

Density and Buoyancy

5E Lesson

The 5E model is a scientifically proven method to improve student engagement and learning in your classroom

- ✓ Engagement
- ✓ Exploration
- ✓ Explanation
- ✓ Elaborate
- ✓ Evaluate



Complete Teacher Instructions

Density and Buoyancy 5E Lesson

Grades 7-10	Density and Buoyancy	O
Lesson Objective: Students will learn about: • Mass and volume • What density is • Solving density problems using $d = m/V$ • Archimedes' discovery • Buoyancy • Density applications		
Possible Student Misconceptions: • Heavy objects sink and light objects float • Large objects sink		
Materials: • 1 device (smartphone, Chromebook, laptop, tablet, or computer) • A means of projecting a PowerPoint presentation • Internet access • General classroom objects and overflow cans for density		
Teacher Notes: ➢ All videos can be accessed directly from the PowerPoint icon while in slideshow mode and it will automatically open, reason, right-click on the image and click Edit Hyperlink ➢ I've created a video walkthrough if needed. It can be accessed here - https://youtu.be/oCIKIP9SaDQ ➢ I don't believe in long lessons. If you feel your students are Stop the PowerPoint and give them a 5-minute break. If you recommend my video collection here - http://www.teachwithfergy.com/the-buoyancy-quiz/ are tons of brain-break videos to choose from all grouped		

Density and Buoyancy – 5E Lesson

Engagement Phase Your students will watch the video 'Buoyancy Quiz?' and complete the following. 1. Watch the video and make your prediction 2. Explain your reasoning 3. Watch the second video to see what happens The first video can be found here - http://www.teachwithfergy.com/the-buoyancy-quiz/ Clicking the link found at the end of the video will access the 'answer video'. Teacher Notes: - Prior to voting on an answer, create a discussion about what the students think will happen and why. - FYI, all the links bring you to the same answer video - If the video doesn't work for one reason or another, go to www.youtube.com and type in "Buoyancy Quiz" - The video is about two minutes long - You may need to show the video more than once	Duration: 20 min Teacher Role: learning and understanding ☐ Connect st experience ☐ Create inte ☐ Ask questi ☐ Understand of the less
Exploration Phase Exploration – Lab Station Activity • In groups of 2-3, have your students complete <i>Exploration – Lab Station Activity</i>. Once they're done, they will submit their passport to you. Teacher Notes: • The complete instructions for my Lab Station activity can be found in the <i>START HERE – Instructions</i> file.	Duration: 1 hour Teacher Role: learning and understanding ☐ Students n experience ☐ Students u creative th ☐ Students n observation results, an connection
Explanation Phase PowerPoint Lessons • The lesson is found in the folder – <i>Explanation – Density and Buoyancy Lessons</i> • This lesson is designed to be completed over two days • There are multiple embedded videos and plenty of opportunity to engage, interact and check for your students' understanding throughout the lesson • The lessons cover the following topics: ➢ Mass and Volume ➢ What is density? ➢ $d = m/V$ ➢ Solving Density Problems ➢ Archimedes	Duration: 1 hour Teacher Role: concepts by material found presentation.

➢ Buoyancy ➢ Applications ➢ Practice Problems Teacher Notes: • All videos can be accessed directly from the PowerPoint. To retrieve them, click on the video icon while in slideshow mode and it will automatically open for you. If they don't open, right-click the image and select Edit Hyperlink or something similar. • I've created a video walkthrough if needed. It can be accessed here - https://youtu.be/oCIKIP9SaDQ • I have also enclosed a PDF version of both the teacher and student versions.	Goals ☐ Students develop understanding of the content ☐ Observations and experiences are discussed and critiqued ☐ Students develop vocabulary ☐ Students are able to connect the content presented to previous experiences
Elaborate Phase Elaborate – Reading Your students will complete – <i>Elaborate – How Do Ships Float</i> . This reading will require your students to move beyond what was covered directly in the lesson and allow them to further develop their understanding.	Duration: 1 hour Teacher Role – Facilitate learning and keep students focused Goal ☐ Students use their newly obtained knowledge to propose solutions and extend their learning to new situations
Evaluate Phase Quiz Have your students complete - <i>Evaluate – Density Problems Worksheets</i> All quiz questions will come from the lesson, reading, and lab station activity.	Duration: 30 min Teacher Role – Distribute and collect evaluation Goal ☐ Students are given the opportunity to demonstrate their understanding and evaluate their own progress

