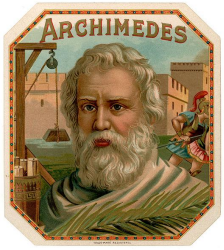
Click here to access the answer garden link where you will reflect and respond to the following question:

What do you think of the Legend of Archimedes and the Golden Crown? Write an adjective to describe the legend.

Explain

Read this about volume:

Archimedes discovered water displacement to determine the volume of an irregular shaped solid.



Watch *Volume* (1:51) to learn more.

Activity Determining Volume/ Water Displacement

Or

1. Ask participants to open joinmyquiz.com
2. And enter this code 556838

Read and answer this question:

Why do you think ice floats on water?

Watch this video to find out *Why Ice Floats On Water (3:55)*

Activity: Explain

Go to flipgrid and explain why ice floats.

Access flipgrid here
(Please be patient as it takes a minute to fully load)

Elaborate

Read the following:

The density of water is 1.0g/cm^3
If the item is less dense than water, it will float. If it is more dense than water, it will sink.

Activity: Determine

Fill in the table
Determine if an unknown object and will float or sink in water:

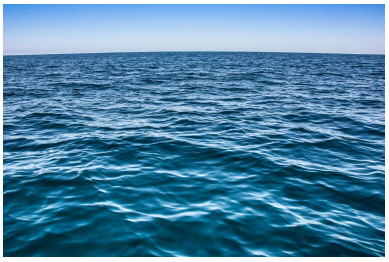
Object	Density g/cm^3	Float/Sink
Apple	**0.9**	
Orange	**0.84**	

<table>
<tr><td></td><td></td><td>
<table>
<tr><td>Dime</td><td>8.91</td><td></td></tr>
</table>
Check your answers
Answer Key
</td></tr>
<tr><td></td><td>Read the following:

We can also calculate density to determine an unknown object.

View Slide Presentation here</td><td>Activity: Complete

Complete the Google form
Click here to access the Google Form</td></tr>
<tr><td></td><td>How does Salinity and Temperature affect the Density of our Oceans?

Click on the image and watch the video to find out more (1:15)
 
Read the article below (you may have to register to read the article)

Why is the temperature of the oceans increasing and what does that mean for our planet?</td><td>Activity: Review
Click the link below to review the Quizlet
Salinity and Temperature

Activity: Read
Read the article/ graph (scroll down):
NASA Article Sea Level/ Vital Signs

Activity: Complete the worksheet
Sea Level Rise worksheet

Check your answers:
Answer Key</td></tr>
<tr><td></td><td>Watch:
Argo: taking our Ocean’s Temperature
(2:32)</td><td>Activity: Answer
In the box below, explain how the Argo floats work:</td></tr>
</table>

Collaborate

With a partner, watch the following video and prepare to answer the video questions about what you have learned about density:

Watch

Click here to watch an Experiment*: Ocean Temperature and Density* (7:42)

Activity: Collaborate

Work with a Partner and collaborate on the following:

How do you think ROY G. BIV & sugar can help us replicate the density of our oceans?

Answer the question in this box:

Activity: Partner Experiment

Perform a Density Column Discuss questions with your partner.

If you are unable to perform the experiment, click the link below to watch a similar version of the written experiment. Rainbow Density Column

This is exactly what occurs in our oceans. Warmer and less dense salt water floats to the top of the ocean's water column. Colder water which has a higher density than warmer water is found at the bottom of our oceans.

Evaluate

Evaluate what you learned:

1. **If the density of water is 1g/cm^3,any object with a density less than water will float. Any object with a density greater than water will sink. So in the Density Column Experiment, How did ROY G. BIV (acronym for the colors of the rainbow) and sugar help us understand density?**

Answer question here:

2. **State one thing you learned about how temperature and salinity affects the density of our oceans?**

Answer question here:

3. **Why does rising ocean temperatures matter to humans and the environment?**

Answer question here:

Activity: Write

Return to the padlet with your initial comment Write a new comment that explains why density is an important concept to understand and one thing you learned about it Access Padlet here

Extend

Watch:

What does ice floating on water have to do with density?
Watch this video to *Density* find out (3:12)

Watch video *Why Oil and Water Don't Mix* (3:49)

Click the link to watch a video on *Why Diet Coke Floats and Regular Coke Sinks (0:48)*

Read:

Read How to tell if your gold is real

Activities

Understand:

Extend your understanding worksheet

Experiment:

Oil and Ice Density Experiment

Practice:

Practice Volume and Water Displacement