UPSIDE-DOWN WATER

SEE SURPRISING EFFECTS OF AIR PRESSURE AND SURFACE TENSION

SAFETY:

- If you spill water, clean it up straight away… we aren't aiming for slippery science today!
- While you SHOULDN'T get wet, don't do this experiment in a place where water would be dangerous e.g. near electrical cords.

WHAT YOU NEED

- A clear drinking glass with a smooth rim
- ½ a cup water
- A postcard or birthday card cut in half along the crease (or another piece of flat, fairly-rigid carboard or plastic)
- A space where it's ok to get wet
- Cloth to wipe up any spills
- OPTIONAL: Food colouring
- OPTIONAL: A piece of fly wire about the size of a postcard and an elastic band

WHAT TO DO

1. Fill your glass around 1/2 full of water. You may want to add a drop of food colouring to it to make it easier to see.
2. Put the postcard on top of the glass.
3. Hold the glass in one hand and spread your other hand over the top of the postcard to hold it in place.
4. Flip the cup upside-down so the postcard now sits underneath the cup. Make sure you hold the postcard flat against the cup.
5. CAREFULLY, BUT WITH CONFIDENCE remove the hand holding onto the postcard. It should stay stuck to the cup! You might want to test this over a sink the first few times you do it. Use a new postcard for each test.
6. You can try changing the amount of water in the cup, the size of the cup postcard, or even the type of liquid in the cup to see if this changes your results.

Once you get the hang of this, you can raise the stakes!

7. Stretch the flywire across the top of the cup and secure it with an elastic band around the rim.
8. Follow steps 2 – 4 above, pouring water into the cup through the flywire.
9. Instead of taking your hand off the postcard, carefully slide it off the flywire. The water should stay inside, even though there are holes in the wire!
10. When you are ready to empty the cup (e.g. over a bucket or sink) give the side of the cup a sharp tap, or tip it to one side.

WHAT'S HAPPENING?

As is often the case with science, a few different things contribute to why the water does or doesn't fall out of the cup.

One is air pressure. Air pushes in all different directions (up, down and sideways). The force of air pushing up on the postcard helps keep the water inside. You may also notice that a tiny bit of water leaks out the side of the cup when you turn it upside down. This makes more space inside the cup for the air to spread out, meaning the air inside is at a lower pressure than the air outside the cup. Air always tries to move from areas of high pressure to low pressure, so the air outside is pushing up with more force on the cup and postcard than the force of the water and air in the cup pushing down.

However, if you just put a card on an empty glass and turned it upside-down, it would fall off… so the surface tension of water is also important. Water likes to hold on tightly to itself and is also good at making a seal between the cup and postcard. You might have seen the effects of surface tension before if you slowly over-fill a glass- the water can bulge slightly above the top of the glass because it is holding on tightly to itself. When you use flywire on the bottom of the cup, the force of surface tension in the water means it holds onto itself, and the skin-like surface of the water stretches across the small holes in the flywire, stopping the water from falling through.