Sink or Float (ages 5-7)

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Summary: This seven-sequence module offers the opportunity to study the floatability conditions for various objects. The students will learn that it is not a matter of mass, but rather volume. The effect of spring water on the object is broached thereafter, then compared to that of saltwater.

Target concepts: The world of matter and objects; water in everyday life.

Objective: Since the start of school year 1996-1997, Ecole des Mines (Nantes) has been involved in a science education project, La Main à la Pâte, putting together toolkits (with all of the material needed to perform experiments in the classroom), as well as a guidance document.

For each topic covered, the document describes a range of experiences and suggests a general sequence of events, list of equipment used and list of required knowledge from the National School Board related to the topic of study. This can be a foundation for setting up science activities, in line with the La Main à la Pâte approach.

The general sequence of events is provided for guidance purposes only.

Intentionally, the document does not elaborate on the pedagogical approach to be adopted, rightfully leaving it to the initiative of the teacher – the specialist.

NB: The seven-sequence module was taken from the guidance document included with the toolkits.

Materials: For a class of 30 (7 groups):

- 7 plastic bins
- 49 empty canisters (camera film size)
- 7 pieces of transparent tubing (Ø = 6 mm, L = 40 cm)
- 14 plastic cups
- straws
- clay
- string
- rubber bands
- 7 steel nails (Ø= 5 mm, L = 15 cm),
- salt
- 1 rock (to be brought from home)
- 1 small fishing pole or bendable wooden stick (to be brought from home)
- 20 1.5-L plastic bottles (to be brought from home)
- 10 0.33-L or 0.5-L small plastic bottles (to be brought from home)
- 7 jam jars (to be brought from home)
- a variety of materials: sand, seeds, rice, flour, cotton, etc. (to be brought from home)
- 1 Roberval scale.

Sequence 1: Pretest

Have children discuss and draw in order to bring out children's pre-conceptions.

Check hypotheses about object floatability selected by students (2 sessions).

Objective: To bring out children's pre-conceptions regarding what floats and what sinks, as well as floatability criteria.

Materials (per child):

- one piece of paper

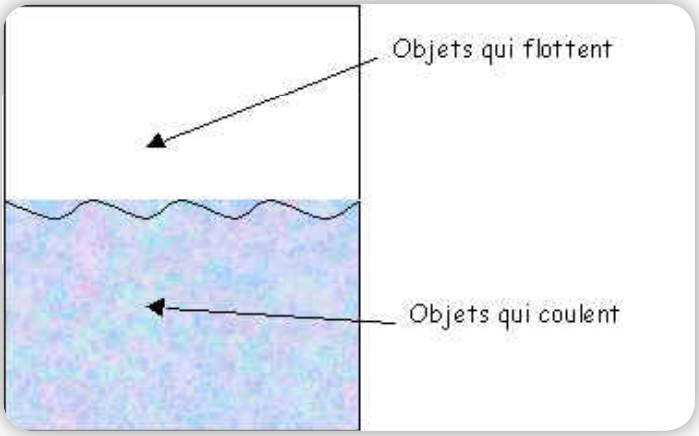
Materials (per group):

- various small classroom objects: pencil, scissors, nail, piece of wood, rubber band, cork, plastic, etc.
- 1 bin half-filled with water.

Session 1

The session begins with a discussion: what is floating? Do you know of any objects that float? What is the opposite of floating? Later, a number of everyday objects are shown (pencil, scissors, nail, piece of wood, rubber band, cork, rock, plastic, etc.) to the children. The children are asked to draw the objects that float and those that sink on a piece of paper showing a side-view of a bin filled with water.

Example:



Objects that float

Objects that sink

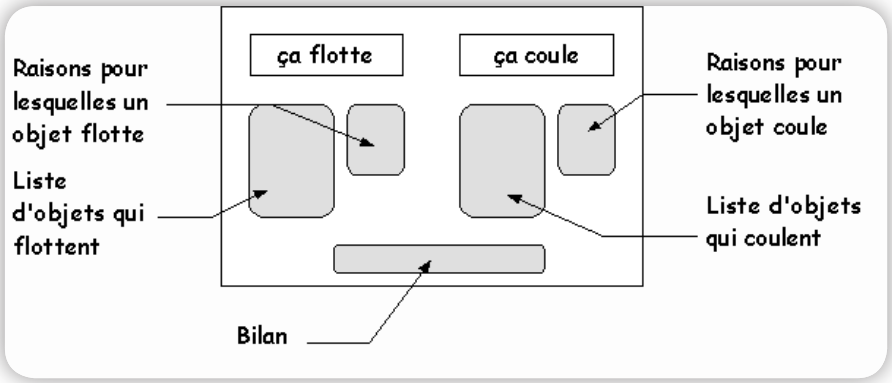
At the end of the first session, all of the results are pooled. Discussion can focus, for instance, on where the objects are positioned in the drawing (at the surface, at the bottom of the bin).

