CARTESIAN DIVER - 3 WAYS

This experiment works based on a force called **buoyancy**. This is the same force that allows things like ships to float in the water and hot air balloons to float in the air.

The **buoyant force** on an object is equal to the **weight of the fluid** the object is displacing. For this experiment, the buoyant force is equal to the weight of the water displaced by the Cartesian Diver.

Objects that are **more dense** than water **sink** because the weight of the water they displace is less than their own weight. Objects that are **less dense** than water **float** because the water they displace weighs more than they do.

Try out these different methods based on what supplies you have around the house or can find at the store.

METHOD 1

Supplies Needed:

- Empty 1-liter Bottle
- 1 Ketchup Packet
- 3-6 Tbsp of Salt

METHOD 2

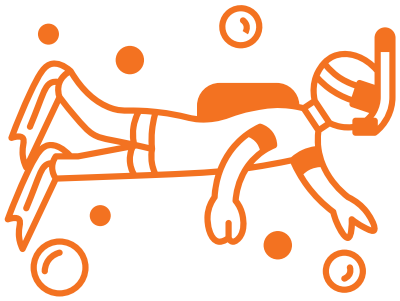
Supplies Needed:

- 1 Plastic Straw
- 4-6 Paper Clips
- 2-3 Small Rubber Bands
- Empty 1- or 2-liter Bottle
- Scissors

METHOD 3

Supplies Needed:

- Pipette Dropper
- Metal Hex Nut
- Empty 1-Liter Bottle
- Scissors
- Cup of Water



CAMP ONE STEP CONNECTED

CARTESIAN DIVER | METHOD 1

Supplies Needed:

- Empty 1-liter Bottle
- 1 Ketchup Packet
- 3-6 Tbsp of Salt

Instructions:

1. Make sure your bottle is empty, clean, and any labels are removed.
2. Fill the bottle to the top with water.
3. Grab a ketchup packet from any takeout restaurant and drop it into the bottle. It's best to do this over the sink in case of overflow. If the ketchup floats, move on to Step 4. If it sinks, skip to Step 5.
4. Screw the cap back on your bottle tightly. Squeeze the bottle, and your ketchup diver should sink! When you let go, it should float back to the top. If it doesn't dive as expected, try a different packet.
5. Add 3 Tbsp of salt to the bottle, then screw the cap back on and shake it up until the salt dissolves. Add more salt, 1 Tbsp at a time, until the packet just barely floats near the top. Fill the bottle with more water if needed and replace the cap.
6. Squeeze the bottle, and your ketchup diver should sink! When you let go, it should float back to the top. If it doesn't dive as expected, try a different packet. Can you find just the right amount of pressure to squeeze and make the ketchup float in the middle of the bottle?

Click HERE to watch a video demonstration of the project!

CAMP ONE STEP CONNECTED

CARTESIAN DIVER | METHOD 2

Supplies Needed:

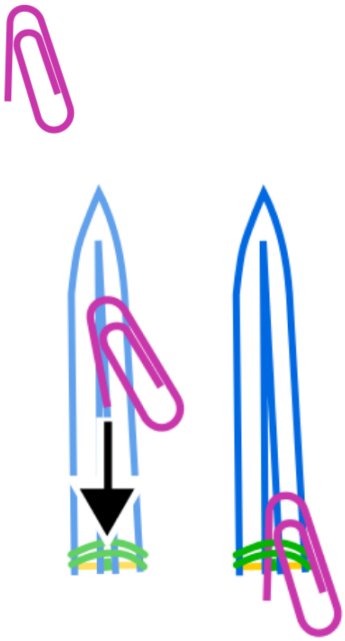
- 1 Plastic Straw
- 4-6 Paper Clips (the colorful coated kind work great!)
- 2-3 Small Rubber Bands
- Empty 1- or 2-liter Bottle
- Scissors
- Cup of Water to Test

Instructions:

1. Make sure your bottle is empty, clean, and any labels are removed.

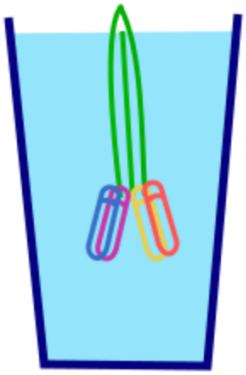
2. Cut the straw to about 6 inches long, then fold it in half. Wrap a small rubber band around near the open ends to hold them together (or use two if needed).

