



Teacher's Guide for: **Secret Sand**

Note: All activities in this document should be performed with adult supervision. Likewise, common sense and care are essential to the conduct of any and all activities, whether described in this document or otherwise. Parents or guardians should supervise children. Rock-it Science assumes no responsibility for any injuries or damages arising from any activities.

NOTE: This is the transcript of a lesson that was videotaped during an actual Rock-it Science class with real students, not actors. The students' brainstorming comments are included on the video but are not transcribed here because they're not part of the lesson presentation.

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Secret Sand

A Rock-it Science Lesson

Filmed November, 2010

Rock-it Science

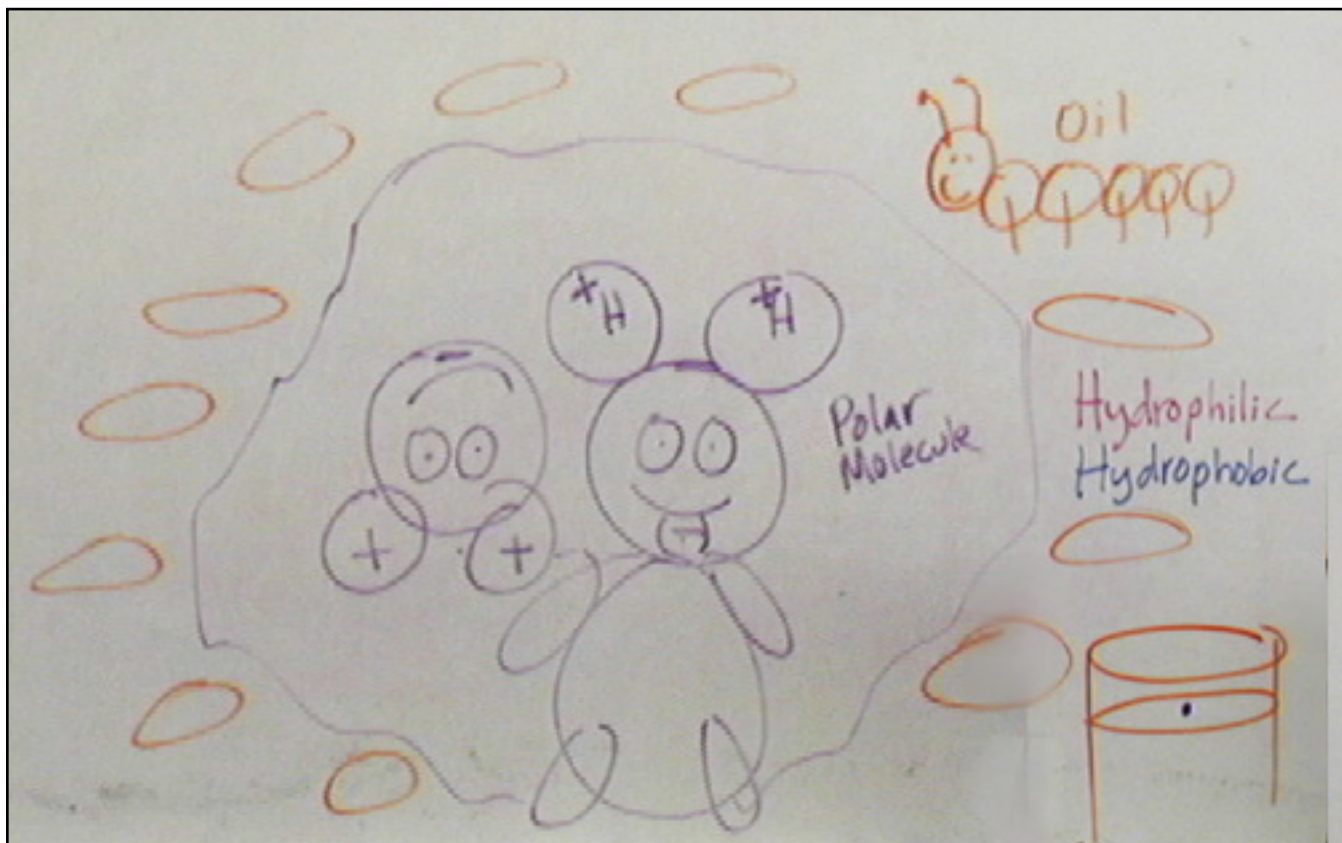
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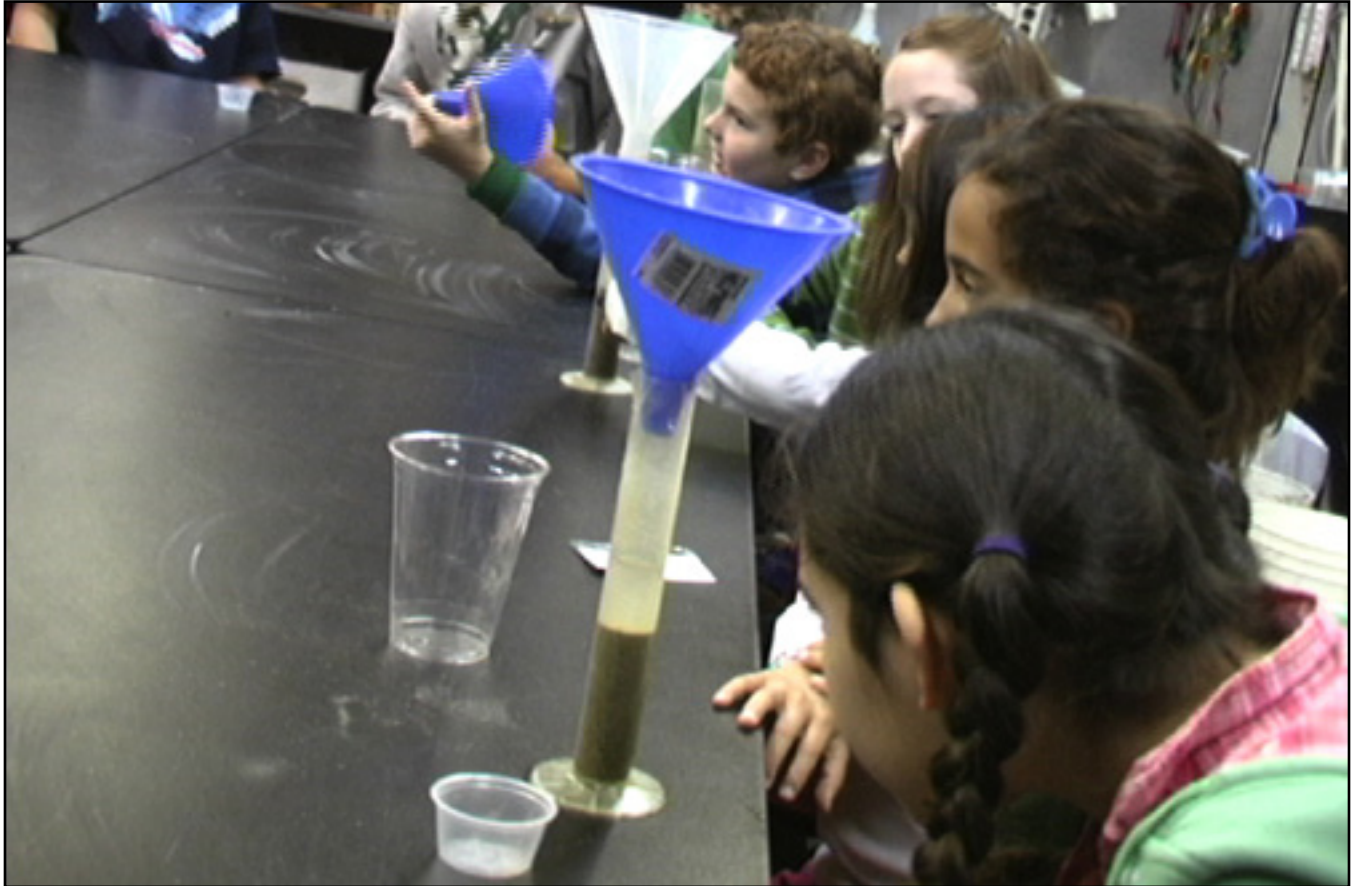
Intro Quick Recap: "Water & Oil Molecules"



