HOW A BOAT FLOATS

The City of Ottawa we know today was born out of a major construction project in the 1820s:

The Rideau Canal.

When the Rideau Canal was first built, its purpose was as a transportation route for British troops to safely make their way from Montreal to Kingston and back.

The Canal has been used for many reasons. Troop transport, trade, public transportation, and more recently, pleasure boating.

The Rideau Canal can't stay open all year round, and is closed for the winter. Although boats can't use the canal in the winter, people still can. Each year in January and February a section of the canal is filled with water that freezes in the cold, and the Rideau Canal becomes the Rideau Canal ***Skateway***!

When spring rolls around, and the ice melts, Parks Canada begins to get the Canal ready to open for another boating season.

DID YOU KNOW…

The first full trip up the Rideau Canal took place in 1832. Lt. Col. John By, the Royal Engineer in charge of building the Canal, rode up to Bytown from Kingston on the steamboat 'Pumper', which was renamed 'Rideau' in honour of the special occasion!

The Rideau Canal welcomes boats of almost all shapes and sizes from May to October each year. Sometimes up to 6 small craft can fit in one of the Rideau Canal's locks at a time, and sometimes boats going down the Canal are so big, only one can fit in a lock at a time. But, with the help of some science, the question we are going to answer today is:

How exactly do the boats on the Rideau Canal float?

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Let's start our little science experiment by learning about something called **DISPLACEMENT.**

WHAT WE'LL NEED…	
-Dry erase or washable marker -Clay or Playdough -3 containers, roughly the same size -Water	1. Fill each of the containers about halfway with water. 2. With your marker, mark the water's level. Roll 3 balls of clay, one small, one medium, one large. 3. Drop each ball of clay into a container, and mark the new water level.

As you can see, the water levels in each of the containers rose after we put the clay in.

But why did the water rise?

This is because of **displacement**. When we put an object in water, it will displace, or move, the water out of the way. Think about taking a bath; when you get in the bathtub, just like the clay making the water in the container move, YOU make the water in the tub move out of the way!

Another question we have to ask is:

Did all the water levels change by the same amount?

No, they did not. The bigger balls of clay made the water rise higher than the smaller ones. When an object goes into water, the amount of water it displaces is equal to the **volume** of the object.

DID YOU KNOW…

If you were to travel all the way down the Rideau Canal, from Ottawa to Kingston, your boat would float along **202 kilometres** of canal, through **24** lockstations, and up and down **47** locks!

Volume is the amount of space an object takes up, or occupies. This explains why the amount of water displaced by each ball is different. Smaller balls of clay will displace smaller amounts of water, and larger balls of clay will displace more water.

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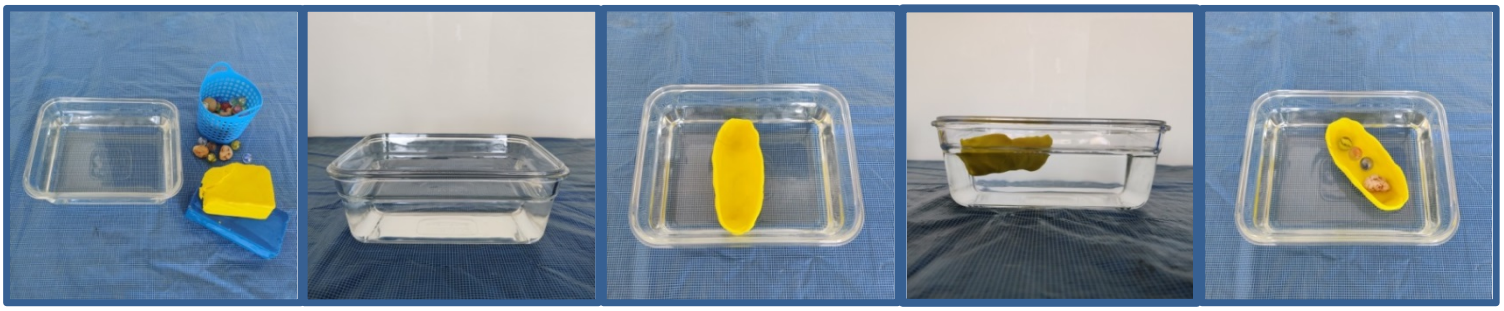
One thing to remember from our displacement experiment is that all three balls of clay sank to the bottom of their containers. It didn't matter what size the ball of clay was, both the large and small sank.

The challenge now is for us to find a way to make our clay float.

WHAT WE'LL NEED…	
-Clay or Playdough -A plastic basin, or glass container -Marbles or small stones -Water	1. Fill the basin or container about ¾ full with water 2. Mold your clay into the shape of a boat 3. Place the boat in the water and see if it floats 4. If it floats, carefully place marbles or stones in the boat to see how much it can hold before sinking



Why do you think the clay sank when it was a ball, but was able to float as a boat?

The force that allows boats to float is called **buoyant force**. Buoyant force occurs when water is being pushed out of the way by an object, and the water pushes back. The power of that a buoyant force depends on the amount of water that is being displaced by an object. If an object is small the buoyant force is small, and if an object is large, the buoyant force is large. Several factors can play a role in determining the buoyancy force and ensuring if an object will float or not such as shape, and **density**.

The density of an object is just how much matter is packed into the space an object takes up.

If you compare your small ball of clay to your clay boat, part of the reason one sinks and one floats is because the ball is much denser than the boat. When we spread the clay out into the shape of a boat, it is much less dense and the shape covers a larger area, and so it displaces a greater volume of water, equal to the weight of the boat, which in turn creates a much stronger buoyant force.

DID YOU KNOW…

In 2019 ***61,145*** people travelled through the numerous locks and lockstations along the Rideau Canal. People from all over Ontario, Quebec, Canada and even the United States paddle, sail, and motor up and down the Rideau Canal each year.

Try building and rebuilding new and different sizes and shapes of clay or playdough boats, drop some stones or marbles in them and see which design can carry the heaviest load before sinking!