

THE PHYSICS OF FLOATING

STEM²D Topic:
SCIENCE

Target Population:
Students, ages 11-14

The Physics of Floating

is part of the STEM²D **Student Activities**

Series. Developed by FHI 360 and

JA Worldwide as part of Johnson &

Johnson's WiSTEM²D initiative (**W**inning in

Science, **T**echnology, **E**ngineering, **M**ath,

Manufacturing, and **D**esign), the series

includes more than 10 interactive and fun,

hands-on activities for youth, ages 12–18,

globally.



The Physics of Floating

STEM²D Topic: Science

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ACTIVITY DESCRIPTION

In this Ignite STEM²D activity, students apply their science knowledge and use critical thinking and problem-solving skills to explore why objects sink or float.

ESTIMATED TIME



This activity is intended to be done at a career fair, science fair, exhibit, or other type of “booth” event. It typically takes **5 to 10 minutes** to complete.

STUDENT DISCOVERIES

Students will:

- Apply their knowledge of science and physics to solve a problem.
- Build important STEM²D skills, such as communication and critical thinking.
- Have fun experiencing STEM²D.
- Be inspired to participate in other types of STEM²D experiences.

GETTING READY

Materials

- 4 clear containers, such as water pitchers or clear vases (*each large enough to easily hold a can of soda*)
- Water (*enough water to fill each of the four containers*)
- Table salt
- 2 (minimum) cans of soda, *including:*
 - 1 can of regular soda (any brand), *such as Coke® or Pepsi®*
 - 1 can of diet soda (any brand), *such as Coke Lite® or Diet Coke®*
- 2 eggs, hard-boiled
- STEM²D brochures, flyers, or other informational materials, *optional and determined by the Activity Leader*

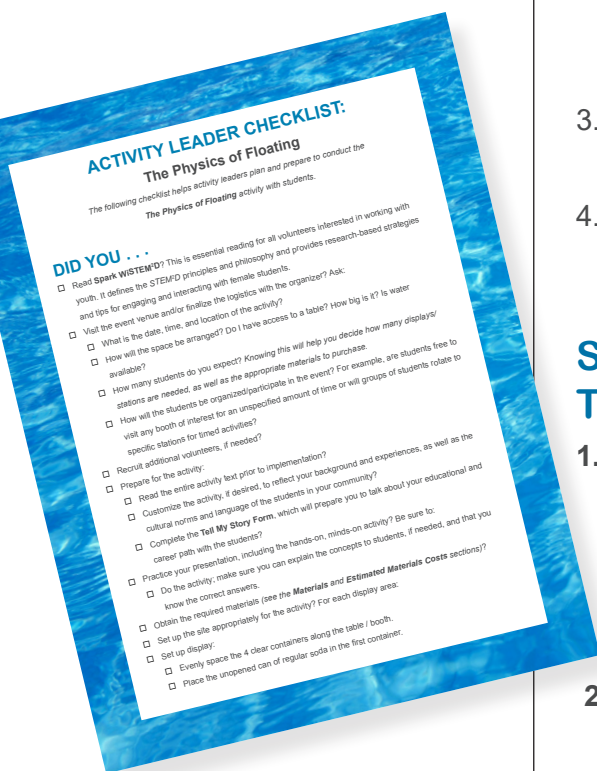


STEM²D Skills

- Communication
- Creative Thinking
- Critical Thinking
- Drawing Conclusions
- Problem Solving

TIPS FOR WORKING WITH STUDENTS

Set up several “The Physics of Floating” displays to accommodate multiple students or groups of students at one time.



Estimated Materials Cost:

Activity leaders can expect to incur less than \$10.00 (excluding water containers) in materials costs when completing this activity with student groups multiple times.

Activity Leader Preparation

1. Read **Spark WiSTEM²D**. This is essential reading for all volunteers interested in working with youth. It defines the STEM²D principles and philosophy and provides research-based strategies and tips for engaging and interacting with students. Download at www.STEM²D.org.
2. Review the **Physics of Floating Activity Leader Checklist** (at the end of this document) for details and specific steps for planning, preparing, and implementing this activity.
3. Set up “The Physics of Floating” display. See the Activity Leader Checklist for more information.
4. See the **STEM²D Student Activities Overview** for additional information.

STEP-BY-STEP INSTRUCTIONS: The Physics of Floating

1. Welcome & Introductions (1 minute)

- Welcome the students as they arrive at the table/booth.
- Tell the students your name, your organization/company, and your job title/occupation.

