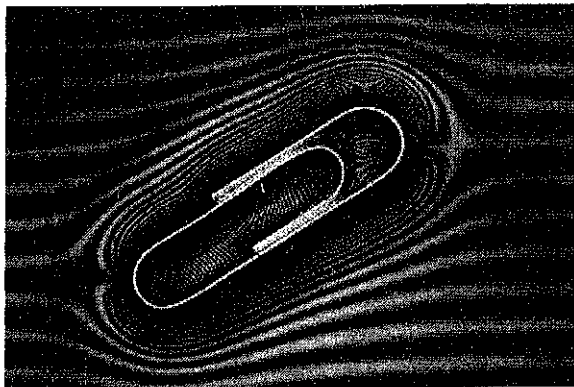


Surface tension

Robert Anderson



The surface tension of water can support even a metal paperclip. By photographing it using a grill in front of the light source, the deformation of the water caused by the clip's weight can be seen. This bending of light is similar to the bending of light by strong gravitational fields, as predicted by Einstein's theories. Surface tension is due to an attraction between the molecules in water, which cause its surface to act in an elastic manner. Surface tension

<http://www.visions-of-science.co.uk/winners2005/win-18.htm>

Sticky Water http://www.exploratorium.edu/ronh/bubbles/sticky_water.html

If you could see molecules of water and how they act, you would notice that each water molecule electrically attracts its neighbors. Each has two hydrogen atoms and one oxygen atom, H_2O . The extraordinary stickiness of water is due to the two hydrogen atoms, which are arranged on one side of the molecule and are attracted to the oxygen atoms of other nearby water molecules in a state known as "hydrogen bonding." (If the molecules of a liquid did not attract one another, then the constant thermal agitation of the molecules would cause the liquid to instantly boil or evaporate. Hydrogen atoms have single electrons, which tend to spend a lot of their time "inside" the water molecule, toward the oxygen atom, leaving them naked, or positively charged. The oxygen atom has eight electrons, and often a majority of them are around on the side away from the hydrogen atoms, making this face of the atom negatively charged. Since opposite charges attract, it is no surprise that the hydrogen atoms of one water molecule like to point toward the oxygen atoms of other molecules. Of course in the liquid state, the molecules have too much energy to become locked into a fixed pattern; nevertheless, the numerous temporary "hydrogen bonds" between molecules make water an extraordinarily sticky fluid. Within the water, at least a few molecules away from the surface, every molecule is engaged in a tug of war with its neighbors on every side. For every "up" pull there is a "down" pull, and for every "left" pull there is a "right" pull, and so on, so that any given molecule feels no net force at all. At the surface things are different. There is no up pull for every down pull, since of course there is no liquid above the surface; thus the surface molecules tend to be pulled back into the liquid. It takes work to pull a molecule up to the surface. If the surface is stretched - as when you blow up a bubble - it becomes larger in area, and more molecules are dragged from within the liquid to become part of this increased area. This "stretchy skin" effect is called surface tension. Surface tension plays an important role in the way liquids behave. If you fill a glass with water, you will be able to add water above the rim of the glass because of surface tension.

You can float a paper clip on the surface of a glass of water. Before you try this you should know that it helps if the paper clip is a little greasy so the water doesn't stick to it (rub it on your nose or forehead.) Place the paper clip on a fork and lower it slowly into the water. The surface-tension skin of the water supports the paper clip.

The water strider is an insect that hunts its prey on the surface of still water; it has widely spaced feet rather like the pads of a lunar lander. The skin-like surface of the water is depressed under the water strider's feet.

Properties of Water: Language Arts Activity

Article Activity 1

-read the article

-write the main idea

highlight or underline
supporting sentences

Article Activity 2

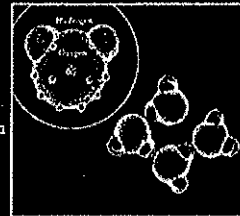
-circle, square, and
triangle worksheet
activity

Article Activity 3

-save the last word for
me Protocol discussion
worksheet

If you could see molecules of water and how they act, you would notice that each water molecule electrically attracts its neighbors. Each has two hydrogen atoms and one oxygen atom, H₂O. The extraordinary stickiness of water is due to the two hydrogen atoms, which are arranged on one side of the molecule and are attracted to the oxygen atoms of other nearby water molecules in a state known as "hydrogen bonding." (If the molecules of a liquid did not attract one another, then the constant thermal agitation of the molecules would cause the liquid to instantly boil or evaporate.)

