



Science Unit: Beluga Whale

Lesson 1: *Float or Sink?*

School Year: 2015/2016

Developed for: Champlain Heights Annex, Vancouver School District

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Grade level: Presented to grades 1-2; Some of the more complicated concepts (e.g., displacement and density) more appropriate for grades 3-4.

Duration of lesson: 1 hour and 20 minutes

Notes: Students will be using containers with water and raw eggs.

Objectives

1. Learn about the special properties of water important to whales.
2. Predict the buoyancy of different types of objects and then observe whether they float or sink in freshwater and salt water (curriculum concept: properties of matter). Learn about what controls buoyancy force and how this relates to life of whales and other large aquatic animals.

Background Information

Buoyancy is the scientific word to explain why things float (or sink) in fluids. Animals in the ocean can grow far larger than animals on land because of the support that water provides them. This support is called buoyancy force and comes from the water that they displace by their bodies. Buoyancy force is the upward force an object feels from the water that is displaced by that object. Heavy, high density objects typically sink while light low density objects typically sink. Density is the mass of an object per unit volume. Any object will either float or sink in water depending on its density (how much a certain volume of it weighs). If it's denser than water, it will usually sink; if it's less dense, it will float. It doesn't matter how big or small the object is. The key basic rule is that an object will sink if it weighs more than exactly the same volume of water than it displaces (or moves out of the way). The more it displaces the more the upward buoyancy force that the water produces. This is how a boat can stay afloat. If it displaces enough water, this water weighs more than the boat itself and therefore provides enough upward thrust (buoyancy force) to support the boat.

The buoyancy of an object floating in water is greater in salt water than in fresh water due to the dissolved salt giving the water a greater density. This increase in density results in a greater upward force and hence an object will float better (higher) in saltwater than in freshwater. When water freezes it becomes ice and floats on water. This is because the molecules of ice are more spread apart than when in water. This means it is less dense than water and therefore floats. If ice was heavier than water then when ice was formed it would sink to the ocean/lake/river bottom and stay frozen and then freeze solid from the bottom up. Most life in the oceans gets oxygen from liquid water and cannot get it from ice – nor could animals move. The oceans of the arctic and Antarctic would all die if ice didn't have this special property.



Vocabulary

Buoyancy:	The ability or tendency to float in water or air or some other fluid.
Density:	Mass per unit volume (high density is heavy, low density is light)
Displace	To move, shift, or force from the usual place or position

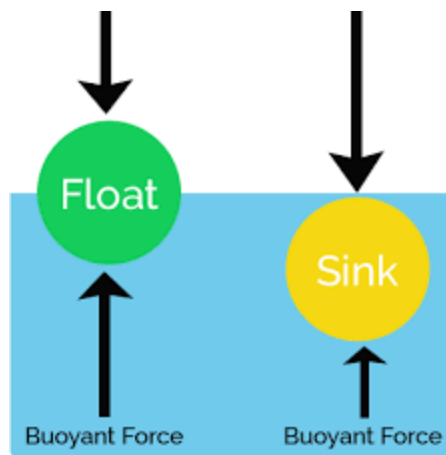
Materials

- | | | |
|---------------------|-----------------------|----------------|
| • 6 inch containers | • Eggs | • Marbles |
| • Play dough | • Small piece of wood | • Box of Salt |
| • Ice cubes | • Cooler to keep ice | • Paper towels |

In the Classroom

Introductory Discussion

1. Short description of 'hook' to capture student's attention.
 - Get the class to brainstorm about why the largest animal to have ever lived lives in the ocean not on land. Talk about how one can float in water when you have air in your lungs but sink when you let the air out. Why do you float? Talk about how one can lift someone in a swimming pool but not out of water. The water is helping lift the person up. Talk about how it easier to float in the sea than in a swimming pool and discuss the only difference is the sea has salt in it.
 - Explain buoyancy is due to the upward force an object feels from the water that is displaced (moved away) by the object. Buoyancy is the scientific word to explain why things float or sink in fluids. Talk about how the level in a bath goes up when you get in – you are displacing the water (which you can show in class by putting your fish into a graduated container) and this creates an upward pushing force. The force increases the more water that is displaced. If the upward force of buoyancy is greater than the downward force due to the weight of the object then it will float. Brainstorm why a piece of wood floats and a rock sinks - introduce the word density (the mass or weight of an object of a set volume) and that a rock is high density and a piece of wood is low density. Explain we are going to do an experiment to show how buoyancy works and why buoyancy of water is so important for Beluga whales and life in the ocean. Get them starting to think why a big heavy metal boat can float.



