Inverted glass of water

A demonstration of the surface tension of water

(Ireland)

Background

Many, if not most, of the explanations for this demonstration that you may find on the Internet are incorrect.

They usually say that atmospheric pressure pushes the card up and holds the water in the inverted glass.

If this were a complete explanation then the 'trick' should work with other liquids, especially ones that are less dense than water, such as cooking oil. But it doesn't.

You will need...

- ✓ clean water
- ✓ a drinking glass or jam jar
- ✓ stiff cards, or thin rigid plastic sheets, of larger diameter than the glass
- ✓ a fine net
- ✓ an elastic band
- ✓ a hole punch or other means of making holes in cards (1 to 5 mm)
- ✓ a basin

Follow these steps

(a)

1. Pour some water into the glass. (It does not need to be full.)
2. Cover the glass with a card.
3. Carefully invert the glass, while holding the card in place, over the basin.

(b)

4. Repeat the process using a card with a hole in it.
5. Repeat the process using a card with several holes in it.
6. Repeat the process but instead of a card use a fine net held in place with an elastic band.
   (A **jam jar** works best for this because it has a large lip that will prevent the net from slipping off.)

So what happened?

As long as the water is clean and the holes in the card (or net) are not too big, then the water should stay in the inverted glass.

The explanation

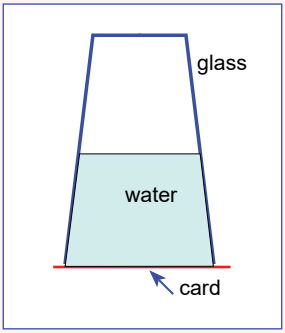
Contrary to what many books will tell you, the key to this is not atmospheric pressure but **surface tension**.

When the glass is inverted the card drops a little and a concave water surface forms around the rim of the glass.

The pressure on the convex side (water side) is less than that on the concave side (air side).
The pressure difference is about 150 Pa if r = 1 mm.

This will also work even if there are holes in the card (up to a few mm in diameter)

It works with water, which has a high surface tension,



but will not work with most other common liquids.

It does not work if detergent is added to the water.
(The surface tension of water is lowered significantly by detergent.)

What next?

Investigate how big the holes in the card can be and still hold the water in the glass.