Scientist Badge
Pack Holiday 1997

Topics

Floating and Sinking

Movement and Mechanics
The Natural World
Light
Electricity and Magnets

Floating and Sinking

Materials needed for Floating and Sinking.

Bowls.	Old bowel.	Newspaper.
Powder paint or oil paints	Cooking oil.	Straws.
Plain Paper.	Balsa wood boat.	Cocktail sticks.
Tin foil.	Nightlight.	Marker pen.
Jar.	Measuring jug.	Mothballs.
Sponge.	Surgical spirit.	Green food colouring.
Funnel.	Small flat bottle.	Saucepan.
Salt.	Large jar.	Egg.
Modelling clay.	Plastic bottles.	Plastic tubing.
Fresh lemon.	Balloons.	Elastic bands.
Raisins.	Lemonade.	Buckets.

Floaters and Sinkers

Some materials are heavier than others, and some are larger than others. If you have an object which has a lot of weight, in a small space (volume), we say it is very ***dense***. If you have a large light object, we say it is not very dense. ***Density*** is a measure of how much weight there is in a certain volume.

Does it Float or Sink?

Equipment: A bowl of water, various objects.

Method: Take some objects and see if they sink or float. Try to guess what will happen before you put them in the water. What do the floaters have in common? Which materials are they made from?

Expected Result: In general you will find that small, heavy objects, such as keys and stones, sink. Large, light objects, such as apples and balloons, float.

Explanation: Generally an object will float on water if it is less dense than water. It will sink if it has a higher density.

You may have found some objects that sometimes float and sometimes sink. For example, a paper towel floats at first, but it soon soaks up the water and sinks. A limpet shell floats one way up but if you turn it over it sinks.

Making Floaters Sink

Equipment: Sponge, lemon, Bucket of water.

Method: The air holes in sponge make it float high out of the water. Squeeze the sponge under the water. Can you see bubbles of air coming out of the sponge? When you let go of the squeezed sponge, how high does it float?

Tiny holes in the peel of a lemon contain air bubbles. The air makes the lemon float in water. But if you peel a lemon, it sinks!

Dancing Mothballs

Equipment: A glass, mothballs, baking soda, vinegar, teaspoon.

Method: Fill the glass almost to the top with water. Add four teaspoons of baking soda and stir well until it is completely dissolved. Add four teaspoons of vinegar to the mixture and stir well. Carefully put four mothballs into the mixture and watch carefully.

Expected Result: You will see the mothballs moving up and down the glass.

Explanation: You will see bubbles of gas forming on the mothballs and this will make them float to the surface. Some of the bubbles will burst when they reach the top. Then you will see the mothballs sink slowly. The vinegar and baking soda when mixed together produce carbon dioxide. Bubbles of this gas stick to the rough surface of the mothballs and act as floats.

Water Pushes Back

When you try to push a tennis ball under water you can feel it pushing back. When you let go the ball 'bounces' to the surface. It is hard to push the ball under water because the water pushes back. When you let go the water pushes it back to the surface again. The upward push of water is called ***upthrust***. An object floats if the upthrust of the water is strong enough to support its weight.

Pushing Water out of the Way

When you get into a bath, the level of the water raises to make way for your body. This is called ***displacement***. You can use displacement to measure the volume of objects.

Equipment: Measuring jug, bottle.

Method: Fill the bottle with water right up to the top. Stick your thumb into the bottle as far as it will go. Some of the water will spill over the edge. Now use the measuring jug to fill the bottle up to the top again. The amount of water you use to do this is equal to the volume of your thumb.

Make a Water Candle

Equipment: Nightlight, matches, jar of water, marker pen.

Method: Fill the jar with water almost to the top. Float the candle on the water. Use the pen to mark the level of the water on the side of the jar. Light the candle and watch the water level.

Expected Result: The water level will go down.

Explanation: As the candle burns, it gets lighter and floats higher in the water. Because the candle pushes less water up the sides of the jar, the water level goes down.

Boat Shapes

A ball of modelling clay sinks in water. But if you make the same ball of clay into a boat shape, it floats. The wide, flat boat shape pushes away more water than the narrow, round ball. The water pushes back harder against the flat shape and this holds it up on the surface of the water.

How Much Cargo?

Equipment: 'Boat' made from tin foil, thin balsa wood, 'cargo'.

Method: Use thin pieces of balsa wood to divide your boat into sections. Load the two end sections with cargo. Then the middle section and one end section. How does this affect the position of the boat?

A container ship is divided into separate sections. This helps to stop the containers moving about as the ship rolls about in rough seas.

Messing about with Masts

Equipment: A balsa wood boat, straws, cocktail sticks, 'masts'.

Method: Find the best position for a mast on a sailing ship. Fix a mast in one place on the boat (use a cocktail stick and slide a straw over it) and tip the boat to one side. When you let go does the boat tip over and capsize? Or does it swing upright again? Try different positions on the boat.

Make some sails to see how they help a boat to go faster. Blow on each sail or use a fan to see which shape of sail makes the boat move fastest. What happens if you blow through a straw on just one side of the sail? Try different shapes, sizes and numbers of sails.