2. Learning Activity: Floating and Density (3-4 minutes)

- Invite the students to look at the display and see if they can guess what’s going on.
- Initiate a discussion and brainstorming activity about the objects in the clear containers. Ask:
 - Why do you think one of the cans of soda is floating and the other is not?
 - Why is one egg floating and the other is not?
- Do not point out that the cans of soda are different or that the water in one of the containers with the eggs is salt water.
- Ask the students to talk about what they already know. Try asking:

- Do you know why things float?
- What role does density play?
- If students cannot tell you why objects float or the role of density, offer some brief background information:
 - **Density** is how close together the molecules of a substance are or how much mass a substance has in a given space. For example, if two objects have the same weight, but are different sizes, the smaller object is denser.
 - In this experiment, the objects (i.e. the cans of sodas and the eggs) have unique densities. The fluids that the objects are in (i.e. the water) also have densities.
 - The ability for an object to float in water (or air or some other fluid) depends on both densities. An object will float if it is less dense than the fluid it is in. We say an object is **buoyant** if it floats in a fluid.
 - Higher-density fluids have more **buoyant force** and it is easier for objects to float in them. Buoyant force is the “upward thrust” of a fluid — it is how much resistance a fluid puts up when an object presses down on it. For example, think about how the ground resists your foot when you step on it. This is buoyant force.
- Encourage students to reflect on the key points presented and talk about why objects float. Say:
 - With these examples in mind, can you guess why one of the cans of soda floats and one does not?
 - Why would one egg float?
- Guide students’ thinking. If necessary, offer the following prompts to encourage responses:
 - Whether an object sinks, or floats is dependent on the density of the object and the fluid it is in.
 - The cans of soda have different densities. Regular soda is made with corn syrup, which is very dense; diet sodas contain artificial sweeteners, which are less dense. The can of diet soda floats, because it is less dense than the can of regular soda – it has less weight in the same space – and it is less dense than the water.
 - Salt water is more dense than fresh water; there are more molecules in the same space. Therefore, identical hard-boiled

KEY WORDS

- **STEM²D**
- **Density**
- **Buoyancy**
- **Buoyant Force**

TIPS FOR WORKING WITH STUDENTS

- Make the activity hands-on by having the students predict (guess) if the objects will sink or float.
- Have the students test the prediction and ask them to put the object in the clear container filled with water.

TIPS FOR MAKING CONNECTIONS

Encourage students to:

- Summarize what they learned.
- Explain in their own words the reasons some objects are floating, and others are not.
- Describe how they applied their knowledge of science and physics to solve a real-world challenge.

eggs (i.e. eggs with the same density) will float in higher-density salt water, but not in the less-dense fresh water.

3. Student Reflection (2 Minutes)

- Wrap up the activity by asking any of the following student reflection questions:
 - Can you think of any real-world applications for this experiment?
 - How does liquid density and buoyancy relate to broader fields of science?
 - How do you think this might be relevant for someone in a STEM²D profession?
- Build on student responses. Consider:
 - Density has wide-reaching effects in the real-world.
 - Density affects how things move in various mediums. For example, density affects how ships move through oceans.
 - This is real-world physics, specifically fluid dynamics.
 - Density affects how certain chemicals interact with one another, even in your own body.
 - This is chemistry.
- Thank the students for joining you today.
- Encourage the students to continue exploring careers in STEM²D. Reassure them that they can do STEM²D.

Key Words

Buoyancy: The ability or tendency to float in water or air or some other fluid.

Buoyant Force: The upward force a fluid projects against an object when the object is sinking or floating in it.

Density: Density is how close together the molecules of a substance are or how much mass a substance has in a given space. The degree of compactness of a substance.

STEM²D: The acronym used for the disciplines of science, technology, engineering, mathematics, manufacturing, and design.

Activity Leader Reflection

After the activity, take a few moments to reflect on the following:

- What went well and what could be improved? What would you do differently next time?

- How comfortable did you feel talking about the broader applications of this exercise on buoyancy and density?
- Do you have a better understanding of STEM²D concepts?
- How useful was the information presented in **Spark WiSTEM²D** to implementing this activity?
- Will you volunteer for this type of experience again?

Resources and References

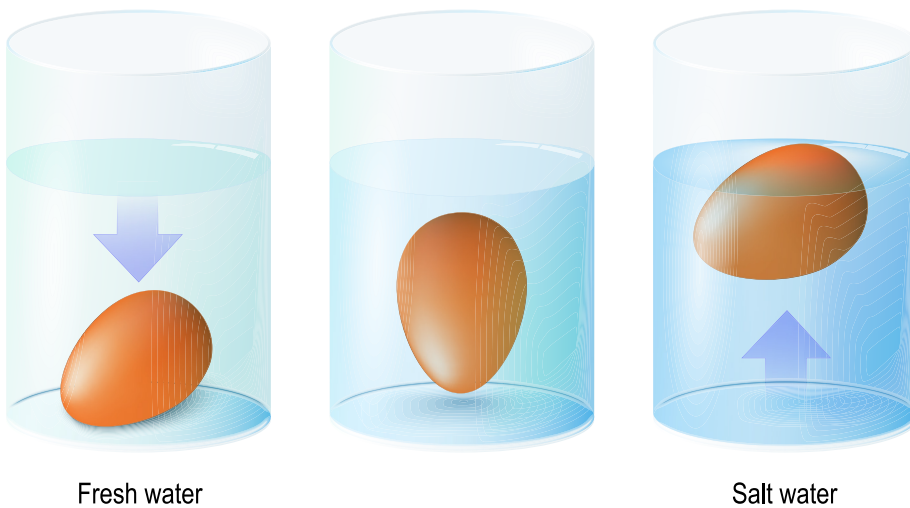
Activity concepts and real-life connections adapted from:

