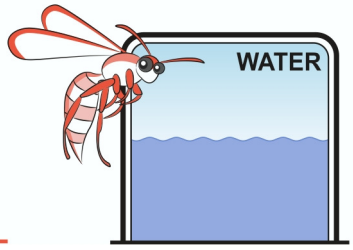


Adhesion (Capillarity) – Teacher Notes

Water droplets are not only attracted to each other but also to the walls of their container. In narrow tubes such as plant fibres, water will rise, each molecule pulling up the next. The narrower the fibre the higher water will rise. This process explains how microfiber cleaning cloths mop up and hold dirty water and how sports clothes can "wick" away sweat. It also explains why the tops of underground water tables are not always flat and why water does not run out of a damp towel.

Capillarity in glass tubes (demonstration, optional)

Three narrow glass tubes of different diameter can be placed in coloured water. The water will rise highest in the narrowest tube. Since the power of attraction decreases with distance from the glass the water surface dips in the centre forming a meniscus.

If you do not have narrow tubes you can try wrapping Glad Wrap round knitting needles to create thin tubes. Tape the edges. Place these in coloured water in beakers.

Capillarity in plant fibres

Although paper was made from rags and papyrus in historic times, it is mostly made from wood and recycled paper nowadays. Trees use long thin tubes in their roots and trunk to pull water with dissolved mineral nutrients from the soil to their leaves. The phloem fibres transport sugars and other nutrients from the leaves for use and storage. Borers can kill trees by breaking the chains of cohesive water molecules and effectively starving it. Both these fibres are mashed to make paper. High quality paper is bleached then dressed with china clay to make it shine. Brown paper is often made with recycled paper.

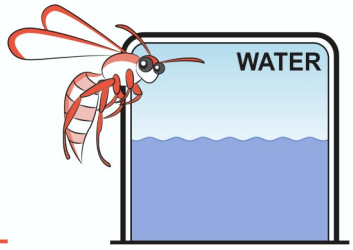
Comparing capillarity in different papers

Materials per student or group:

- Three different papers E.g. filter paper, kitchen towel, photocopy paper, newspaper, brown paper
- Scissors, pen and a ruler
- One beaker half full of water (food colouring optional)

Cut papers into equal sized strips 130mm by 40mm. I used a ruler as template. Mark the long sides with 10mm divisions. Hang the strips to the same depth in the beaker of water. Leave paper in beaker for 15 minutes. Remove and compare to find which paper has the greatest capillarity.

Adhesion (Capillarity) – Teacher Notes



Students board data and decide whether both range and average should be included. This activity produces data that is observable, measurable, repeatable and reportable.

Microfiber cloths hold and retain water because of capillarity in the thin micro-tubes they are made from. Water and the dirt held by it are strongly attracted to the walls of the micro tubes. Writing from normal pens will not leave marks on take-away containers as their surface is not made from fibres and the ink will smear away. Plastic "paint" pens must be used to leave lasting labels.

Twisted paper towel

Paper is made of plant fibres. Roll thin long strips of paper towel into a rope shape. Almost fill one beaker with water and leave the other empty. Place one end of the towel rope into one beaker and the other into the empty beaker. Mark the level of water on each beaker with a pen or piece of sticky tape. Although movement will start almost instantly it can take almost four hours for the water to move from beaker to beaker.

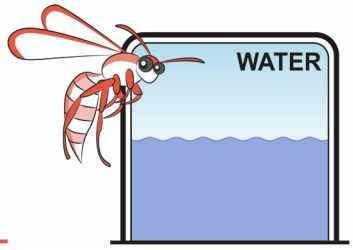
In hot climates rapid evaporation can remove water from the damp paper towel as fast as it rises. It is also interesting to note that the molecules of some food colouring are large and the colouring may appear to move at a different rate than water (See above).

Coloured Flower (Extension)

A white flower placed in coloured water may change to the colour of the water if left overnight. Care must be taken that the flower is freshly cut or air will enter into the veins and capillarity will not proceed. A scalpel or sharp knife cut through the flower's stem will demonstrate the cells transporting the dye.

Stains (Extension)

On a piece of unbleached calico or a light coloured piece of cotton or linen, drop solutions of coffee, tea, fruit juice etc. Leave overnight to dry. Explain the pattern of colour that results. This can also be done on paper towel but the material is very easy to tear and must be left on a plate or board for support.



Adhesion (Capillarity) – Teacher Notes

Minimise your footprint/handprint on resource usage

Students can also discover how to save money (and the environment) when using paper towels. On average people use four tri-fold paper towels or tear off three or four chunks of towel roll every time they dry their hands. If this usage can be reduced to one towel or chunk the savings to the school and home budget and to the environment will be great.

View http://www.youtube.com/watch?v=2FMBSblpcrc for a suggestion on how to organise a quick fun lesson

Students wash their hands as usual then either shake them twelve times or shake them as long as it takes to sing one verse of “Happy Birthday to you”. They can then dry their hands on only one sheet of towel folded in half.

Folding increases interstitial suspension, as any parent can tell. If there is a puddle on the floor, folding a cloth in two, dropping it on the puddle and then stepping on it and stepping back will increase the fluid uptake!

This is a useful activity for demonstrating “Science as a Human Endeavour” at school assembly.

ASIDE Terrible teacher’s jokes

Capillarity sucks!

Cap-hillarity – the funny side of tubes