Each phase is clearly described

A Complete Lesson

Which is heavier?

1 kilogram of feathers



Or



1 kilogram of lead?

They both have a mass of 1kg so they weigh the same
but the lead has more stuff in it → more dense

← **Make sure your students are on track**
Student copies with blanks
Videos embedded right into your slideshow

Recall Mass

Mass

- A physical property that represents the amount of matter (stuff) an object contains
- Measured in:

—
—
—

- The most famous of these favors for the king was that of the gold crown
- Watch the following video



Crown of Syracuse

Interactive and Engaging Activities

How Do Ships Float?

Scientific Reading Comprehension Article

How Do Ships Float?

We have all seen massive, heavy ships full of people and cargo floating along on the water. This immediately raises a question: How does a ship stay afloat? The answer has to do with several properties of solids and liquids, including density, weight, pressure, and buoyancy.



The density of an object is the mass (or how much matter is in it) divided by its volume (how much space it takes up). It would make sense to think space has less mass than the matter in it, but that's not always true. In fact, the matter in it is often more dense than the space it takes up. For example, a brick is denser than the air around it, and a rock is denser than the water it's in. Weight is simply the force of gravity acting on an object and is the object's mass multiplied by the acceleration of gravity. The gravity is basically the same throughout our planet, weight and mass are often used interchangeably. However, the mass of an object never changes, while its weight can, depending on where it is. You would not weigh the same on the moon as you do on Earth because the force of gravity is weaker on the moon than on Earth.

Water has mass and density and exerts pressure on objects within and upon it. When an object - such as a ship - enters water, it is experiencing two opposing forces: the force of

gravity pulling down on it and the force of the water pushing up on it. If the object's density is less than the density of water (or if it has a lower mass - or weight - than the equal volume of water), it will float. This is buoyancy: the object is pushing against a weight less than its own weight. The object is pushing against a weight less than its own weight and so will float on top of the water. A negatively buoyant object weighs more than an equal volume of water and will sink. A neutrally buoyant object has the same weight as an equal volume of water, so will float at a neutral depth without rising or sinking. According to Archimedes' Principle, which states that the upward force of water on an object is equal to the weight of the water displaced by the object. This is why objects feel lighter under water than at the surface: the upward force of water helps to counteract the force of gravity. Thus, an object will only sink if its weight is greater than the upward pressure of the water. In other words, when it has displaced its weight in water. If this happens, the object becomes submerged and will float. If it doesn't happen, it will sink. For example, a rock is small and will sink because a little weight in water, before becoming submerged, is much less, so the other force is relatively minimal weight being before it becomes submerged, given how it is.

Ships are built to be more like a beach ball than a rock. A displaced one more body of the ship, all of the air inside the ship (which is lighter and less dense) is pushed out. Because the weight of the ship is distributed throughout a large area and much of its interior is air, it easily displaces its weight in water without sinking. Despite a heavier ship with all its cargo in the water, then a lighter ship and the more cargo and people that are



Improve your students **Scientific Literacy** and **Analysis Skills**, use as an **Emergency Substitute Plan** or create **Applicability** in your classroom

Density and Buoyancy Lab Station Activity



7 Lab Station Activities to get your kids out of their seats and engaged in their learning

Get away from tired practices and unengaged students



Provide a Scientifically-Proven means of instruction



Incorporate Technology and Increase Collaboration