“Sinking Soda Surprise – SICK Science,” *Steve Spangler Science*. Accessed 27 Oct 2017. <https://www.stevespanglerscience.com/lab/experiments/sinking-soda-surprise/>

“Salty Science: Floating Eggs in Water,” *Scientific American*. Accessed 27 Oct 2017. < <https://www.scientificamerican.com/article/salty-science-floating-eggs-in-water/>>

“How Salty Does the Sea Have to Be for an Egg to Float?”, *Science Buddies*. Accessed 27 Oct 2017. < https://www.sciencebuddies.org/science-fair-projects/project-ideas/OceanSci_p003/ocean-sciences/how-salty-does-the-sea-have-to-be-for-an-egg-to-float>

“Floating Egg,” *Science Fun for Everyone*. Accessed 27 Oct 2017. < <http://www.sciencefun.org/kidszone/experiments/floating-egg/>>



The ability for an object to float in water (or air or some other fluid) depends on the density of the object and the density of the fluid it is in. An object will float if it is less dense than the fluid it is in. We say an object is buoyant if it floats in a fluid.

ACTIVITY LEADER CHECKLIST:

The Physics of Floating

The following checklist helps activity leaders plan and prepare to conduct the

The Physics of Floating activity with students.

DID YOU . . .

- , Read **Spark WiSTEM²D**? This is essential reading for all volunteers interested in working with youth. It defines the *STEM²D* principles and philosophy and provides research-based strategies and tips for engaging and interacting with students.
- , Visit the event venue and/or finalize the logistics with the organizer? Ask:
 - , What is the date, time, and location of the activity?
 - , How will the space be arranged? Do I have access to a table? How big is it? Is water available?
 - , How many students do you expect? *Knowing this will help you decide how many displays/stations are needed, as well as the appropriate materials to purchase.*
 - , How will the students be organized/participate in the event? For example, are students free to visit any booth of interest for an unspecified amount of time or will groups of students rotate to specific stations for timed activities?
- , Recruit additional volunteers, if needed?
- , Prepare for the activity:
 - , Read the entire activity text prior to implementation?
 - , Customize the activity, if desired, to reflect your background and experiences, as well as the cultural norms and language of the students in your community?
 - , Complete the **Tell My Story Form**, which will prepare you to talk about your educational and career path with the students?
- , Practice your presentation, including the hands-on, minds-on activity? Be sure to:
 - , Do the activity; make sure you can explain the concepts to students, if needed, and that you know the correct answers.
- , Obtain the required materials (*see the **Materials** and **Estimated Materials Costs** sections*)?
- , Set up the site appropriately for the activity?
- , Set up The Physics of Floating display:
 - , Evenly space the 4 clear containers along the table/ booth.
 - , Place the unopened can of regular soda in the first container.

- , Place the unopened can of diet soda in the second container.
- , Put one hard boiled egg into container three and container four.
- , Fill all 4 containers with water.
- , To the fourth container, add enough salt (and STIR!) to cause the hard-boiled egg to float.

Double check:

- , Container 1: The can of regular soda immersed in water should sink (not float).
- , Container 2: The can of diet soda immersed in water should float.
- , Container 3: The hard-boiled egg immersed in water should sink.
- , Container 4: The hard-boiled egg immersed in saltwater should float.

Bring a camera, to take photographs, if desired.

Obtain and collect permission slips and photo release forms for conducting the activity, if applicable?

Have fun!



Tell My Story Form

This form will help activity leaders prepare to talk about their STEM²D interests, education, and career path in a relevant and personal way.

ABOUT YOU

Name: _____

Job Title: _____

Company: _____

When/Why did you become interested in STEM²D? _____

What do you hope young people will get out of this activity? _____

FUN FACT:

Share a little about your background. Ideas:

- Share a memory from childhood when you first had your “spark” or “interest” in STEM.
- Detail your journey, highlighting what you have tried, what you learned, steps to success, etc.
- Failures or set backs are also great to talk about—difficulties, and/or challenges, and how you overcame them.

EDUCATION AND CAREER PATH

What classes/courses did you take in secondary school and in college that helped or interested you most? _____

How did you know you wanted to pursue a STEM²D career? _____

What was your postsecondary path, including the institution you attended and your degree? *If you switched disciplines, make sure you explain why.* _____

What your current position entails. *Be sure to include how you use STEM²D during a typical work day.* _____



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