

FLOAT OR SINK? A TEST ON THE DENSITY OF MATERIALS (Part 1)

- A dynamic lesson on material properties, density and predictions -

Overview	
Discipline	Science
Class context	Level: Elementary School I (final years) and Elementary School II (initial years). Students must have basic knowledge about some properties of materials, such as mass and volume.
PhET Sim	Density https://phet.colorado.edu/en/simulations/density
Estimated time	45-60 min

Learning Objectives
<ul style="list-style-type: none">• (BNCC) Express yourself freely through drawing, painting, collage, folding and sculpture, creating two-dimensional and three-dimensional productions.• (BNCC) Establish comparison relationships between objects, observing their properties.• (BNCC) Record observations, manipulations and measurements, using multiple languages (drawing, recording by numbers or spontaneous writing), on different supports.• (BNCC) Classify objects and figures according to their similarities and differences.• (BNCC) Explore phenomena in everyday life that demonstrate physical properties of materials – such as density.<ul style="list-style-type: none">○ Check the behavior (floating, sinking) of some objects in the water.○ Relate the behavior of materials in water with their density.○ Stimulate some steps of the scientific method.○ Organize scientific information through tables and schematic drawings.
Materials
Electronic device: computer, cell phone or tablet. PhET Density Simulation. https://phet.colorado.edu/en/simulations/density

Synthesis	
Pre-Lab	10 min
<p>Students may not recognize the difference between mass, volume and density, in addition to confusing the behavior of some materials (sinking or floating) when placed in water. Support students to identify their prior knowledge with the pre-lab activity, which must be completed before the Initial Free Exploration.</p>	
Free Initial Exploration (if students have access to an electronic device)	10 min
<i>The teacher...</i>	<i>The students...</i>
<ul style="list-style-type: none"> • Ask students to work in pairs/trios. • Encourages students to take a few minutes to explore the “Density” simulation. • Ask students to share their observations with other teams. • Circulate around the room and ask students: <ol style="list-style-type: none"> 1. What can you do with this simulation? 2. How many objects can we use in the simulation? 3. What information is shown for each object? 4. What connections did you make between the questions in the Pre-Lab and what you experienced in the simulation? 5. What questions do you have about the simulation? <p>After the initial exploration, a group discussion is recommended to ensure that students understand how to correctly and objectively use the simulation.</p>	<ul style="list-style-type: none"> • They begin to play freely with the simulation. • Discover how to use the simulation, including its controls. • Respond to the teacher's informal questions.
Collecting Evidence and Analyzing Data	
25 min – 40 min	
<i>The teacher...</i>	<i>The students...</i>
<ul style="list-style-type: none"> • Ask students to begin working on the questions in the “Collecting Evidence and Analyzing Data” section of the Activity Sheet, in pairs/trios, but answering individually. • When filling out the Table, ask students to exchange materials to have access to their respective mass, volume and density data. • Circulates around the room to be attentive to students' doubts and asks questions that guide their understanding. • In the schematic drawing activity, encourage students to make accurate illustrations, according to each one's artistic abilities. • Ask students to briefly share their thoughts and impressions about the simulation; what questions they have; if they filled out all the information in the table, if they made all the requested drawings and promotes discussions on any of the previous questions. • Encourages students to complete the challenge in the topic “Analyzing Data”. 	<ul style="list-style-type: none"> • Complete the table on the Activity Sheet. • Create six schematic drawings of the objects when they are placed in the water. • They answer the teacher's questions. • Ask questions or ask for help when necessary. • After answering the questions, they share their answers with other teams. • They become able to compare hypotheses with results.

- Promotes a group discussion to understand the relationship between the Pre-Lab Activity predictions and the data collected in the simulation.
- Allows students to point out other objects that sink or float based on their previous experiences.
- At the end of the analysis (last question), you can ask quick questions that serve as feedback for learning and direct students to the answer, such as:

1. Which concept in the class did you find most difficult/easiest?
2. What are the key concepts of today's activity?
3. What else would you like to know about the topic of this class?

The learning continues...

To enrich this activity:

- **DO** the Activity: FLOAT OR SINK? AN ESSAY ON THE DENSITY OF MATERIALS (Part 2)
- **DO** all simulation tests in the Science Lab (if available) or in the classroom. Use a clear basin or bucket. You can also use other materials and ask students to predict what will happen (sink or float) before checking. If appropriate, ask students to create a new table to fill in during the experience.
- **DRAW** students' attention to the fact that we float more easily when we fill our lungs with air (reducing the organism's density) and sink more easily when we empty our lungs of air (increasing the organism's density).
- If appropriate, **ESTABLISH** a relationship between density and buoyancy adjustment in bony fish (Osteichthyes) through the gas bladder (swim bladder). Next, we have an interesting experiment that can be used as a model to represent this adjustment - "Submarino na garrafa (EXPERIÊNCIA) - Manual do Mundo" -, whose link is:

<https://www.youtube.com/watch?v=R6XCLdEEj0c>

Exploring the “Density” simulation (Part 1)

- Activity Sheet -



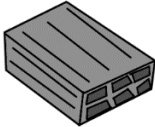

Name: _____ Class: _____

Pre- Lab

Instructions

In this activity, we will identify the ideas you have about the properties of some materials when placed in water. **ANSWER** the following questions individually.

