**ACTIVITY: Investigating floating and sinking**

**Activity idea**

In this activity, students directly observe how everyday objects behave in water and investigate the factors that determine whether an object will float or sink. Through play and exploration, students are supported to predict, observe and make sense of their observations.

By the end of this activity, students should be able to:

* make predictions about whether a range of objects will float or sink
* discuss where the objects are in the water – for example, on top or partially submerged
* make observations that may contribute to understanding why the items float or sink
* classify/group items on the basis of similarities in their ability to float or sink
* design their own investigation to answer a question they have regarding floating and sinking (optional).

**For teachers**

***Introduction/background***

This set of activities enables students to interact with a variety of objects and test whether they float or sink. The activities build upon each other to encourage students to make more detailed and refined observations regarding the phenomenon of floating and consider why an object floats or not. The article [Building Science Concepts: Floating and sinking](https://www.sciencelearn.org.nz/resources/3181-building-science-concepts-floating-and-sinking) has useful background information for educators.

***Alternative conceptions***

Most students will have experiences with floating and sinking – from time spent in the bath, lake or pool. Through play and observation, they will have created their own concepts and explanations regarding why things float or not. Students are unlikely to have considered the concepts of density and forces. They will, however, have developed personal vocabulary to describe their experiences.

The most common alternative conceptions that students have regarding floating and sinking involve size and weight. Students will most often think that an object ﬂoats because it is small and/or light and it sinks because it is big and/or heavy.

Additional alternative conceptions include:

* the softness of an object – soft objects are more likely to float than hard objects
* hollowness – objects only float because they are hollow/have air inside of them
* where the object sits in the liquid – floating objects must sit wholly above the surface of the liquid
* similarities in weight – if two objects weigh the same, they will both float or both sink.

Being aware of alternative conceptions helps educators identify them when they surface in discussions and provides an opportunity to scaffold change.

***Forming accurate conceptions requires time and multiple learning experiences***

Density – the relationship between mass and volume – is an abstract concept. It is not easily perceived through observation. Forces – gravity and the upwards force of buoyancy – are also complex concepts.

It may take several years for students to build their understanding of the concepts that underlie floating and sinking. Experiencing, identifying and describing the patterns associated with this physical phenomenon feature in levels 1–5 of the New Zealand Curriculum (NZC).

***What you need***

* A collection of objects – choose a wide variety of sizes, shapes, weights and materials – for example, paper, wood, plastic, metal, cloth and leaves
* A collection of spherical items – for example, large glass marble, golf ball, tennis ball, candle, styrofoam ball, ball of wool/pom pom, ping pong ball and an orange
* A collection of candles – choose a wide variety of sizes, shapes and colours
* A large container of water such as an aquarium with transparent sides to observe what is happening
* Water
* Hula hoops or similar
* Paper or devices to record ideas

**Activity 1: Floating and sinking – a sorting activity**

***What you need***

* A collection of objects – choose a wide variety of sizes, shapes, weights and materials – for example, paper, wood, plastic, metal, cloth and leaves
* A large container of water such as an aquarium with transparent sides to observe what is happening
* Water
* Hula hoops or similar
* Devices to record ideas

***What to do***

1. Fill the container with water.
2. Choose a couple of the items for demonstration. This is an ideal time to discuss procedures – how to place and retrieve items in the container, observation procedures – and to introduce vocabulary. Students may have differing ideas regarding words like ‘floating’ and ‘sinking’ so use this opportunity to gather ideas and establish what the terms mean in a scientific context.
3. Invite students to examine the collection of objects. Ask them to make predictions as to whether the items will float or sink.

1. Use the hoops to sort the items based on student predictions – float, sink, not sure.
2. Test the predictions by placing the items one at a time into the water.

*Note: Allow time to establish whether each item is floating or sinking. Some may appear to float but then gradually sink, others may appear to sink but then float just below the surface.*

1. Ask students to observe and report on what happens. Discuss the position of the item in the water. Is it floating on the surface, partially submerged or fully submerged? Discuss sinking as ‘falling’ through the water to the bottom of the container.
2. Use the observational evidence to sort the items back into the hoops marked float, sink and not sure. Challenge older students to sort how the items floated – whether on the surface, partially submerged or possibly even suspended.
3. Share the results (as in the example below) and add in the students’ ideas on what might be helping the objects to float or sink. Younger students can make drawings and use labels.

|  |  |  |
| --- | --- | --- |
| **Item** | **Observation: float or sink** | **Ideas as to why the item might float or sink** |
| tennis ball | float | has a furry covering  has air inside it  lightweight |
| nail | sink | made of metal  heavy for its size  small volume so will only displace a tiny amount of water |
| plastic lunch box | float | made of plastic  has air inside it |

***What to look for***

* Do students use the terms ‘floating’ and ‘sinking’ appropriately?
* How do students describe items that float just beneath the surface of the water?
* How do students explain the sinking or floating phenomenon?
* What language do students use to describe the properties of objects that float?