Session 2

After reviewing the results from the previous session and, in order to check the children's hypotheses, experimentation begins.

At the end of the session, a discussion takes place to identify some of the criteria for floatability: each of the objects used during the experiment is reconsidered and the children are asked to explain why each floats.

To conclude the session, a large poster can be set up with the children:



	These float	*These sink*	
Reasons why an object floats			*Reasons why an object sinks*
List of objects that float			*List of objects that sink*
	Conclusion		

The conclusion at the bottom of the poster will highlight the most important criteria, in the children's view, for which an object floats or sinks (matter, object mass, shape, amount of water, etc.).

Sequence 2: How an object's shape influences its floatability

Sequence 2 in Sink or Float module: Two objects with the same mass do not necessarily have the same floatability. It depends on their shape (1 session).

Objective: To compare the floatability of 2 objects with the same mass, but different shapes, and touch on the influence of the space occupied by the object in the water.

Materials (per group):

- modelling clay,
- a bin,
- a jam jar

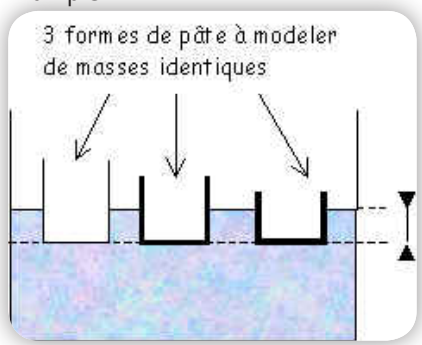
Materials (for the class) :

- a scale.

Procedure

The children are asked: "In your opinion, if two objects have the same mass and one sinks, will the other sink too?". The children experiment in groups. They use the scale to form pieces of modelling clay with the same mass. They are then challenged to make the pieces of clay float.

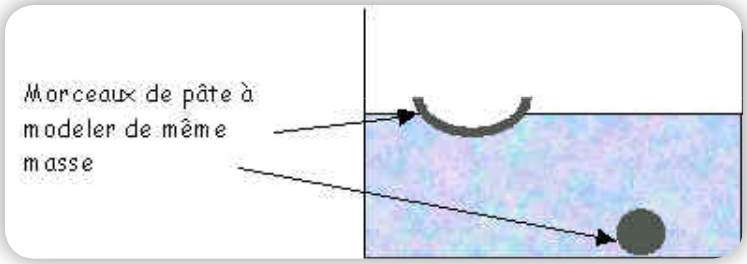
Example:



Pieces of modelling clay with the same mass

The children discuss in their groups, then as a class, to try to explain the experiment. The discussion will touch upon the space occupied by the object in the water, which varies depending on the object's shape. The concept of immersed volume can be "brought out" by modelling several shapes of different heights but identical mass, using a matrix (jam jar, for instance):

3 pieces of modelling clay of identical mass



Sequence 3: How an object's mass influences its floatability

two objects of the same shape (identical from the outside) but different masses do not have the same floatability. (1 session)

Objective: To compare the floatability of objects with the same shape and volume, but different masses, and begin to discuss the influence of mass.

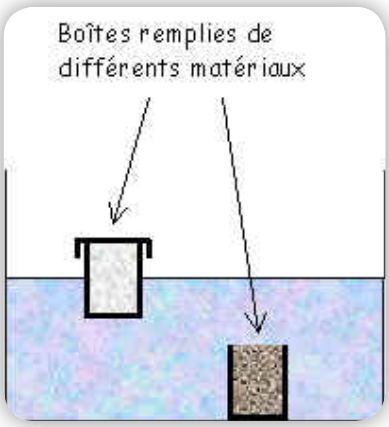
Materials (per group) :

- 7 empty camera film canisters,
- a variety of materials (sand, seeds, rice, flour, cotton, modelling clay, etc...),
- a scale,
- a plastic bag.

Procedure

First, the children are asked whether two objects of the same shape and volume but different masses float in the same way. The children observe and handle the canisters, which are empty and closed. They all float in the same manner. Then, they are asked to come up with an experiment in which they can compare the floatability of objects of the same shape, but different masses. They are shown different materials which they can use. The children discuss this in groups. They should remember to fill the canisters completely, whatever the material used. They are then asked to predict what will happen when they put the canisters in the bin, and check whether they are correct, by immersing them in the water. (A balance may be used to compare the mass of each canister).