- Mickey Mouse is a water molecule.
- His ears are positive, and his chin is negative.
- These look like north and south poles, so he's called a polar molecule.
- Polar molecules like other polar molecules, but the other one has to be upside down. The positive ears like the negative chin, so they stick together like magnets.
- Water molecules like to clump together in a ball to be magnets.
- Oil molecules are like a caterpillar, and they don't have separation of charge. They don't like to hang around with each other. They'll go wherever you push them.
- If you have water molecules and oil caterpillars floating around, the waters will push the oils out of the way so they can be with each other.
- If you dump oil in water, it forms a blob, goes somewhere on its own. But if you put water-based food coloring in oil, it sits there like a perfect drop on the surface of the oil.
- Things that like water are called "hydrophilic," and things that don't like water are called "hydrophobic."

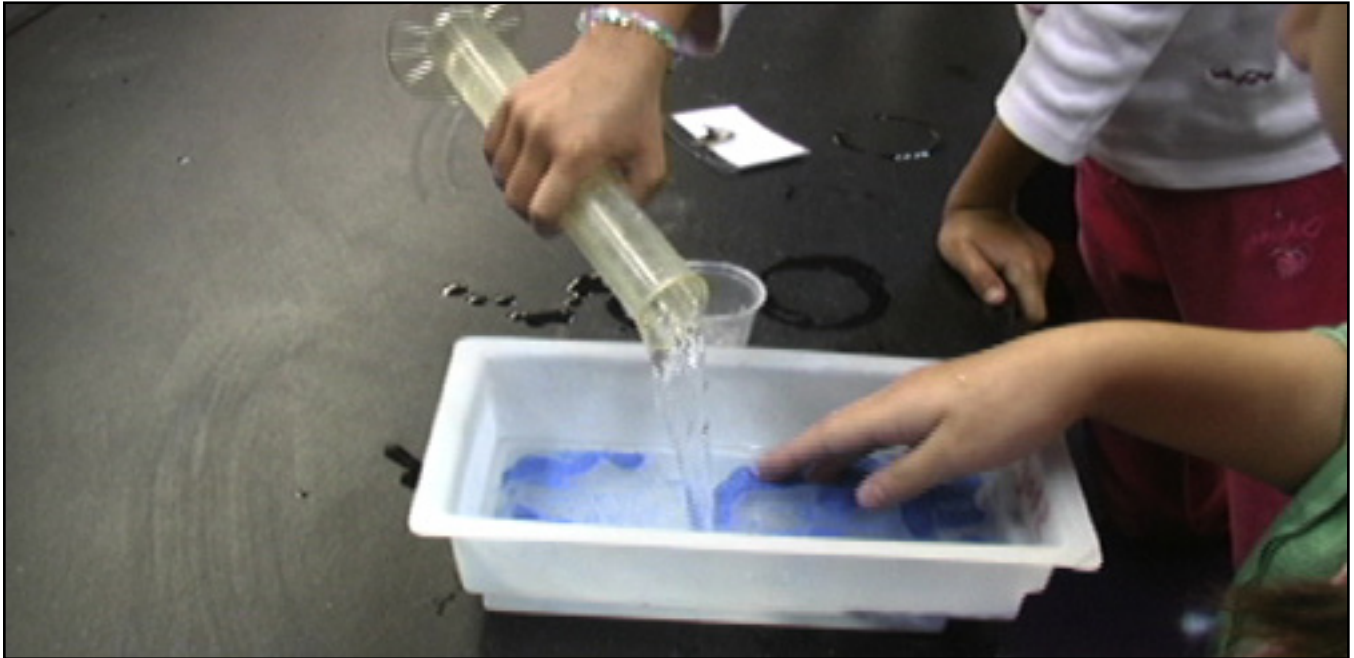
Experiments Quick Recap:

Experiment #1: "Ordinary Sand and Water"



- Give each pair of students a graduated cylinder and show them how to read the scale on the side.
- Give students a 2-oz souffle cup. Have them fill it with ordinary sand, pour it into the cylinder through a funnel, and read the scale to see how much is in there (approx. 40 ml.).
- Dump the sand out of the cylinder into a plastic cup.
- Fill the cylinder with an equal amount of water.
- Pour the sand back into the cylinder.
- See if the contents of the cylinder are now twice as much (the water plus the sand).
- If not, ask students why they think there's a difference.
- When finished, dump out the contents of the cylinder into the plastic cup and rinse out the cylinder with water.

Experiment # 2: "Secret Sand & Water"



- Repeat the experiment using Secret Sand in the cylinder instead of ordinary sand.
- See if the total volume is twice as much as the water. Ask why they think this happens.
- Afterwards, students dump their mixture into a shallow plastic tub so they can feel it with their fingers. They can add more water if they like, and Instructor may add more sand.
- Afterwards, have them dump out the water while keeping the sand in the tub. Then Instructor collects the sand to re-use.
- Explain that ordinary sand is siliCON dioxide, and Secret Sand is coated with siliCONE oil, which likes siliCON sand.

Experiment # 3: "Fire Extinguisher Powder"



- Show students an ABC fire extinguisher. A means it will put out A-type fires, which include wood, paper, clothes, hair, etc. (things that normally burn).
- B-type fires are liquids like oil, gasoline, frying fat.
- C-type fires are electrical, like a computer.
- The powder inside the extinguisher is mostly monoammonium phosphate, which is used for baking. It also contains mica, ammonium sulphate (fertilizer), talc (baby powder), and “nuisance dust.”
- Instructor has emptied the contents of extinguishers into a container and walks around and lets students look at it and smell it, but not touch. Do not blow on it, because it's very fine powder.
- Outside, Instructor pours some of the powder onto the surface of water in a clear plastic tub and slowly places his fingers in it, then lifts his hand out, which remains dry.
- Students take turns dipping their hands into the water through the powder. They can't splash around in it.
- Explain the pros and cons of using a fire extinguisher inside a house. For a cooking fire, it depends on how big it is. For a small one, you can turn off the heat and put a lid on it, but the flames will extend out the sides while you're doing it and burn your arm. If you use an extinguisher, the powder will stick to everything in your house.
- If it's a larger fire, immediately go to the neighbor's house and call 9-1-1.
- A fire extinguisher won't put out a Christmas tree.

Equipment List: "Secret Sand"

Items needed for Instructor:

Consumables:

- Water

Other:

- Container of Magic Sand
- Container of ordinary sand
- Fire Exguisher
- Container of fire extinguisher powder
- Tubs, clear plastic, large (2 each)
- Buckets, 5-gallon, 2 ea. for water

Items needed for Students:

Consumables:

- Water, about 1 cup

Other:

- Graduated cylinder
- Cup, clear plastic, 16-oz
- Cup, souffle, 2-oz.
- Funnel
- Tub, clear plastic, shallow
- Ordinary sand, about 40 ml
- Secret Sand, about 40 ml
- Tub, clear plastic, medium-size (one per 2 groups)

Prep Work:

- Empty contents of two fire extinguishers into a resealable clear plastic container.
- Empty packages of Magic Sand into a resealable clear plastic container.