**Activity 2: Looking for patterns**

***What you need***

* The grouped objects (student-generated data) from the sorting activity above
* Hula hoops or similar
* Paper or devices to record ideas

***What to do***

1. Observe the items in the collection of objects that float.
2. Discuss some of the common characteristics shared by the items – for example, made of plastic or wood, hollow, squishy. There are no incorrect answers as long as students can justify their thinking.
3. Create new groups of items based on their shared characteristics. Place them in separate hoops with labels or descriptions.
4. Repeat this process with the collection of items that sink.
5. Ask students to come up with other everyday objects that would fit into these categories.
6. Record or share the results of the activity.

***What to look for***

* Are students able to group items by shared characteristics?
* Do these characteristics involve alternative conceptions – such as heavy or light – that may require further discussion to move to a more scientific view?
* What reasons do students provide for the phenomenon of floating or sinking? Are there any changes to their thinking?
* Can students accurately recognise and describe instances of floating and sinking from their everyday life? (This connects well to the ‘Participating and contributing’ strand of the NZC and the science capability ‘Engage with science’.)

**Activity 3: Exploring similarities and differences in materials**

***Science concept: density***

If an object is less dense than the water it is displacing, it will float. If an object is denser than the water it is displacing, it will sink.

Very simply, density is determined by:

* how tightly packed the particles are inside the object – for example, a glass marble compared to a pom pom
* whether the object’s shape causes it to hold air – for example, a ping pong ball compared to a golf ball.

***What you need***

* A collection of spherical items – for example, large glass marble, golf ball, tennis ball, candle, styrofoam ball, ball of wool/pom pom, ping pong ball and an orange
* A large container of water such as an aquarium with transparent sides to observe what is happening
* Water
* Hula hoops
* Paper or devices to record ideas

***What to do***

1. Display and/or handle the spherical items. Discuss similarities and differences.
2. Ask the students to make predictions as to whether the items will float or sink.

1. Use the hoops to sort items based on their predictions – float, sink, not sure.
2. Test the predictions by placing the items one at a time into the water.
3. Ask students to observe and report on what happens.
4. Use the observational evidence to sort the items back into the hoops marked float, sink and not sure.
5. Discuss the properties of the items and the influence this might have on whether the item floats or sinks.
6. Create new groups of items based on their shared characteristics. Place them in separate hoops with labels or descriptions.
7. Ask students to consider other spherical objects that might fit into the categories.
8. Record or share the results of the activity.
9. Extend the activity by using items that have similar sizes and shapes but have different densities – for example, plastic and metal spoons, plastic and metal rulers, dry pumice rock and non-porous rock, a piece of chalk and a metal bolt.

***What to look for***

* What reasons do students now give for the phenomenon of floating or sinking? Are there any changes to their thinking?
* Are students able to group items by shared characteristics?
* Do these characteristics involve alternative conceptions – such as heavy or light – that may require further discussion to move to a more scientific view? For example, a golf ball and ping pong ball are of similar sizes. A golf ball and an orange have similar weight.
* Are the suggested objects appropriate for the category? For example, a basketball will float and a bowling ball will sink.
* Are students beginning to discuss the composition of items? That some items have air inside of them?

**Activity 4: Exploring density**

***Science concept: density***

If an object is less dense than the water it is displacing, it will float. If an object is denser than the water it is displacing, it will sink. With many candles, wax is less dense than water, so wax candles float regardless of their size or shape.

***What you need***

* A collection of candles – choose a wide variety of sizes, shapes and colours – test the candles prior to the activity to ensure they all float
* A large container of water such as an aquarium with transparent sides to observe what is happening
* Water
* Hula hoops or similar
* Paper or devices to record ideas

***What to do***

1. Display and/or handle the candles. Discuss similarities and differences.
2. Ask the students to make predictions as to whether the candles will float or sink. Will size or weight make a difference?

1. If desired, use the hoops to sort items based on their predictions.
2. Test the predictions by placing the candles one at a time into the water.
3. Ask students to observe and report on what happens.
4. Discuss the properties of the candles and the influence this might have on their behaviour in the water.
5. Record or share the results of the activity.

***What to look for***

* What reasons do students provide for the phenomenon of floating or sinking? Are there any changes to their thinking?
* What terms or descriptions do the students use regarding size, shape or weight of the candles?
* Do students recognise that the candles are made of a similar substance (wax) and this is influencing whether the candles float or sink?

**Activity 5: Student-led investigations**

***What to do***

1. Review the activity results.
2. Discuss questions the students might have or things they would like to explore.
3. Help students refine their questions and consider the materials needed.
4. Provide time for students to create text or images explaining the investigation’s process.
5. If possible, create the opportunity for students to experience each other’s investigations.
6. Discuss the activity results and outcomes.

***What to look for***

* What language are the students using in the design of their questions and investigations?
* What concepts are they exploring? Are they still focused on the simple aspect of ‘will it float?’ or are they able to explore in greater detail?
* Are there changes to their thinking about floating and sinking?
* Are they able to use more scientifically accurate terminology and explanations in their investigations?
* Are they able to explain their results with appropriate clarity?