3. Take the outside end of one paper clip and straighten it slightly. Hook that part of the paper clip over the rubber band on your straw. The holes of the straw should be pointing ***down***, and the end of the paperclip you just straightened should also point ***down***.



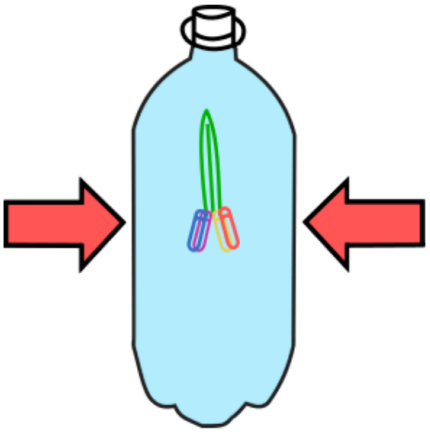
CAMP ONE STEP CONNECTED

CARTESIAN DIVER | METHOD 2



4. Use your cup of water to test the weight of the diver. Add one paper clip at a time until your diver floats almost entirely below the surface in your test cup.

5. When your diver is ready, fill the bottle to the top with water. Carefully place the diver inside the bottle. Again, the holes of the straw should be pointed ***down***. Screw the cap back on your bottle tightly. Squeeze the bottle, and your diver should sink! When you let go, it should float back to the top.



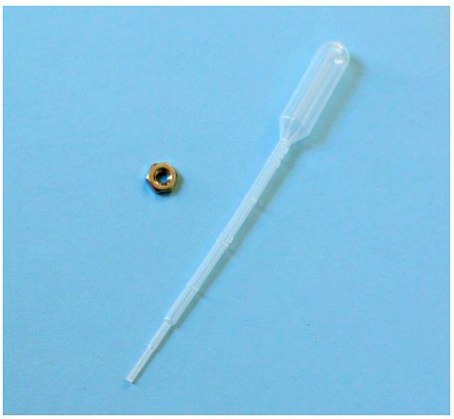
TIP: If your diver only sinks, you either have too much weight or may need to replace your straw. The straw can crack if pinched too hard, and will make the diver lose its buoyancy and only sink.

CAMP ONE STEP CONNECTED

CARTESIAN DIVER | METHOD 3

Instructions:

1. Trim off the bottom part of your pipette that looks like a straw. Leave a tail that's about 2 cm long (as big as a penny).
2. Slide the hex nut over the tail you left on the pipette. It should fit snug and not slide off. If too loose, you may need to add some glue or wrap a piece of pipe cleaner underneath to keep it from falling.



3. Fill your clean 1-liter bottle to the top with water.

Supplies Needed:

- Pipette Dropper
- Metal Hex Nut
- Empty 1-Liter Bottle
- Scissors
- Cup of Water

Optional Supplies:

- Aquarium Rocks
- Mini Fish
- Pipe Cleaners
- Permanent Marker
- Hot Glue or Electrical Tape

CAMP ONE STEP CONNECTED

CARTESIAN DIVER | METHOD 3

4. Use your cup of water to get your diver ready for mission. Squeeze the balloon-like part of the pipette and fill it with a little water from the cup, then drop it into the cup. We want the diver to just barely float on the surface. If it sinks, squeeze a little water out and try again. If it floats too much and lays sideways, fill it with a little more water.



5. When your diver is floating just right, put it in the bottle - careful not to squeeze out any water - and screw on the top.
6. Gently squeeze the sides of your bottle and watch the diver drop to the bottom. When you let go, it should return to the top!
7. Add aquarium rocks or fish to your diver's underwater environment, or decorate your diver with permanent marker and pipe cleaners. You may need to squeeze the water out of your diver in order to decorate and then re-fill it.

CAMP ONE STEP CONNECTED