

Gravity-Defying Water

Can water defy gravity?
Find out for yourself!



Grab this stuff:

- A** Water
- B** A glass
- C** Thick laminated card
- D** Plastic tray

Gravity-Defying Water



Fill the glass with water.



Place the card on top and turn the glass over, while holding onto the card and making sure the card always stays flat. Do this over the plastic tray.



When the glass is upside down let go of the card... and it should stay where it is!

Gravity-Defying Water notes

Aims

- Predictions – make predictions and then investigate whether they are correct.
- Observation skills – experiment, watch what happens and make appropriate notes.
- Scientific inquiry – explore gravity and air pressure.

Practicalities and preparation

- When turning the glass over, always keep the card flat.
- Because the activity will more than likely be repeated a few times we recommend laminating the cards as this will make it last longer. Thick card on its own will work, but after a few attempts the card will become saturated and create a mess.

The science – an introduction

In order for the water to fall out of the glass, air has to replace it. This cannot happen when the water at the rim of the glass has formed a seal with the card and with the air pressure in the room pushing up on the card. Air pressure is caused by molecules of air pushing against things, and is one of the main factors that affects the weather. Although the water seal on the glass is relatively sticky, it will not last for ever. In time gravity will break the seal by pulling the card and the water down.

Discussion

- Will the seal hold for ever?
- What is stopping the water from coming out?

Extensions

- Do the experiment again using a plastic or polystyrene cup, but this time poke a hole near the bottom of the cup. Cover it tightly with your thumb until the cup is upside down, with the card suspended. Then release your thumb and watch what happens.

When you move your thumb, air rushes in the hole, raising the pressure of the air inside to match the pressure outside. This means there is no net force pushing the card up, so gravity wins.

- You can also create gravity-defying cups. Blow a balloon up to one-third of full size, then wet the rims of two plastic or polystyrene cups and hold them against the sides of the balloon while you finish blowing it up. How many cups can you attach?

The inflating balloon creates suction by getting bigger, so less of the balloon is actually in the cup. This lowers the air pressure, so the suction is really the pressure of the air outside the cup 'pushing' the cup into the balloon and making it stick there.

- Place a glass upside down in a bowl of water. Why does the air remain inside the glass?

- Put a straw into a glass full of water. Suck some water up the straw and then put your thumb over the end that is in your mouth. Now, keeping your thumb over the straw, take the straw out of the water. What happens?

When the straw is just sitting in the glass there is nothing separating the air in the atmosphere from the air in the straw. This means that the air in the atmosphere and the air in the straw are pushing down on the water in the glass with the same force. When you suck on the straw you make the water move up the straw. If you put your thumb over the end it traps the water in the straw, and your thumb separates the water in the straw from the air pressure of the atmosphere. If you pull the straw out of the water and

keep your thumb over the end, the water stays in the straw. This is because there is no air pushing the water down from the top of the straw where your thumb is, but the air in the atmosphere is still pushing up at the open end at the bottom, keeping the water in the straw. The force from the air in the atmosphere pushing up is stronger than the force of gravity pulling down!

Links to real life

Car tyres, also known as pneumatic tyres, have an airtight inner core filled with pressurised air. The pressure of the air inside the tyre is greater than air pressure, so the tyre remains inflated even with the weight of a vehicle resting on it.

Links to the Science Museum

Galleries:

- Challenge of Materials
- atmosphere ...exploring climate science

Further information

- Lava Lunacy
- Blow-Up Balloon
- Fizzy Fountain