

# Don't Be So Dense

## Relative Density

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| **Grade Level** | 6th Grade | **Time Frame** | 120 minutes |
| **Subject** | Science | **Duration** | 2-3 class periods |
| **Course** | Physical Science | | |

## Essential Question

How do you explain density?

## Summary

Students will investigate the relationship between mass and volume, which leads to density. This lesson includes modifications for advanced classes if needed.

## Snapshot

**Engage**

Students predict whether objects will sink or float.

**Explore**

Students measure density cubes and analyze the data.

**Explain**

Students connect what they learned with the density cubes to analyze a density tower.

**Extend**

Students try to get a piece of modeling clay (such as Play-Doh) to float.

**Evaluate**

Students use GramIt to create an image and hashtag about what they learned..

## Standards

*Next Generation Science Standards (Grades 6, 7, 8)*

**MS-PS1-2:** Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

## Attachments

- Evaluate GramIt—Don't Be So Dense.docx
- Evaluate GramIt—Don't Be So Dense.pdf
- Explain Slides—Don't Be So Dense.pptx
- Explore Handout Full Guided—Don't Be So Dense - Spanish.docx
- Explore Handout Full Guided—Don't Be So Dense - Spanish.pdf
- Explore Handout Full Guided—Don't Be So Dense.docx
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- Explore Handout—Don't Be So Dense.docx
- Explore Handout—Don't Be So Dense.pdf
- Extend Handout—Don't Be So Dense - Spanish.docx
- Extend Handout—Don't Be So Dense - Spanish.pdf
- Extend Handout—Don't Be So Dense.docx
- Extend Handout—Don't Be So Dense.pdf
- Inside Out—Don't Be So Dense - Spanish.docx
- Inside Out—Don't Be So Dense - Spanish.pdf
- Inside Out—Don't Be So Dense.docx
- Inside Out—Don't Be So Dense.pdf

## Materials

- A variety of objects of different densities (see Engage for ideas)
- A clear plastic tub, filled with water
- Sets of density cubes (Explore)
- Explore handout (attached; one per student)
- Inside Out handout (attached; one per student)
- Explain Slides (attached)
- Modeling clay, such as Play-Doh (Extend)

# Engage

Students will walk in, and a variety of objects and a big tub of water will be placed at the front of the room. Either post directions or ask students to construct a three-column chart in their notes and title the chart, "Will It Sink or Float?" The first column is labeled "Object," the second column is labeled "Prediction," and the third column is labeled "Actual Result."

### Teacher's Note: The Spice of Variety

A "variety" of objects means just that—but be mindful of trying to get both objects that sink and objects that float. Styrofoam, wood, and rocks are "obvious" examples of what should be included. But others that aren't as obvious should be included as well. Melons, pumpkins, and other squashes float, despite how heavy they are. Softballs also float (as long as they aren't waterlogged), but golf balls sink: This could lead to clearing up the common misconception that bigger things are always denser. For even more fun, try bowling balls that weigh 6 pounds (sometimes 8, but 6 is guaranteed to float)! One last challenge: If you find something that has the same density as water, when you float it inside the water, it will neither sink nor float, which blows students' minds.

Direct students to write each object displayed in the object column, and then have them predict whether they think the object will sink or float when put in the water. Allow students to hold the objects if they want. Once they're done with their predictions, have students share their predictions before you put the object into the water. Then, put the objects into the water. Have students write down the actual results as they happen.

# Explore

Offer a set of density cubes to each pair of students, along with rulers and mass scales around the room.

**Teacher's Note: Not a DIY Activity**

Sadly, it's difficult to make effective density cubes at home, so they're better ordered. The precision needed to make all the cubes the same size is best left to those that have expensive, accurate machines.

Allow students time to investigate the different blocks. Common observations usually include that all the blocks are the same size (which can be verified by the ruler), but they're different colors and have different "heaviness." Allow students access to the scales to investigate the idea of "heavy" and "light." Also, give access to graduated cylinders and water for a further investigation of water, so students can relate each cube to the density of water. Either give each student a copy of the attached **Explore** handout, or post the questions on the handout for students to write in their notebooks.

**Teacher's Note: Need More TLC?**

If just setting students free seems above their capability, a fully guided worksheet is attached to help them make the appropriate observations. They're asked the same questions, but there's just a little more scaffolding to help them get to the answers.

# Explain

Pass out a copy of the attached **Inside Out** handout to each student (or have them copy the Inside Out design into their notebooks). First, have students brainstorm what they know and have learned from the Explore in the middle circle (this should take anywhere from 2-5 minutes). Then, have students share what they've written with an elbow partner.

In the second circle, have students write what their partner has written that they forgot to include (this should also take 2-5 minutes). Next, show the YouTube video of making the density tower.

When the entire video has played, go back and pause it at 1:11, which is the full density tower. In the biggest circle, students should write what they're seeing and why they think the layers are possible.

Finally, display the attached **Explain Slides**, asking questions about the layers. Have students work in their pairs to answer the questions in the biggest circle. Ask students to share their thoughts and answers, clarify misconceptions and explain that it's possible to layer liquids because they have different densities. Also, discuss how objects will sink down to the layer that has the closest density to the object.

### Teacher's Note: Don't Give It Away

Don't let students see the video or image on the slide until they have completed the self and partner brainstorms. The purpose of Inside Out is to explore what each student individually knows, then add on to that.

# Extend

Going back to the tub of water, grab a piece of balled-up modeling clay and show it to students. Drop it in the water and comment on how it sank. Tell students they will receive their own piece of modeling clay, and their task will be to make it float. Pass out the attached **Extend** handout, where students will document their thought-process and the success/failure of their attempts (or you can post it and have students draw it out in their notebook).

Give students no more than 15 minutes to complete this task. If they don't find success, then that's fine; it's just something to consider when they reflect on the task. However, when the struggle becomes real for students, you can give them hints like "How does the density of water compare to the density of the modeling clay right now?" then "If you have to use the entire mass of the clay I gave you, how can you make its density lower than water?"

### Teacher's Note: Spoilers

The way to get it to float is to make a really flat, thin boat shape. Don't tell students that, of course. In fact, if they don't succeed, consider never telling them and making them investigate on their own if they really want to know.

### Teacher's Note: Reaching Higher

For an advanced class, flip the Extend and Explore sections. This makes the modeling clay task harder, but it provides context for the measuring of the cubes. Switching them also creates an opportunity for deeper reflection, since they can use what they learned with the density cubes to justify what went right or wrong with the modeling clay attempts.

# Evaluate

Students will summarize all that they've learned about density using the Gramit strategy. In a short summary, have students write about what they've learned and add both an image and whatever appropriate hashtags they think complement what they've written. When they've written their Gramit, have students share out their responses. This is the opportunity to assess their learning in the moment and clear up misconceptions.

## Resources


- Arbor Scientific. (n.d.). http://www.arborsci.com/set-of-density-blocks
- K20 Center. (n.d.). Gramit. https://learn.k20center.ou.edu/strategy/2554
- K20 Center. (n.d.). Inside out. K20 Learn. https://learn.k20center.ou.edu/strategy/a89b55a468ff764491d10ec5b2005c9d
- Spangler, S. (2010, December 8). "Amazing 9 Layer Density Tower" Sick Science! [Video]. YouTube. https://www.youtube.com/watch?v=-CDkJuo_LYs