WATER WALK

What are the three primary colours?

How does water travel on the paper towel?

What happens when the primary colours mix?

Equipment required:

6 glasses
Water
Paper towels
Red, yellow and blue food colouring

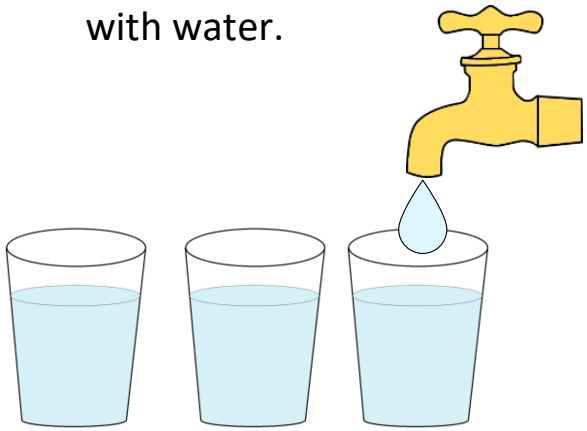
Can you explain the findings?

Water Walk

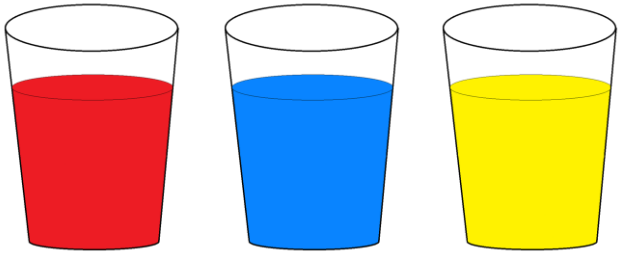
DEPARTMENT OF CHEMISTRY

UNIVERSITY OF OXFORD

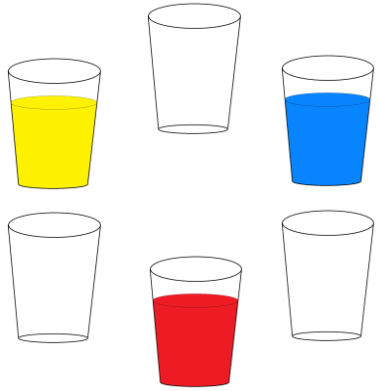
1 Fill 3 equal sized cups to just below the top with water.



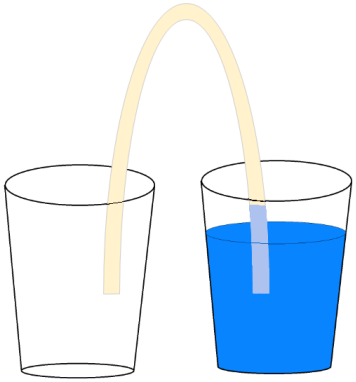
2 Colour the three waters using food colouring. Add blue to one, red to another and yellow to the third.



3 Arrange the cups in a circle, with empty glasses in between the full glasses.

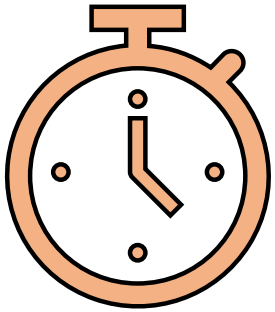


4 Fold a short piece of paper towel, and place in each cup, to connect every adjacent cup.



5 Watch what happens as you add the paper towel connections…

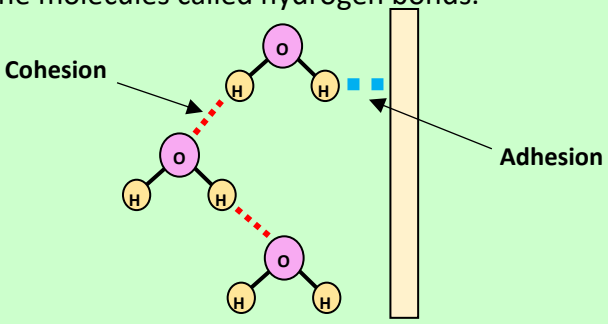
6 Leave for two hours and see what happens…



The science behind the scenes…

In this experiment, water moves up the paper towel. This is not what we would expect from simple gravity (the force that pulls everything down towards the ground). So, why does this happen? Answer: **Capillary action**!

Capillary action is a result of **adhesion** and **cohesion**. Adhesion is the attraction of water molecules to other surfaces. Cohesion is the attraction of water molecules to each other, by forces between the molecules called hydrogen bonds.



Paper towels are made from fibres called **cellulose**, which attracts water molecules. These adhesive forces between water and paper are stronger than the cohesive forces, so the water prefers to bind to the paper. As the water moves up the paper towel, the cohesive forces pull the water **up** the towel, across the bridge, defying gravity.

The transferring of the solutions from the full glass to the adjacent empty glasses allows for the mixing of two colours. The three full glasses contain red, yellow and blue coloured water, which are the three **primary colours**. When two primary colours mix, they form a new **secondary colour**. The colour wheel represents the primary and secondary colours, which is what we recreate in this experiment!

Yellow + **Red** → Orange

Red + Blue → **Purple**

Blue + Yellow → Green

Practical investigation:

Equipment:

- ☐ 6 glasses
- ☐ Water
- ☐ Paper towels
- ☐ Red, yellow and blue food colouring

Method:

1. Fill 3 equal sized glasses to just below full with water.
2. Add blue food colouring to the water in one glass, red food colouring to another and yellow food colouring into the third. Add the food colouring **generously** and **mix**.
3. Arrange the 6 glasses in a circle, with an empty glass in between each full glass.
4. Fold a **short** piece of paper towel and place as a connection between adjacent glasses (from a full glass into an empty glass). There should be a separate paper towel connection in between every adjacent pair of glasses.

5. Watch what happens as the paper towel is added between the empty and full glasses.
6. Leave the set up for **two hours** and see what happens.

Questions:

(a) Why do we use red, blue and yellow as the three colours? [They are the three primary colours]

(b) What happens as the paper towel is added to the full glasses? [Water moves up the paper towels by capillary action]

(c) What has happened after leaving the set up for 2 hours? [The water can travel into adjacent empty glasses, and the colours of two water solutions mix in the previously empty glass to form the secondary colours purple, orange and green]

Science isn't just useful in the labs…

Capillary action is used by **plants** to survive! Plants take up water through their **roots**, and need to transport water to places all around the plant. Roots are at the bottom of the plant, so they need to defy gravity. The water molecules are attracted to the inside of the plant **stem** and the **adhesive** forces work with the **cohesive** forces to pull the water (and all the nutrients dissolved in the water) up and around the plant, aiding the plant to live!

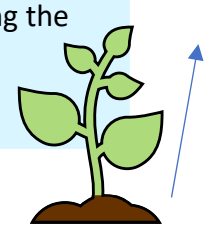


Photo citations:
http://clipart-library.com/clipart/1004920.htm