



Classroom Teacher Preparation

Physics 17: Density

Please use the following to prepare for the next SfS lesson.

Description:

Students explore density with a boat-related challenge & a polydensity bottle. Students construct boats out of aluminum foil to float in small ponds. Younger students measure the mass that their boats can support before sinking; older (6th-8th grade) students calculate the predicted capacity of their boats and then test them in order to compare their prediction to the actual maximum load.

Lesson Objectives – SWBAT (“Students Will Be Able To...”):

3rd-8th

- Express density in terms of volume and mass
- Explain that relative density (i.e., Density A vs. Density B) determines whether objects float or sink

Disciplinary Core Idea (DCI)

PS1 Matter and its Interactions – PS1.A Structure of Matter

- (3rd-5th) Because matter exists as particles that are too small to see, matter is always conserved even if it seems to disappear. Measurements of a variety of observable properties can be used to identify particular materials.
- (6th-8th) The fact that matter is composed of atoms and molecules can be used to explain the properties of substances, diversity of materials, states of matter, phase changes, and conservation of matter.

Science & Engineering Practice (SEP)

Planning and Carrying out Investigations

- (3rd-5th) Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
- (6th-8th) Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.

Crosscutting Concept (CCC)

Structure and Function

- (3rd-5th) Different materials have different substructures, which can sometimes be observed.
- (6th-8th) Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.

Preparation:

This lesson is intended to be an introduction to the topic.

Room Set Up for Activities:

Students will work in pairs or groups of three to build boats out of aluminum foil. The students will float their boats in containers of water. All items that can't get wet should be cleared from the desks.



Safety:

There are no safety concerns with this lesson.

Related Modules:

This lesson may be taught as part of a sequence or group of related modules on Chemistry or Physics. Other modules in these sequences include:

Chemistry 2: *Chemical Identification* - A single chemical may be able to take on many forms, rendering simple methods of identification such as sight ineffective. Chemists (your students) therefore use a multitude of tests to compare the properties of a sample to known values in order to identify an unknown material. (Indirectly related)

Chemistry 4: *Separation of Substances* - Students design and implement a multi-step purification process for a mixture and then calculating the recovered fraction of components to determine its effectiveness.

For other module sequences and groups, look here: www.sciencefromscientists.org/sequences

Standards Covered:

Please click the following link to our website to review the standards covered by this lesson, listed by state:
www.sciencefromscientists.org/standards/

Lessons are matched to both national NGSS and local state standards.

After Our Visit:

Extend this lesson by making raisins "dance" in a glass of soda

Access this Extension activity by visiting the Classroom Post found on our website at sciencefromscientists.org/cohorts. Use the name of your school/cohort and password to log in.

To help Evaluate, check out our Open Response questions online at sciencefromscientists.org/open-response-questions. They are freely available for all of our lessons for current teachers. Use the password supplied by your instructor to log in.

Additional Resources:

Include any useful links to videos or websites can be listed here with general descriptions of what they are.

- Engineering challenge: Build a clay boat: https://www.teachengineering.org/view_activity.php?url=collection/duk_/activities/duk_float_mary_act/duk_float_mary_act.xml
- Make a density column: <http://scifun.chem.wisc.edu/HomeExpts/layeredliquids.htm>
- Dancing raisins: <http://scifun.chem.wisc.edu/HomeExpts/dancingraisins.htm>