



Quicksand



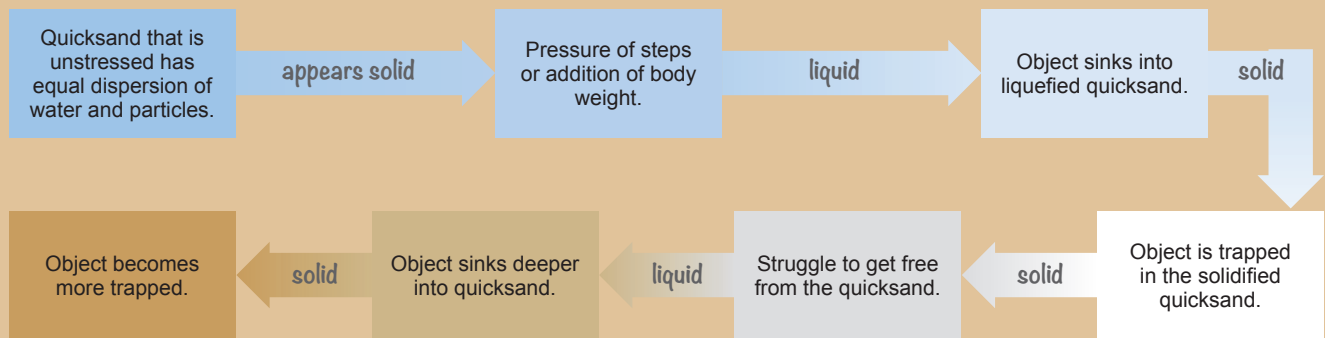
When you walk across the beach, you will notice that the dry sand (farthest from the water) holds your weight but it is quite hard to walk on because you do sink into it. However, as you get nearer the water, the wet sand holds you firmly and it is much easier to walk on. This phenomenon relates to how quicksand works.

Dry Sand	Wet Sand	Quicksand
<ul style="list-style-type: none"> • The particles of dry sand are touching one-another as friction holds them together as a solid. • Dry sand is able to withstand downward pressure, holding objects on top. 	<ul style="list-style-type: none"> • There are gaps between the particles of wet sand and water fills them in, holding it together very tightly. • Wet sand is able to withstand downward pressure, holding objects on top. 	<ul style="list-style-type: none"> • The particles of quicksand are separated and water surrounds each particle, resulting in very little friction. • Quicksand is unable to withstand downward pressure so objects sink.

Newtonian fluids are those that behave as expected when under stress such as water. Non-Newtonian fluids, on the other hand, behave in odd ways. Take a mixture of cornflour and water for example. When you hit or squeeze the mixture (apply force to it), it feels solid. Yet if you slowly stir or pour it, it runs like a liquid. Both the cornflour mixture and quicksand are non-Newtonian. Quicksand behaves in an opposite manner to the cornflour mixture. Quicksand is made up of very fine particles (sand or silt), clay and water. It is a **shear-thinning non-Newtonian** fluid. Sheer-thinning refers to the fact that it gets thinner and more liquid when under stress or with movement/vibration. It is more solid with little force and more liquid with lots of force.

The make-up of quicksand is described using another set of scientific terms; **colloidal hydrogel**. An example of another colloidal substance is milk. The fat particles in milk are **dispersed** through a watery solution; they are essentially **microscopic** particles floating in a solution. Quicksand is made up of very fine silt or sand **suspended** throughout water. These types of suspension solutions don't tend to separate out if you leave them to sit. A hydrogel is a **matrix** of long compound chains that hold water in between them. Because of their structure, they are able to hold large volumes of water but not feel wet. An example of an artificial hydrogel is the material inside disposable nappies which is able to suck in and contain large amounts of urine. Quicksand is a naturally occurring hydrogel as it is composed of **miniscule** particles surrounded by water molecules.

If you look at quicksand, it looks solid. Even if you walked slowly onto it, it would likely hold your weight for a short time. Quicksand acts like a solid when unstressed but as soon as it becomes stressed through rapid movement or vibration, it quickly changes to behaving like a liquid and like any liquid, it won't hold any weight.



People who enter quicksand and sink due to their weight, need to keep calm, move slowly and make their body as flat as possible in order to increase their **surface area** and decrease the pressure their body is applying to the quicksand. If a person panics and thrashes around to try to escape, they will sink quite rapidly as the stress of their movement's causes the quicksand to undergo a sudden and rapid decrease in **viscosity**. Once the person has sunk into the quicksand, the water and sand separate which forms hard areas of sand that hold the limbs of the person tight. In order to pull themselves out, they need to apply a large amounts of force to the quicksand to turn it back into a liquid and get themselves free. Even if the person does panic, it is unlikely that they will sink below their waist as the quicksand isn't normally that deep. By moving slowly, the viscosity is increased and allows the limbs to be pulled out.



Despite what is shown on movies and TV shows, it really is unlikely that a person would be swallowed whole by quicksand because the human body actually floats better on quicksand than water. Quicksand has a density of 2g/mL and the human body has a density of 1g/mL (similar to water, the human body is around 75% water after all). Because the density of quicksand is greater than the density of the human body, the human body should float on it. The only reason it sucks people in is because their movements stress the substance and cause it to change from a solid to liquid and back again. While quicksand is unlikely to suck someone in and cover them completely, it can be dangerous. For example, if the person is on their own and has become tired from struggling in the quicksand, it could result in the person dying from **dehydration, hypothermia** or even drowning if tides come back in. The key thing to remember if you become stuck in quicksand, is to stay calm and move slowly.



Check out this clip of Bear Grylls in quicksand...
[youtube.com/watch?v=MJTGwZM05IQ](https://www.youtube.com/watch?v=MJTGwZM05IQ)