2. Briefly describe science experiment/activity.



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- Students will make predictions on whether each of the items provided will sink or float in fresh water.
 - After everyone has made their predictions, pairs of students will test their predictions and record their observations, noting whether their prediction was right or wrong.
 - After testing each object, student will be asked to make a boat shape from play dough to see if they can make the play dough float. They will then add a cup of salt to the water and retest whether the egg now floats or sinks.
 - Together review the class results and discuss buoyancy and how buoyancy is important in the lives of whales and other marine creatures.
3. Explain that the focus of this lesson is to introduce the process of making a prediction, observing an experiment, recording results and drawing a conclusion from those results. The lesson involves the buoyancy of objects and relates to the curriculum via states and properties of matter.
 4. Briefly describe safety guidelines.
 - Let the students know that we will be using raw eggs and to be careful and not to be splashing water

Science Activity/Experiment

Activity Title: Testing whether objects float or sink

Purpose of Activity:

To learn about buoyancy and the special properties of water (that salt water provides more buoyant than freshwater and that ice float on water because ice is less dense than water)

Experimental Observations:

Students will use their prior knowledge of what things sink or float to predict whether five different objects will float or sink in freshwater. They will then observe and record whether they were right or wrong. They will then make additional predictions on whether a boat made out of play dough (which had sunk as a ball) will float or not and whether if a cup of salt is added to the water whether the egg will now float (noting it would have sunk in fresh water). The results of each observation will be discussed as a group.

Methods and Instructions:

Set-up prior to experiment: Ideally, students work in pairs and all items are set out prior to starting bar the ice.

1. Provide the worksheet and ask students to make their predictions.
2. Test the five different objects in order, a marble, a ball of play dough, a piece of wood, an egg and an ice cube. Make sure the students record their observations and note if their prediction was right or wrong. The data sheet is set up to put ticks in the relevant box (floats/sinks). An additional box is provided to tick or cross whether the student got their prediction correct.
3. Next ask students to predict whether a boat made of play dough will float or whether if salt is added to the water whether the egg will now float.
4. Show the students how to make an even circular (coracle-like) boat, by flattening the play dough and having nice even sides. Let them test floating their boats then add a good cup of salt and let them test the egg. This time it will float. Ask them to think about why the egg now floats (What has changed)?
5. Make sure the data sheet is completed and get the students to clean up and then come to carpet area to discuss their results. Students that finish early could test different boat designs or see how many marbles it takes to sink the boat.
6. The Class will discuss the basic concepts of buoyancy and weight. Marbles, the egg and play dough are denser than fresh water – they are heavy and compact and so sink (called negatively buoyant).



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Wood is less dense than water and floats (positively buoyant). So an object with higher density than water will sink in water. Students should all agree that the marble, egg and play dough ball sank.

7. Next talk about the ice floating – brainstorm over why this happens and why this is such a vital property of water. Ice must be less dense than water – the molecules of ice are more spread apart than when in water. That makes it less dense (or less heavy) than water. Ice also often has air bubbles trapped which help it float. So as ice is less dense than water it will float (like ice on a pond or an iceberg). If ice was heavier than water then when ice was formed it would sink to the ocean/lake/river bottom and stay frozen and then freeze solid from the bottom up. Most life in the oceans gets oxygen from liquid water and cannot get it from ice – nor could animals move! The oceans of the arctic and Antarctic would all die if ice didn't have this special property.
8. Discuss the egg in freshwater and saltwater. Discuss how saltwater gives you more buoyancy than freshwater – because it has more matter in (the salt) and this makes it denser and now the egg is LESS dense than the saltwater. Discuss floating in the Dead Sea – a body of water with very high salt content where one can float with no effort at all. We will discuss how this helps large animals to live in water in the closing discussion.
9. Ask who managed to float their boat? Ask them to think about why they think the boat floats but the same piece of play dough sinks when in a ball? The reason why the boat and indeed large metal ships can float in water is because by making a boat shape, enough water has been displaced (moved out of the way to the hull or sides of the ship to weigh MORE than the weight of the boat itself. The basic rule is that an object will sink if it weighs more than exactly the same volume of water than it displaces.

Closure Discussion

1. How can whales grow so big? The buoyancy of an object floating in water is greater in salt water than in fresh water. This helps support their bodies and so they can grow heavier and bigger. Discuss floating and reading a newspaper in the Dead Sea.
2. Talk about a child's buoyancy in the swimming pool. We can increase buoyancy by having lots of air in our lungs (never panic and swallow water as this reduces buoyancy), by wearing low density floats or kicking or sweeping one's arms to provide more upward force.
3. Review why it's so important that when ice freezes it floats.
4. Review the basic rule - that an object will sink if it weighs more than exactly the same volume of water than it displaces.

Extension of Lesson Plan

1. Test different objects.
2. Design different boat shapes.



Buoyancy Data Sheet		Name		Date
Object	Circle Your Prediction	Object SINKS?	Object FLOATS?	Correct Prediction
<i>Marble</i>	<i>SINKS FLOATS</i>			
<i>Ball of Play Dough</i>	<i>SINKS FLOATS</i>			
<i>Wood</i>	<i>SINKS FLOATS</i>			
<i>EGG</i>	<i>SINKS FLOATS</i>			
<i>ICE</i>	<i>SINKS FLOATS</i>			
Play Dough Boat	SINKS FLOATS			
Play Dough Boat and 3 marbles	SINKS FLOATS			
EGG in SALTWATER	SINKS FLOATS			
Other:	SINKS FLOATS			