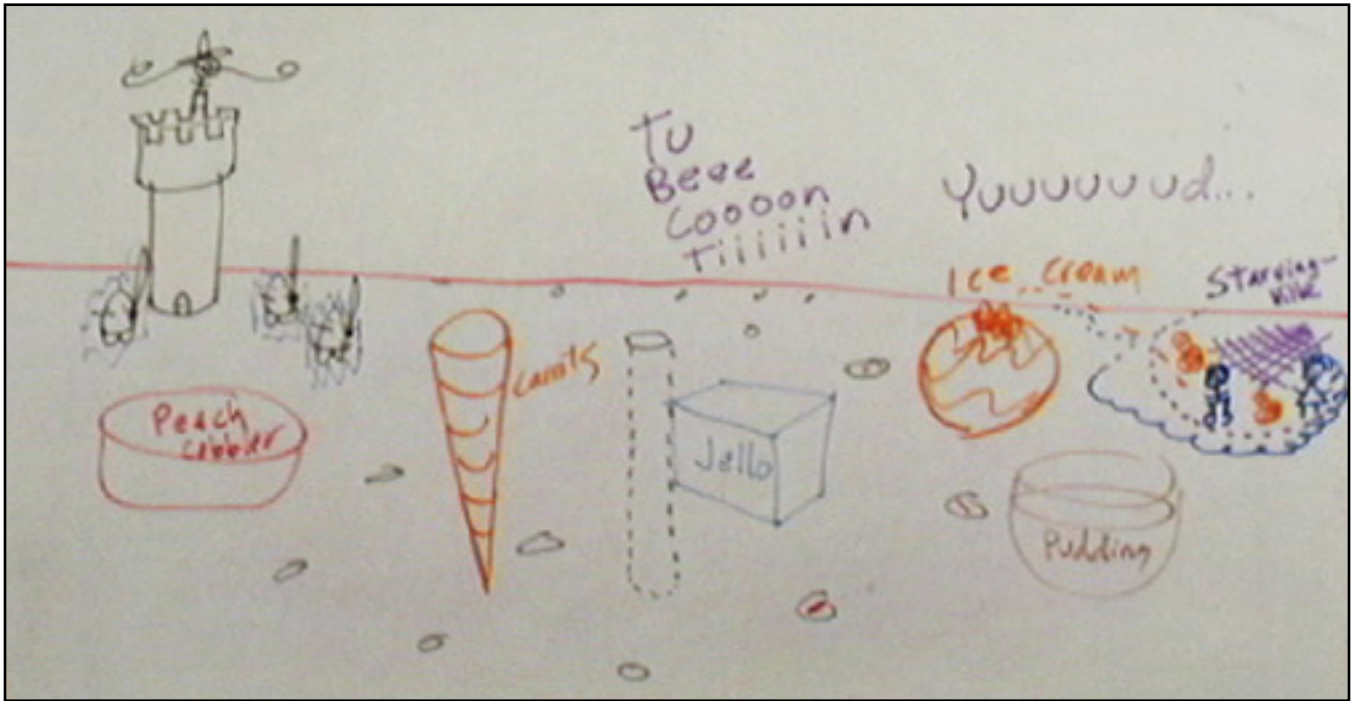


Secret Sand



Fire Extinguisher Powder

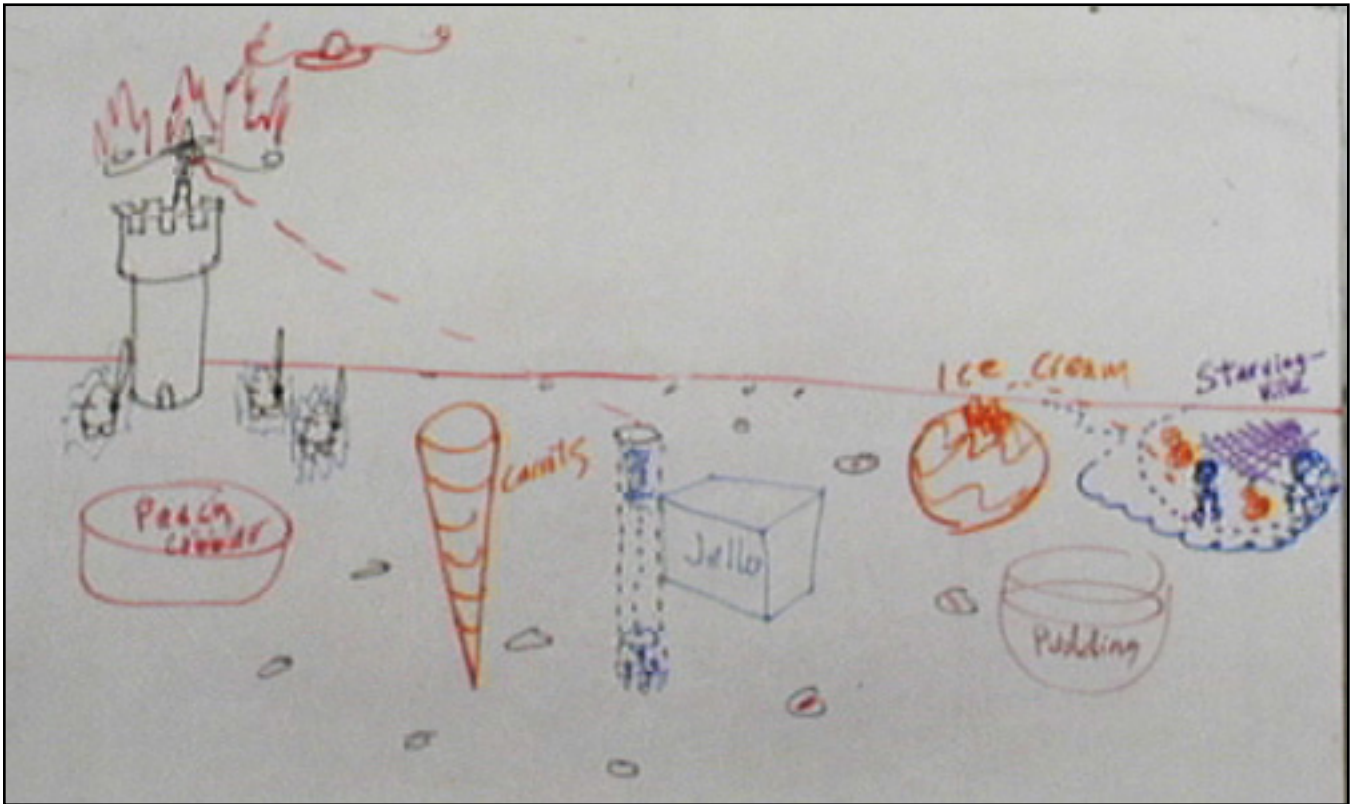
Story Recap: "Jack and Jill and the Dessert Desert"



Part 1:

- There was a desert made of desserts. Nearby was Starvingville.
- There was a dotted line in the sand around Starvingville, and the people wouldn't cross it to get to the desserts in the desert, even though they were starving. They thought they would die if they crossed it.
- Jack jumped over the line, then came back to show that it was safe. But the people believed he was dead and were afraid to go near him.
- Jack & Jill called their Kick-Mes and let the people slam them around and have fun with them, so they'd realize that nothing could harm the Kick-Mes. Then Jack had them throw the Kick-Mes over the line into the desert.
- The Kick-Mes landed in the food and came back with some of it stuck to them, and the people ate the food off the Kick-Mes so they weren't starving anymore. And they started celebrating.
- Evil Mister Fred heard their laughter and sent the minions to find out what was going on.
- When they found out, Evil Mister Fred told the minions to pound a bunch of holes in the desert with their baseball bats. And there was water down in the holes.
- After the people ate the desserts, they got thirsty, so Jack & Jill went to look for water and found the holes.
- Jack jumped into one but couldn't get out. Jill tried to lower her hair down so Jack could climb out, but Evil Mister Fred had installed laser beam igniters in the holes, so Jill's hair burned up before it could get to Jack.

