**ACTIVITY: Floating and sinking – exploring forces**

**Activity idea**

In this activity, students explore the forces that underpin floating and sinking.

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

* use a variety of objects to experiment with the forces of floating and sinking
* begin to use content vocabulary
* begin to discuss the forces that act on the objects in the water
* draw a diagram to label what they noticed using the conventions of diagrams.

**For teachers**

***Introduction/background***

An object floats when the weight force (gravity) on the object is balanced by the support force (upwards push or upthrust) of the water on the object. If we push down on a floating object, this creates an unbalanced force and the object no longer floats. We can feel the support force (upthrust) pushing the object upwards while we are pushing it downwards. We can see the support force in action when the object pops up or even pops out of the water when we stop pushing it down.

Both gravity and upthrust are unseen forces, which adds a significant layer of complexity to learning about floating and sinking. Understanding these concepts and forming accurate conceptions requires time and multiple learning experiences. Experiencing, identifying and describing the patterns associated with this physical phenomenon feature in levels 1–5 of the New Zealand Curriculum.

***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 forces and density. They will, however, have developed personal vocabulary to describe their experiences.

It’s important to address content vocabulary. There are many words with common meanings that differ from scientific meanings. For example, younger students may:

* associate floating with objects like balloons or clouds
* find the term ‘balance’ confusing – in this context, we are looking at the equal action of opposing forces
* find the term ‘force’ confusing – in this context, force is the influence that produces a change.

Students often hold alternative conceptions regarding floating and sinking, most commonly involving 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.

***What you need***

* A collection of objects that float – for example, empty sealed plastic drink bottles or jars, bath toys like rubber ducks and tennis balls
* A collection of items that sink
* Containers of water
* Paper or devices to record ideas

***What to do***

1. Prior to the activity, gauge students’ thinking about why some things float. Discuss content vocabulary now and continue to keep this in mind while experimenting.
2. Place an object that sinks in a container of water. Discuss the students’ observations. (Sinking is a type of falling. Gravity is pulling the object downwards to the centre of the Earth.)
3. Place an object that floats in a container of water. Discuss the students’ observations. Why doesn’t this object fall? What’s holding it up? (Although the force of gravity is pulling on the object, the force of the water supporting the object is stronger.)
4. Press the floating object into the water. Discuss what’s happening, including the forces that are pushing down and the force that is pushing up.
5. Release the object and observe what happens. Discuss the students’ observations. What force caused the object to pop back up and possibly even jump out the water? (The force of the water – the upthrust – is stronger than the pull of gravity.)
6. Observe what happens to the object after it rises to the surface. Discuss how the forces are at balance again, meaning the object floats.
7. Invite students to experiment with the various items. Discuss the pushes and the push-backs and the pulls as objects sink. Discuss which of the pushes/pulls are the strongest, along with the evidence to back the statements up.
8. If space allows, try pushing items of different sizes under the water. Do the forces feel the same or does one feel stronger than the other. What might cause them to be different?
9. Invite students to create diagrams to show what they think is going on. If this is a new experience for younger students, model what the diagram could look like. An example is shown below.