Hydrogen atoms have single electrons which tend to spend a lot of their time "inside" the water molecule, toward the oxygen atom, leaving their outsides naked, or positively charged. The oxygen atom has eight electrons, and often a majority of them are around on the side away from the hydrogen atoms, making this face of the atom negatively charged. Since opposite charges attract, it is no surprise that the hydrogen atoms of one water molecule like to point toward the oxygen atoms of other molecules. Of course in the liquid state, the molecules have too much energy to become locked into a fixed pattern; nevertheless, the numerous temporary "hydrogen bonds" between molecules make water an extraordinarily sticky fluid.



Within the water, at least a few molecules away from the surface, every molecule is engaged in a tug of war with its neighbors on every side. For every "up" pull there is a "down" pull, and for every "left" pull there is a "right" pull, and so on, so that any given molecule feels no net force at all. At the surface things are different. There is no up pull for every down pull, since of course there is no liquid above the surface; thus the surface molecules tend to be pulled back into the liquid. It takes work to pull a molecule up to the surface. If the surface is stretched - as when you blow up a bubble - it becomes larger in area, and more molecules are dragged from within the liquid to become part of this increased area. This "stretchy skin" effect is called surface tension. Surface tension plays an important role in the way liquids behave. If you fill a glass with water, you will be able to add water above the rim of the glass because of surface tension.

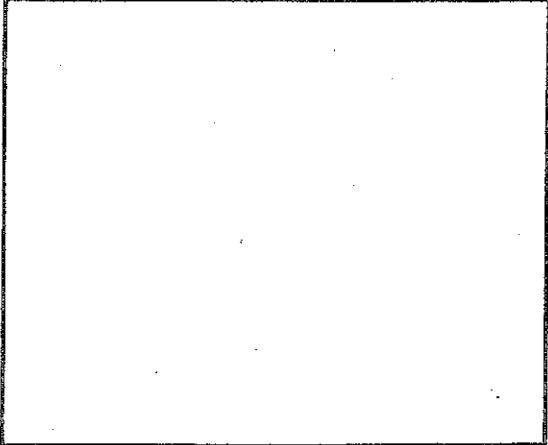
You can float a paper clip on the surface of a glass of water. Before you try this you should know that it helps if the paper clip is a little greasy so the water doesn't stick to it (rub it on your nose or forehead.) Place the paper clip on a fork and lower it slowly into the water. The paper clip is supported by the surface-tension skin of the water.



The water strider is an insect that hunts its prey on the surface of still water; it has widely spaced feet rather like the pads of a human hander. The skin-like surface of the water is depressed under the water strider's feet.

CIRCLE, SQUARE, TRIANGLE
Article Reflection Guide

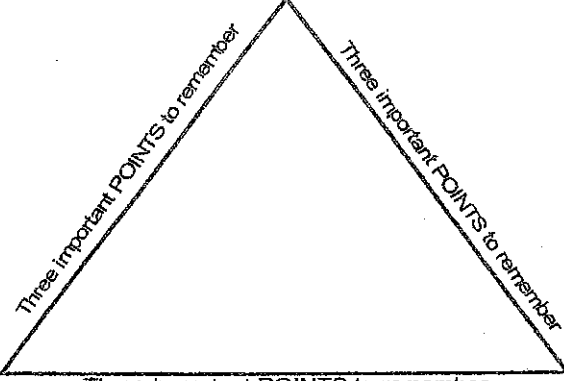
Something I learned that SQUARES with my beliefs



Something I learned that SQUARES with my beliefs

Something I learned that SQUARES with my beliefs

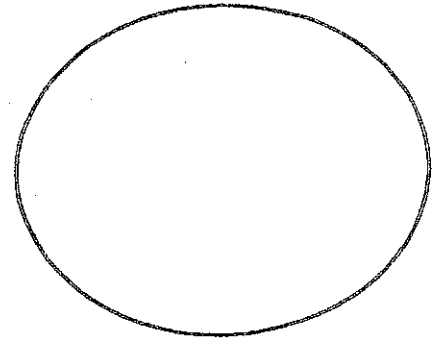
Something I learned that SQUARES with my beliefs



Three important POINTS to remember

Three important POINTS to remember

Three important POINTS to remember



A question going AROUND in my mind