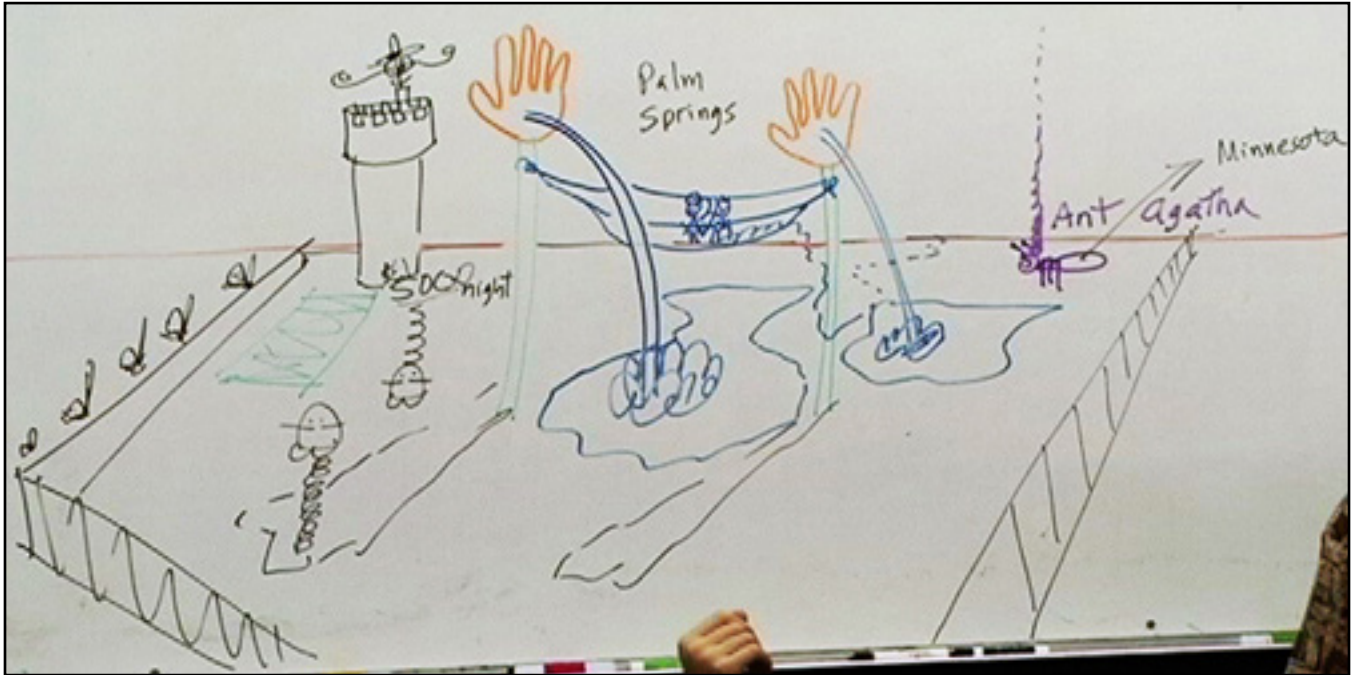
Story Recap (cont.):



Ending:

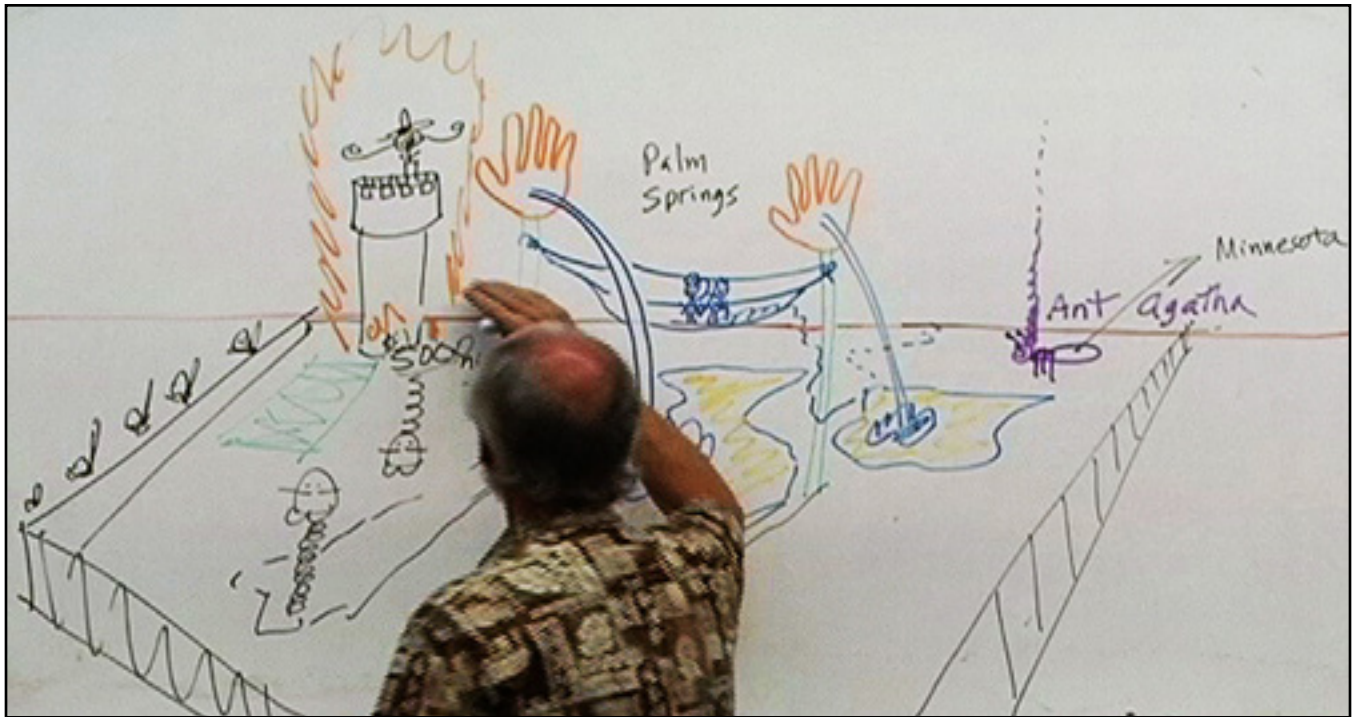
- Jack remembered a story he had read about a fox and a stork. The fox invited the stork to dinner, but gave it food the stork couldn't eat. Then the stork invited the fox to dinner and gave him soup in a tall narrow container with a small opening at the top. The stork's long beak could reach it, but the fox couldn't. So the fox dropped rocks into the container to raise the level of the liquid.
- Jack & Jill had the Kick-Me's jump into the water holes. Kick-Mes sink, so the water level rose and shorted out the lasers. When it got to the top, Jack & Jill grabbed buckets and took the water back to Starvingville.
- One of the Kick-Mes had coated himself with fire extinguisher powder just for fun, and jumped into the water and became all shiny. The laser hadn't been shorted out yet, and the beam hit the Kick-Me, who thought this was fun.
- The beam bounced off the Kick-Me's shininess and hit Evil Mister Fred.
- His mustache and hat caught on fire, and he blew up.

