

EQUIPMENT BUILD PLAN

AIR & WATER PRESSURE

Tantulus Cup

A Tantulus cup looks like an ordinary cup, but a bent straw hidden inside forms a siphon. Below the red line it holds water normally; fill it any higher and the siphon starts and empties the entire cup. It takes a plastic cup and two bendy straws and is a perfect lead-in to how siphons work.

Written from Bruce's original workshop handout. Bruce's final review of this plan is in progress.



DIFFICULTY	BUILD TIME
Beginner	20 minutes
COST	SAFETY
Under \$2	Everyday care
GOOD FOR	
Teachers, Families, Makers	

What it shows

Fill it past the red line and the whole cup drains away through its own bottom.

Key ideas: siphons, air pressure, gravity, potential energy

Safety (Everyday care). An adult should drill the hole in the cup. Use the hot glue gun with a grown-up nearby. Test it over a sink or bucket.

CONSTRUCTION

Build it

Materials

☐ Plastic cup, clear preferred · 1

- ☐ **Bendy straws** · 2
Or a flexible plastic tube
- ☐ **Rubber band** · 1
Optional, instead of hot glue
- ☐ **Small paper label** · 1
For the 'Do not fill above the red line' sign

Tools

Drill with a bit slightly smaller than the straw

Scissors

Hot glue gun (optional)

Red marker or paint

1

Gather the materials

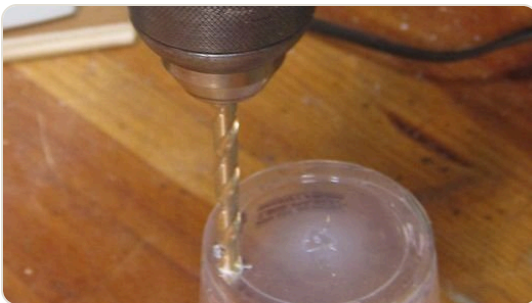
You need a plastic cup, two bendy straws, and a drill with a bit slightly smaller than the straw.



2

Drill the cup

Drill a hole in the bottom of the cup slightly smaller than the straw's diameter, so the straw will be a tight fit. It can go in the center or near the edge.



3

Slit the short end

On the first straw (the siphon straw), cut a slit about 3/4 inch long into the short end above the bend.



4

Add an extension

Cut a piece from the second straw and push it into the slit end of the siphon straw. This lengthens the short leg so it will reach almost to the bottom of the cup.



5

Point the long end

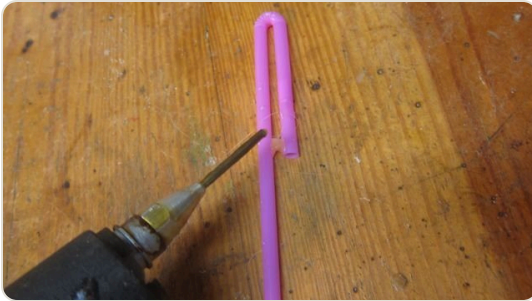
Cut the long end of the siphon straw at an angle so it is easier to start through the hole in the cup.



6

Secure the joint

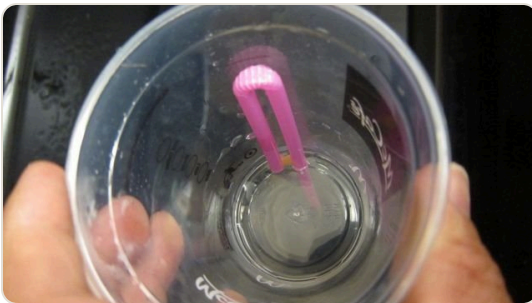
Put a spot of hot glue on the joint between the straws, or wrap it with a rubber band. This is optional but keeps the straw from coming apart.



7

Install the siphon

From inside the cup, push the long end down through the hole until the bend sits below the cup's rim and the short leg nearly touches the bottom. If it leaks, seal around the straw with hot glue or try a smaller hole in a new cup.



8

Paint the red line

Mark a red line around the cup level with the top of the straw's bend, and add a sign: 'Do not fill above the red line!'



9

Test it

Over a sink, fill the cup below the line; it holds water. Then fill it past the line and watch it drain completely.



THE PHYSICS

How it works

The bent straw is a siphon. As long as the water is below the top of the bend, it simply sits in the short leg at the same level as the water in the cup, and nothing happens.

Once the water rises above the bend, it flows over the top and down the long leg, filling the whole straw. Now the column of water in the long leg outside the cup is taller than the short leg inside. Gravity pulls that longer column down, and air pressure pushing on the surface of the water in the cup pushes more water up the short leg to replace it.

The flow continues as long as the outlet is lower than the water surface in the cup, so the cup drains until the water level drops below the end of the short leg and air gets in. Water flows from the higher level to the lower one, from higher to lower potential energy. In principle, air pressure can push water up a siphon as much as about 33 feet above the water surface.

GO FURTHER

Variations

Using it

- Set the cup out with its sign and see who cannot resist adding a little more water.
- Have students research the Greek myth of Tantalus and explain why the cup is named after him.
- If the cup is only half full, how can you start the siphon without adding more water? (With the straw at the edge, tilting the cup works.)
- Once the siphon is running, can you stop it? Will it start again on its own?
- Use it to launch a full siphon lab: which way does water flow when both ends are in buckets, and what happens when the levels are equal?

- Tantalus bucket: Bruce made a five-gallon bucket version with PVC pipe, with the drain pipe ending flush with the bucket bottom so it sits flat. Students washed glassware in it, then started the siphon to empty it neatly into the sink instead of splashing it.
- Placing the straw near the side of the cup lets you start the siphon by tilting the cup when it is almost full.

IF IT DOESN'T WORK

Troubleshooting

IF THIS HAPPENS

Water leaks around the straw.

TRY THIS

Seal around the straw with hot glue, or drill a smaller hole in a fresh cup.

IF THIS HAPPENS

The cup does not drain completely.

TRY THIS

Lengthen the short leg so it reaches almost to the bottom of the cup.

IF THIS HAPPENS

It drains before the water reaches the line.

TRY THIS

The red line is too high; move it level with the top of the straw bend.