Canisters filled with different materials



Sequence 4: How Water Influences an Object's Floatability

Water has an influence on an immersed object. It pushes the object it holds all the way to the top (1 session).

Objective: To demonstrate the action of water on an object's floating: it "pushes" the object it holds all the way to the top"

Materials for Workshop 1:

- 1 plastic bin,
- 2 0.33-L or 0.5-L plastic bottles

Materials for Workshop 2:

- 1 plastic bin,
- a fishing pole or bendable wooden stick,
- string,
- 1 0.33-L or 0.5-L plastic bottle

Materials for Workshop 3:

- 1 Roberval scale,
- sand,
- 1 rock,
- string,
- 1 plastic bin.

Procedure

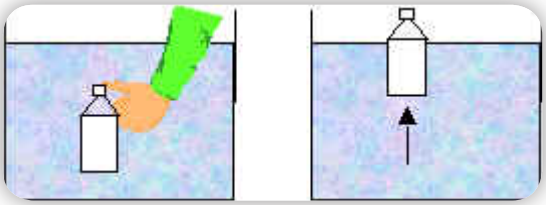
At the beginning of the session, the children are asked what they think about how water affects an object's floatability. Does water have no effect at all? Does it affect only objects that float, or all objects? Does it also affect objects that sink?

The children are offered the opportunity to work on a sequence of 3 workshops, watching the effect that water has on an object in each situation. After each workshop, the children suggest explanations.

Workshop 1

The children immerse a small empty, closed plastic bottle, then let it go.

The bottle is swiftly pushed to the top.

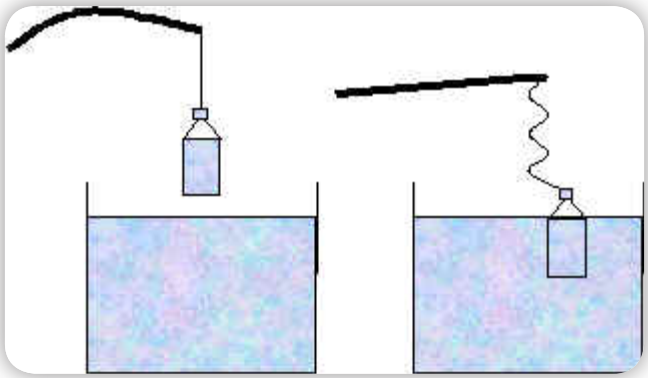


Water exerts an upward power on the object that floats.

Workshop 2

A small bottle filled with water or sand is attached to a fishing pole. When plunged into the water, the bottle noticeably "pulls less on the string".

This experiment lets students grasp the action of water on an object that is sinking.



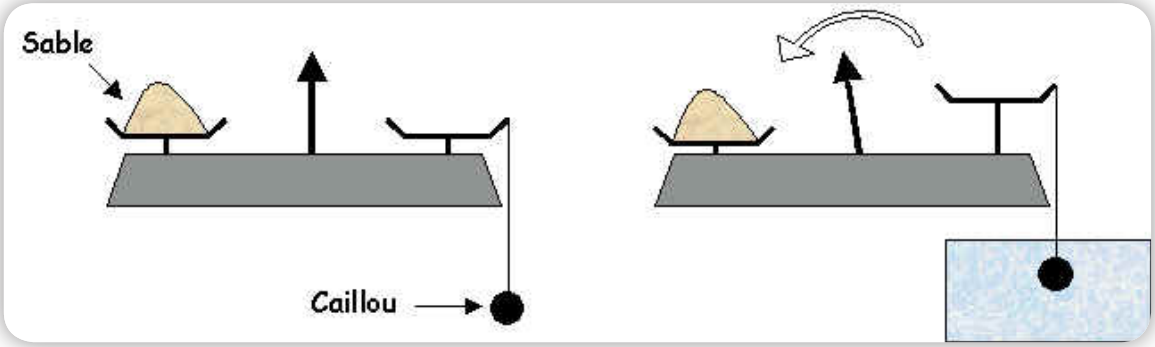
The water exerts an upward push on the bottle that is sinking.

Workshop 3

The children balance out the scale as shown in the drawing below, then watch how the balance changes when a rock is immersed in a recipient filled with water.

Sand

Rock



The water exerts an upward push on the rock that is sinking.

Note: be careful not to leave the children with the idea that the rock is lighter than the water. It is only the water's action on the rock that changes the balance.