Bottles and Balloons

Try putting some hollow objects in some water (plastic mug, plastic bottle, bowl, saucepan, empty drinks can). You will find that they all float. Try pushing them under the water. Look at all the bubbles of air rising to the surface. Even though hollow things look empty, they are really full of air. Fill a plastic bottle half full of water and put on the top. The bottle still floats in water. How much water do you have to put inside the bottle before it sinks?

Lifting Buried Treasure

Balloons are full of air so they float high out of the water. If you tie a balloon to a sinker, such as a metal spoon, it will float underneath the balloon. Archaeologists use special balloons to lift objects they find on an underwater dig up to the surface.

Rising Raisins

Equipment: Plastic beaker, raisins, lemonade.

Method: Put some raisins in the bottom of a clear plastic beaker. Fill the beaker half full of a clear fizzy drink like lemonade. Watch what happens.

Expected Result: The raisins will soon zoom up and down the beaker.

Explanation: The bubbles of air in the fizzy drink cause the raisins to float to the surface, where the bubbles break and the raisins sink back down.

Yellow Submarine

Equipment: Clear jar, fresh lemon, balloon, elastic band.

Method: Cut a piece of lemon peel in the shape of a submarine. Fill the jar with water and put the lemon peel into the water. Cut a circle from the balloon and stretch the balloon over the top of the jar. Hold the balloon in place with an elastic band. When you press hard on the balloon with your finger what happens? What happens when you take your finger off?

Expected Result: The submarine will sink slightly when you press down and rise when you let go.

Explanation: Air can be easily compressed into a smaller space, but water cannot. As you press on the balloon, you squash the tiny bubbles of air in the lemon peel into a smaller space and let extra water in. This makes the submarine heavier so it sinks a little. When you take your finger away, the air expands again, pushing out the water. This makes the submarine lighter and it rises up again.

Bottle Submarine

Equipment: Plastic bottle with lid, bowl of water, short length of plastic tubing.

Method: Make a hole in the lid of the bottle and another in the bottom. Hold a finger over the hole in the bottom and fill it with as much water as possible. Push the tubing through the top hole and put the top on the bottle. Lower the bottle carefully into the bowl and blow hard down the tube.

Expected Result: The submarine rises.

Explanation: As the air from your lungs goes inside the bottle, it pushes out some of the water, making the submarine lighter so it rises, just like a real submarine.

Floating Liquids

To measure how things float in different liquids, scientists use an instrument called a ***hydrometer***. The hydrometer sinks farther into some liquids than others.

Make a Hydrometer

Equipment: Straw, modelling clay, surgical spirit, salt water, jar.

Method: Cut about 6cm off a straw and push a small blob of clay onto the end. Use a thick pencil to mark a line on the straw every 5mm. Try floating your hydrometer in ordinary water, salty water and surgical spirit. How does it float each time.

Expected Result: The hydrometer floats higher in salty water and lower in the surgical spirit.

Explanation: Salty water is heavier than ordinary water so it pushes harder against objects floating in it. To float in salty water, objects need to displace less water than they do in ordinary water. So the hydrometer floats higher in salty water. In surgical spirit, the hydrometer floats at a lower level compared to ordinary water. This shows that surgical spirit is lighter than water.

Salty Surprises

Equipment: Saucepan, salt, large jar, egg.

Method: Pour some warm water into a saucepan and add some salt. Stir with a spoon and keep adding salt until you feel a gritty layer building up on the bottom of the pan. Leave the salty water for several hours until it is no longer cloudy. Then it is ready to use. Half fill a large jar with the salty water and put the egg into the water. Now carefully pour some ordinary tap water down the side of the jar. What happens?

Expected Result: The egg will seem to 'float' in the middle of the jar.

Explanation: The tap water is lighter than the salty water so it floats on top. The egg sinks down through the tap water but floats on top of the salty water. It looks as if it is floating in the middle of the jar.

The Floating Circle

Equipment: surgical spirit, cooking oil, green food colouring, water, funnel, small flat bottle.

Method: Fill the bottle about half full of water. Add a few drops of green food colouring. Use the funnel to pour a few spoonfuls of oil into the bottle. Now add some surgical spirit and watch how the oily layer bends in the middle. Keep adding the surgical spirit until the oily layer becomes a circle floating in the middle of the green liquids.

Explanation: When you add the surgical spirit it mixes with the he water and makes the water lighter (less dense). The watery mix pushes up less strongly against the oily layer so the oil starts to sink down into the watery mix. As you add more surgical spirit, the watery mix starts to push on the oil equally from all directions. This makes the oil into the shape of a ball.

Marbling

By floating oily paints or inks on the surface of water, you can make wonderful swirly patterns to decorate paper. This is called marbling because the patterns are like the ones you can see in pieces of polished marble.

Equipment: an old bowl, marbling inks or oil paints (or powder paint mixed with cooking oil), plain paper, straw, newspaper.

Method: Put plenty of newspaper on the floor and put on an apron. Put the bowl in the middle of the newspaper and fill it half full of water. Drop two or three different colours onto the water in turn. You dont need much of each colour. Use the straw to swirl the paint carefully around until you make a pattern that you like. Now gently lay a piece of thick paper flat on the surface of the water and quickly lift it off again. Hold the paper over the bowl until most of the water has dripped off into the bowl. Leave the paper to dry.

To clear the water of old colours, put a paper towel on the surface of the water. It will soak up the colours so you can lift them out of the water.