Alternate Story Recap: "Jack & Jill and the Palm Springs Contest"



Part 1 (This is an alternate story that can be used in place of the "Dessert Desert"):

- There was a desert oasis with palm trees that had springs coming out of them (the water kind, not the boing kind). Someone bought the land, put a fence around it, locked it in, and charged people \$500 a night to come and stay there and swim in the water and enjoy the sunshine.
- Jack & Jill's Ant Agatha ran the place.
- Evil Mister Fred convinced Ant Agatha that she needed a vacation and that he would run the place for her while she was gone. So Ant Agatha went off to Minnesota for a vacation.
- Evil Mister Fred had his minions build him a castle in Palm Springs, and he raised the prices to \$5,000 a night. And he had minions with baseball bats guarding the fences so no one could leave.
- Jack & Jill suggested a contest to keep people entertained. The first one was to hop on one leg one hundred times, and whoever gets there first wins. A minion came out with a big spring on one foot, and he won.
- The second contest was to jump from a palm tree down to the ground and bounce back up to the palm tree. Jill thought she could win by using her hair for a bouncy cushion, but a minion came out with a spring on his head, and he won.
- Then Evil Mister Fred proposed a contest where you have to jump into the pool, swim around, and jump back out. If they can come out perfectly dry, he'd let them live.



Alternate Story Ending:

- Jack called the Acme Store of Everything, ordered some fire, and had them deliver it directly to Evil Mister Fred's castle.
- Evil Mister Fred called for help, and Jack grabbed the fire extinguisher and started squirting it at the swimming pool. When Evil Mister Fred called for help again, Jack used the extinguisher to put out the fire at the castle.
- Jack & Jill asked Evil Mister Fred if he was grateful because they had saved his life, but he said no, and insisted on finishing the contest.
- Jack & Jill jumped into the swimming pool, right through the fire extinguisher powder. They swam a little bit, then jumped out, brushed off the powder, and were perfectly dry.
- Evil Mister Fred couldn't believe it. His eyes bugged out and his head exploded.

Transcript: Intro -- "Water & Oil Molecules"

There's Mickey Mouse the water molecule. And his ears are positive. They always say, "The cup is half full." His head is negative. It says, "The cup is half empty." And since he's got some positives and some negatives, they look kind of like north and south poles to some people. So they call him a polar molecule. He's a polar molecule. That must mean he's a polar bear. There.

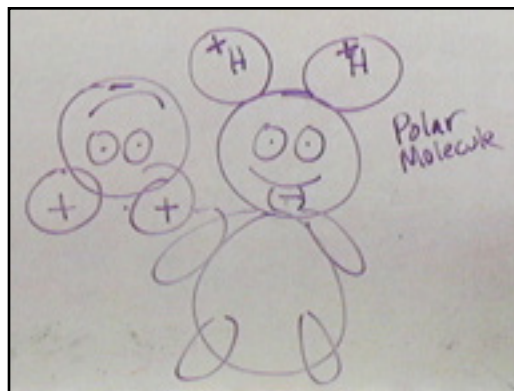
Well, it turns out polar molecules like other polar molecules, but the other polar molecule has to be upside down. So, like that. Because the positive ears like the negative -- it really should be on his chin. The positive ears like the negative chin, and the negative chin over here likes the positive ears over there, and they can stick together like magnets.

So water's always like that. Waters always like to clump together in a ball to be magnets. If you look at oil molecules, they're different. Oil molecules look like caterpillars, and they don't have a separation of charge, and they don't care to hang around with each other. They'll go wherever you push them. So if you have a bunch of oil caterpillars floating around, the water guys will push the oil ones out of the way so the water guys can be with each other. They like each other. So it's not that the oil guys don't like the water molecule guys. It's just that the water molecule guys like each other a lot. So they stick together.