End the session by pooling all of the comments to show the role of water on an immersed object.

Sequence 5: How the Amount of Water Influences Floatability

The amount of water does not have any influence on the floatability of an object (1 session).

Objective: Observe the influence of the amount of water on an object's floatability.

Materials per group:

- 2 plastic cups,
- modelling clay to ballast the cups,
- 1 plastic bin.

Procedure

Initially, each child writes what how he thinks the amount of water influences floatability. After pooling the opinions through a "survey", the children are challenged to design and carry out an experiment that shows the role of the amount of water on an object that floats. The children move to the experimentation stage. They ballast the cups with modelling clay to produce an object that floats, and plunge the same cup in a bin filled with a lot of water, then in one with little water (put in enough modelling clay so that the cup floats sitting straight up).

They observe then draw the immersion level.

Floating ballasted cup

Note: the experiment can be repeated with an object that sinks

The expression "amount of water" can be replaced by "water depth".

Sequence 6: How Liquid Density Influences Floatability

Summary: An object floats more easily in saltwater than in freshwater (1 session).

Objective: Broach the concept of a liquid's density: the study will be limited to two examples, freshwater and saltwater

Target concepts: The world of matter and objects; water in everyday life.

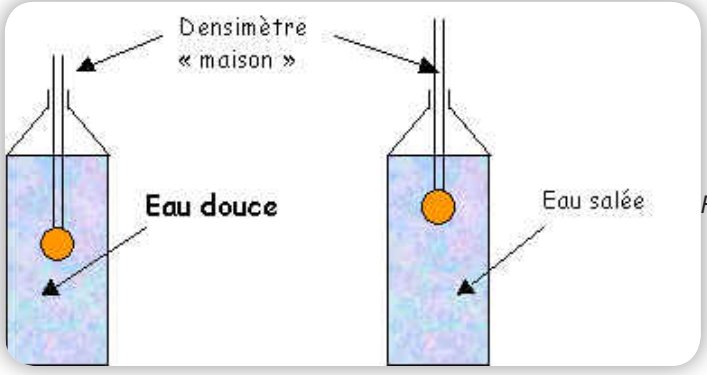
Materials per group:

- 1 plastic bottle filled with freshwater,
- 1 plastic bottle filled with saltwater,
- 1 straw,
- modelling clay.

Procedure

At the start of the session, the children give their opinion on the difference in floatability between freshwater and saltwater. After explaining what a densimeter is (here, it will be a straw ballasted with modelling clay so that it floats), the children build a densimeter in each group and plunge it into a bottle of freshwater and a bottle of saltwater.

The children depict their observations in a drawing and look for an explanation.



"Home-made" densimeter

Freshwater *Saltwater*

Sequence 7: Building a Submarine

Building a submarine, meaning an object that can alternately float or sink (1 session).

Objective: Design and build an object that can alternately float or sink.

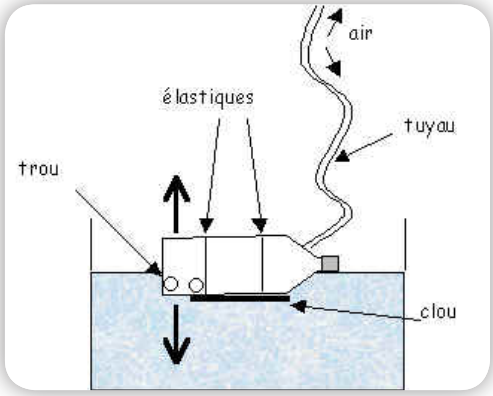
Re-establish the concepts touched upon previously.

Materials per group:

- 1 small tank at least 15 cm in depth,
- 1 0.33-L bottle mineral water,
- a piece of transparent tubing (Ø = 6 mm, L = 40 cm),
- 1 steel nail (Ø = 5 mm, L = 15 cm),
- 2 rubber bands.

Procedure

The schoolteacher announces to the class that each group will be asked to design and produce an object that alternately floats or sinks. "Do you know of any objects that can both float and sink?": submarines. After discussing how submarines work and focusing on the use of reservoir tanks that fill up with air or water (ballasts), each group comes up with its own model and moves to the design stage. Holes must be punched in the bottle so that it can fill up with water and use the tubing to bring in air. A long nail is used to ballast the plastic bottle and facilitate immersion.



air

rubber bands

tubing

Hole

nail

An experimental protocol designed by the teacher can also be suggested so that the children build a submarine model.

Going farther

During the week, you may come back to the session, asking the children to write a design notice.