

Educational Innovations[®]

#MS-2RED/BLUE & #MS-3ORG/GRN

Magic Sand

Magic Sand, contrary to its name, is not magic. Magic sand is, in fact, normal sand that has been covered in a special coating: trimethylhydroxysilane, $(\text{CH}_3)_3\text{SiOH}$. This protective coating is hydrophobic, or “water fearing.” Like oil and water, magic sand and water do not mix – at all. This gives the magic sand some interesting properties that you and your students can explore.

First, demonstrate to your students the terms “hydrophobic,” (water fearing) and “hydrophilic” (water loving). The simplest way to do this is to add some food coloring to water in an empty soda bottle, and then, as your students watch, add oil. The oil and water will not mix, even when the bottle is shaken, because oil is hydrophobic. The molecules of oil will bond much more readily with each other than with the water molecules, and therefore the two substances do not mix. For a fun example of a hydrophilic substance, try one of Educational Innovations’ Gro-Beasts. These small dinosaurs and alligators will slowly grow when placed in water.

Next, introduce your students to magic sand by pouring some on to a piece of paper. Invite students to touch the dry sand. Ask them if they think the sand will be hydrophilic or hydrophobic. If you are able, provide some normal, “non magical” sand for comparison. For an amazing display of magic sand’s hydrophobic property, quickly pour the sand into a clear container filled with water. The hydrophobic nature of the magic sand allows the sand to retain its shape under water. In fact, using a stirring rod or even your finger, you can mold the sand into different shapes. Notice the silver sheen on the surface of the sand. Challenge students to explain what causes this. The reflection or refraction of light might enter into the discussion.

Another interesting demonstration of Magic Sand’s properties is to gently tap some sand on the top of a glass of water. If done gently, the water’s surface tension will cause the magic sand to float on top of the water. Once a thick, even coat of sand is floating on top of the water, you can try two different experiments. First, gently press your finger down on the sand, until your finger appears beneath the surface of the water. This is especially impressive in a glass with clear sides. Remove your finger, and it should still be perfectly dry. If you press too deeply or quickly, the magic sand may clump and sink to the bottom. The second experiment also requires a floating layer of sand – once an even layer is achieved, use a pipet to gently drop water on top of the sand. Your students will be amazed to see the water bead on top of the sand! Adding enough water will cause the layer of sand to break and sink.



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Play Catch with Water!

Take two plastic spoons and cover them first in rubber cement, then in magic sand. This creates a hydrophobic surface that can be used to toss a drop of water back and forth! Younger students will love watching and learning about hydrophobic surfaces this way.

How to Destroy Your Sand:

Magic Sand can lose its hydrophobic properties if the special coating on the sand is removed or damaged. This can be done one of two ways. Oil will readily mix with magic sand, and this can cause your sand to become “wet,” and you will not be able to reuse the sand. Common soaps such as dishwasher detergent will remove the hydrophobic coating from magic sand, causing it to become ordinary, hydrophilic sand. While this can make for an interesting demonstration, please remember that the process is irreversible.

The History of Magic Sand:

Magic Sand was originally created as a way to mop up ocean oil spills. The idea was that magic sand would repel water but absorb oil and sink to the bottom, allowing the oil to be dredged from the bottom of the water at a later time.

Today, magic sand is used by arctic utility companies. Sometimes buried equipment in the arctic needs repairs, but frozen arctic ground is very difficult to dig through. These companies will sometimes bury their equipment in magic sand, which will not absorb water or freeze, providing easier access to damaged equipment. (See www.chemistry.org for details!)

The Future of Magic Sand: YOU!

What uses can you and your students come up with for magic sand? Underwater sandcastles? Waterproofing sandboxes? The possibilities are endless!

When you're done with your sand, simply pour as much water as you can from the glass and then add a small piece of paper towel to the sand. Gently shake the container with the sand. Remove the wet towel and return the sand to its container for storage. It's perfectly dry! Magic Sand can be used over and over again, and stored in the same bottle.