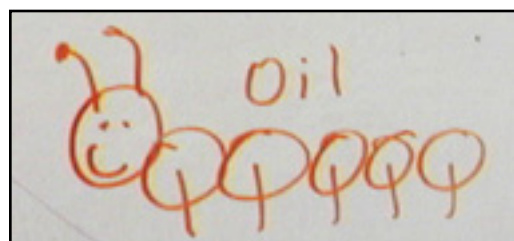
Have you ever dumped water in oil? And it forms a blob, goes somewhere on its own. Or if you put food coloring, which is water-based, in oil, it sits there like a perfect little drop on the surface of the oil. So if you've got a cup of oil and you put in a drop of, say, purple food coloring, the

drop will just sit there like this perfect little drop in the oil. And you can poke it around and stuff, but it comes around back to being a drop unless it sticks to your finger.

So today we're going to be goofing around with things that like water, and things that don't like water. And they made up a name for it, because they aren't happy just saying "things that like water" and "things that don't like water." They want to give it a name that nobody can figure out. So they call them [writes "hydrophilic"]. One of them is that, and the other one is [writes hydrophobic]. Hydro means water, philic means love. Hydro means water, phobic means hate. So if you happen to be hydrophilic, you love water. If you happen to be hydrophobic, you hate water. But first we need a crazy story.



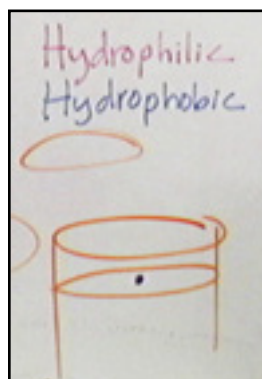
Mickey Mouse water molecules.



Caterpillar oil molecules.



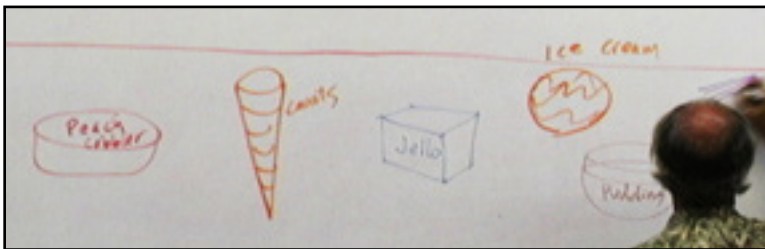
Water molecules clump together.



Drop of food color
in oil.

Story: "Jack and Jill and the Dessert Desert"

Once upon a time, there was a not-deep and a not-dark dessert. [Student: Desert!] No, there was a desert, but the desert was made out of dessert. There was ice cream there, there was jello there, chocolate pudding. [Student: Carrots! Peach cobbler!] Carrots? Peach cobbler? And there was a city over here called Starvingville. And they lived right next to the desert dessert -- or the dessert desert. And they never went out there. There was this like dotted line in the sand, and nobody in Starvingville would cross the dotted line. Wouldn't hurt you to cross the dotted line, but they wouldn't go across it. It's kind of like cows not going across white stripes in the road. Ever see white stripes in the road? And cows won't walk over the white stripes. [Student: Why?] I don't know.



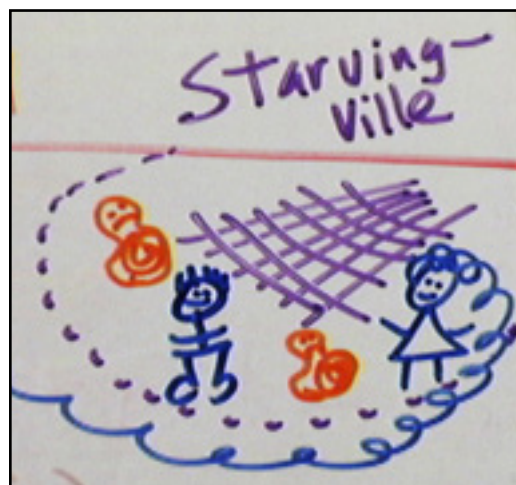
Desert made out of desserts.

And the people in Starvingville called Jack and Jill, and they said, "Jack and Jill, we need help. We're starving out here." So Jack and Jill went there and they couldn't believe their eyes. Here was food everywhere, but the people in Starvingville weren't eating it. And they said, "Why don't you go out there?" And they said, "Because if we go across that dotted line, we'll all die a horrible death." And Jack and Jill said, "Where did you get that idea?" And they said, "Because it's true, it's true!"

Jack and Jill said, "Well, come with us." So Jack and Jill went out there and they stood next to the dotted line on the ground. And everybody said, "(Gasp!) Stay away, stay away!" And Jack jumped over this dotted line. And he didn't die. And they said, "(Gasp!) You're dead!" And Jack says, "I'm not dead, see? [Pokes himself in the chest with his finger.] I'm alive." And he jumped back.

And they said, "Look at Jack -- he's dead! Stay away from Jack. Nobody touch Jack, or you'll die, too!" And Jill said, "Uh, Jack, I think that didn't work." And Jack said, "Well, you jump over!" And Jill said, "No, I think we'd better think of something else." So Jack and Jill went back and spoke to the people of Starvingville, and they decided the people there needed some help. So they called their friends the Kick-Mes. There's the Kick-Mes.

And everybody in Starvingville said, "Aw, how cuuute! Kick-mes!" And everybody took a Kick-Me home, and they'd kick the Kick-Me's all around and slam them on the ground, throw them against the walls, toss them in the fireplace, and the Kick-Me's said, "Yeah, do it again, do it again!" And the people in Starvingville were happy, even though they were still starving. And Jack and Jill said, "Now, we've got a plan." They said, "Hey, people in Starvingville, you notice the Kick-Me's can't be hurt, right?" And they said, "Yeah!" "No matter what you do, they can't be hurt, right?" And they said, "Yeah!" "Okay, throw your Kick-Me's out into the dessert desert." And they said, "Okay."

