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Question?
Contact: Heather Chaillier
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Michigan Tech
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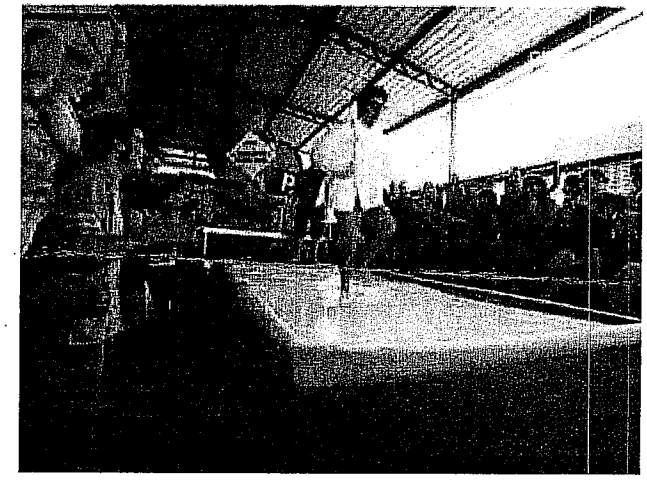
How can I walk on a liquid?

The science behind non-Newtonian fluids



Corn starch provided by:

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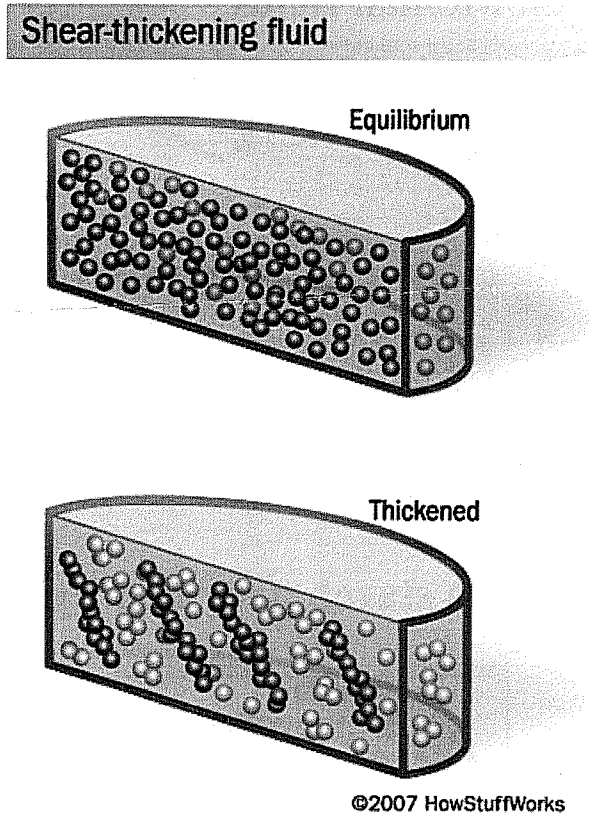
HOW IT WORKS!

The fluid is a **colloid**, made of tiny particles suspended in a liquid. The particles repel each other slightly, so they float easily throughout the liquid without clumping together or settling to the bottom. But the energy of a sudden impact overwhelms the repulsive forces between the particles – they stick together, forming masses called **hydroclusters**. When the energy from



the impact dissipates, the particles begin to repel one another again. The hydroclusters fall apart, and the apparently solid substance reverts to a liquid. "shear thickening" causes this property of this non-Newtonian fluid

TERMINOLOGY

Viscosity -thickness", or resistance to flow.
Examples: Water is "thin" (low viscosity)
Honey is "thick" (high viscosity)

Rhelogy-study of viscosity

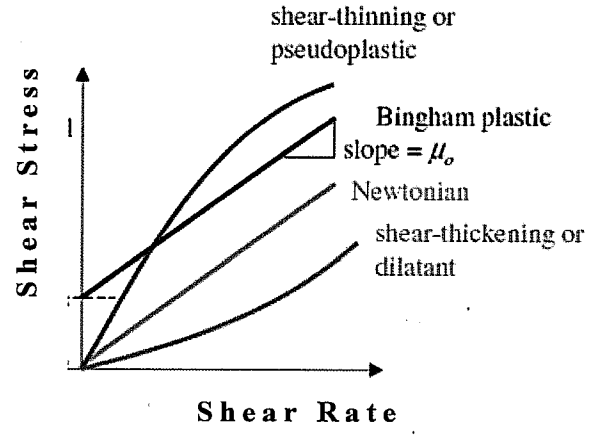
Bingham plastic -behaves as a rigid body at low stresses but flows as a viscous fluid at high stress

Newtonian fluid –its stress versus rate of strain curve is linear and passes through the origin, doesn't change with strain rate (water, milk, apple juice)

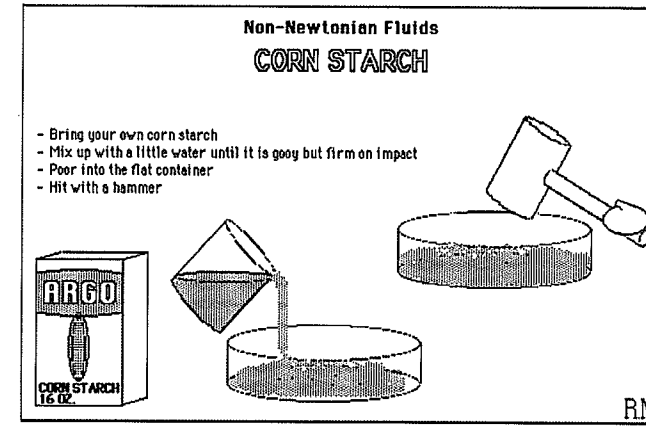
non-Newtonian fluid –a fluid where viscosity changes with the applied strain rate

Shear thickening-material where viscosity increases with the rate of shear (Normally thin, they can become thick when stirred or hit)

Shear thinning-viscosity decreases with increasing rate of shear (Normally thick, they can become thin and flow like water when stirred or shaken)



ANOTHER EXPERIMENT!



REAL LIFE APPLICATIONS!

-Shear thickening

Bullet-proof vests-absorbs the energy of a high velocity projectile impact but remain soft and flexible while worn

Wet sand (quicksand)

-Shear thinning

Paint-one wants the paint to flow readily off the brush when it is being applied to the surface being painted, but not to drip excessively

Ketchup- shaking a bottle causes the contents to undergo an unpredictable change in viscosity

Whipped cream

Blood

Nail polish

Shampoo