1. **WRITE** what will happen to the objects (sink or float) in each case.

Description of the situation		Prediction of what will happen
A STYROFOAM is placed in the water.		
ICE is placed in the water.		
A BRICK is placed in water.		
A COIN is placed in the water.		

Source of images: Free Pick, Gartic, Ultra Coloring Pages.

2. **SHARE** your predictions with your colleagues and, if necessary, change your prediction (use a different color pencil/pen).

3. **REFLECT** on the following question:

Do you think the size of an object is a good indicator of whether it will sink or float? Tip: Think of a big ship and a small rock. Think of other examples that can be used to answer this question.

Group Discussion: SHARE your answers with your group and other groups.

Free Initial Exploration

Instructions

- **ACCESS** the simulation at: <https://phet.colorado.edu/en/simulations/density> ("Intro" screen) and explore the simulation features/controls.

After exploration **REFLECT** on:

- What can you do with this simulation?
- How many objects can we use in the simulation?
- What information is shown for each object?
- What connections did you make between the questions in the Pre-Lab and what you experienced in the simulation?
- What questions do you have about the simulation?

Group Discussion: SHARE your answers with other groups.

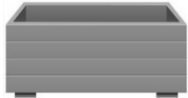
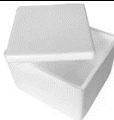

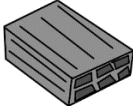


Collecting Evidence and Analyzing Data

Instructions

COLLECTING EVIDENCE

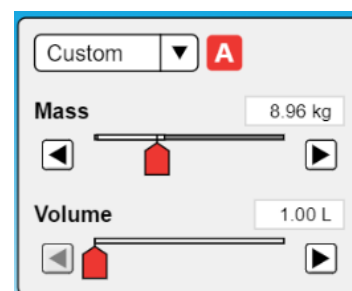
Activity 1 (Table 1). Float or Sink?

- **USE** the "Intro" Screen and **COMPLETE** the following table based on your observations.

Material		Density (Kg/L)	Sink (mark with an "X")	Float (mark with an "X")
Wood				
Styrofoam				
Ice				
Brick				
Aluminum				
Custom*				

Source of images: Caravela Coleções, Free Pick, Gartic, Mylo View, Ultra Coloring Pages.

* Copper will be our personalized object. You can "manufacture" it in the simulation using the following settings: observations.



Activity 2. Behavior of materials through schematic drawings.

- **MAKE** schematic drawings of the behavior of each material after being placed in water (draw as close to what the simulation showed).

ANALYZING DATA

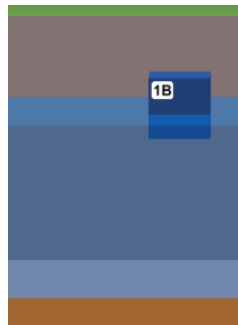
- **REFLECT:** Were your predictions made in the Pre-Lab Activity confirmed or challenged during the simulation?
- **(CHALLENGE) COMPARE** the density of the materials (Table 1) with the density of the water in which they were placed (1kg / L). What causes an object to float? What causes an object to sink?

- **WRITE** a short text that talks about what you learned in this simulation. Then, exchange your answer with other classmates to read what they learned.

Group Discussion: SHARE your answers with other groups.

Post - Lab

ANALYZE the image below carefully and answer questions 1 and 2.



1. It is correct to say that this block could be the representation of:

MARBLE



a)

SCREW



b)

BALLOON WITH AIR



c)

STONE

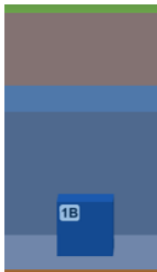


d)

Source of images: Yoyo Brasil, Free Pick, Pinterest, Lets DrawIt.

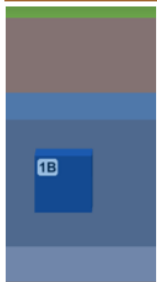
2. It is correct to say that if a larger block with the same material were placed in water:

a)



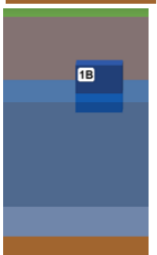
it would totally sink.

b)



it would partially sink (half the water).

c)



it would continue in the position it is in.

d)

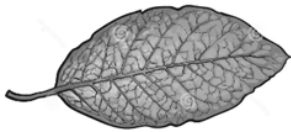
more information is needed to know.

ANALYZE the image below carefully and answer questions 3 and 4.



3. It is correct to say that this block could be the representation of:

DRY LEAF



a)

CHICKEN BONE



b)

PLASTIC BAG



c)

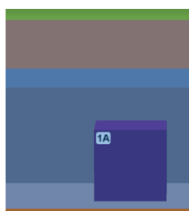



PENCIL



d)

Source of images: Yoyo Brasil, Free Pick, Pinterest, Lets Draw!t.

4. It is correct to say that if a smaller block with the same material were placed in water:

- a)  it would continue in the position it is in.
- b)  it would rise to half the water.
- c)  it would float.
- d)  more information is needed to know.

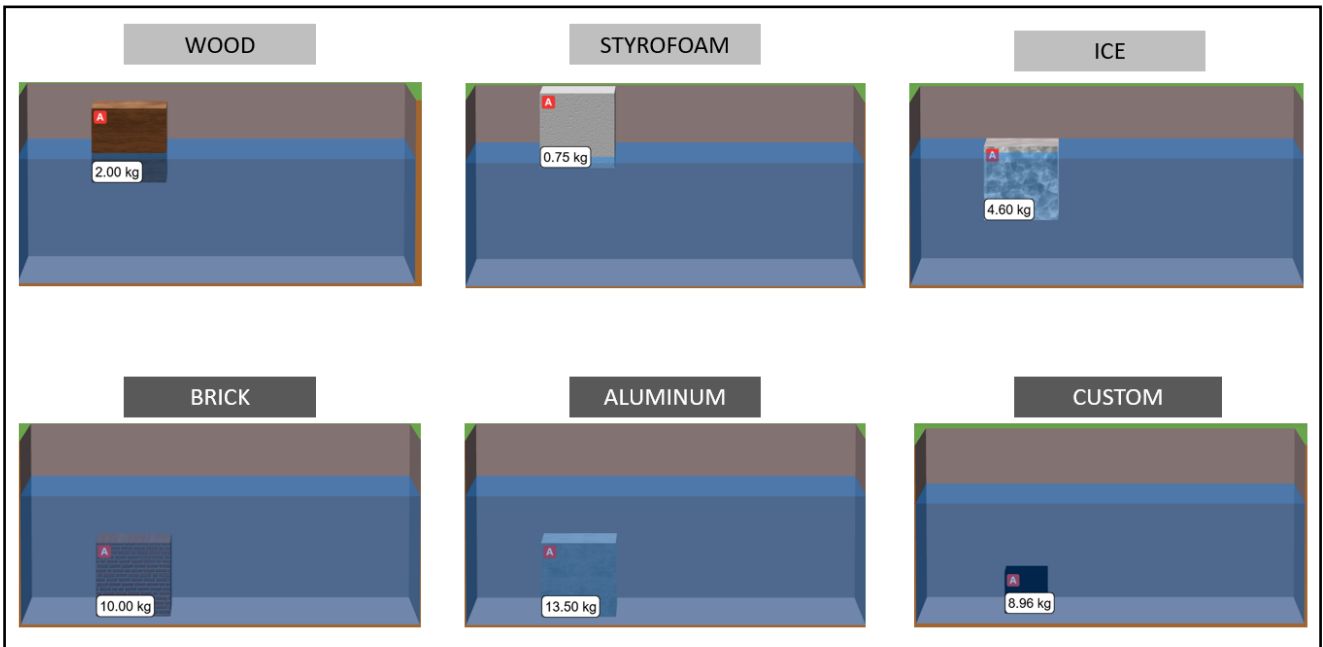
5. **EXPLAIN** why the blocks from the previous questions behave differently when they are placed in water.

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Suggested Answers

Description of the situation	Prediction of what will happen
A STYROFOAM is placed in the water.	Personal response.
ICE is placed in the water.	Personal response.
A BRICK is placed in water.	Personal response.
A COIN is placed in the water.	Personal response.

Material	Density (Kg/L)	Sink (mark with an "X")	Float (mark with an "X")
Wood	0,40		X
Styrofoam	0,15		X
Ice	0,92		X
Brick	2,00	X	
Aluminum	2,70	X	
Custom	8,96	X	



CHALLENGE

When a material has a density greater than that of water, its tendency is to sink in it; When a material has a lower density than water, its tendency is to float in it.

Post-Lab

1. C.
2. C.
3. B.
4. A.
5. The blocks have different densities: the first has a density lower than that of water; the second has a density greater than that of water.