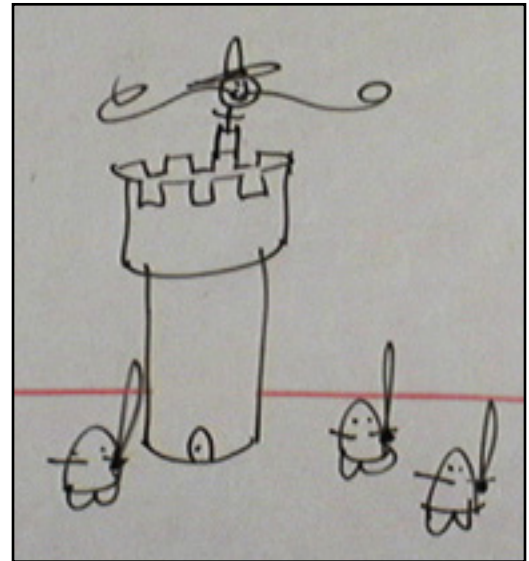


Jack & Jill with their Kick-Mes.

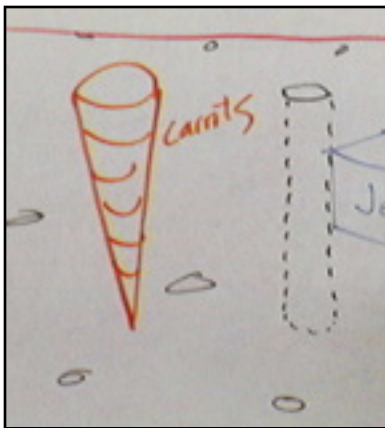
So they all ran to the lines and they bam! -- kicked their Kick-Mes over the line. Splat, right in the ice cream. And then the Kick-Mes came bouncing back with whatever they landed in. A little bit of jello, some carrots, peach cobbler, pudding, whatever. And they brought the stuff back to the people in Starvingville, and now the people in Starvingville were eating! They weren't starving anymore. And they were happy, and they were celebrating. Which makes somebody else really sad.

Now Evil Mister Fred heard about this, and he can't stand it. The people in Starvingville are no longer starving, and they're not moaning and groaning. He likes to go to sleep by the sound of moaning and groaning. He's out there, and he said, "Minions, what's that sound I hear?" And the minions said, "What sound, boss? I don't hear any sound." He said, "I hear laughter!" And they said, "No! Not laughter! Anything but that!" And Evil Mister Fred said, "Yes, I hear laughter. Go find it and make it stop." And the minions said, "All right, boss."

So they started running around in the desert trying to find out where the laughter was coming from. And of course, if was coming from Starvingville. So the minions came back and they said, "Evil Mister Fred, they're not starving anymore. There's some silly little creatures out there all covered with pudding, and they're licking off the pudding." And Evil Mister Fred said, "Yuck! Okay, we're going to have to stop this nonsense."



Evil Mister Fred and his minions.



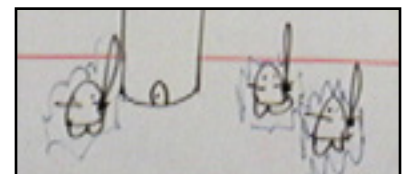
Holes in the desert.

So he said, "Minions, go pound a bunch of holes in the desert." So the minions went out there. And they weren't allowed to use shovels, so they used their baseball bats and banged holes in the desert. So they banged these deep holes. There's holes here and holes there, holes all over the place. And Evil Mister Fred said, "You just wait and see. I'm so smart, they're going to kick those Kick-Mes out there, and the Kick-Mes aren't going to resist the temptation to jump down in those holes. They'll be trapped inside, and they'll never be able to get out again."

And he waited, and sure enough, Kick-Mes came bouncing in -- boing, boing, boing -- they saw the holes, looked in them, and didn't jump inside. And went back to the food. And Evil Mister Fred said, "D'oh!"

How come they didn't go in the holes? Arrrghh!" And when the minions were banging these holes, the minions would come back to Evil Mister Fred all wet. And Evil Mister Fred said, "You know, this is a desert. How come every time you guys come back from making holes, you're all wet?"

The minions said, "Because there's water down there." And Evil Mister Fred said, "Water? Don't tell anybody about that. This is a desert. Not supposed to be any water out there."



Wet minions.

The little people in Starvingville, after they ate all the desserts, started getting thirsty, and thirstier, and thirstier! "We've got to have water! What are we going to do?" And Jack and Jill started running around and looked in these holes. And sure enough, there was water way down there in all those holes. And Jack said, "I'm going to go down there and get some water." And Jill said, "Fine, you go in there."

So Jack jumped in the hole. And Jack said, "Uh, I can't get out." And Jill said, "Yeah, you can't. Too bad." Now, Jill decided to lower her hair down there to get Jack out. Well, Evil Mister Fred had equipped the holes with laser beam igniters. And her hair caught on fire. Jack probably caught on fire on the way down.

Now, if you're Jack and Jill, Jack's trapped down in one of the holes, and you want to bring water to the people in Starvingville, how would you do it?

Imagination and Brainstorming Time

[Students make suggestions] (THERE ARE NO WRONG ANSWERS! Whatever they say, you should reply: "That's a good idea," "They might do that," etc. After brainstorming, proceed with the experiments, then finish the story.)

We'll leave this To Be Continued . . .

Experiment #1: "Ordinary Sand and Water"



Graduated cylinder.

Now we're going to do some experiments and see what happens. We're going to use some of these guys *[holds up a graduated cylinder]*. These are musical instruments *[runs fingernails across the ridges on the side of the cylinder]*, nail files. You know what they're called? *[Student: Tubes!]* Tubes! They went to high school and got a diploma. So they graduated. And they're the shape of a cylinder. They're graduated cylinders. And there's numbers on them. The numbers go from zero to one hundred in ml's. What's an ml? *[Students: Milliliters.]* Milliliters. That's good.

Well, first we're going to pour in -- we're going to fill it about half full of water. Then we're going to pour in sand. And we're going to pour in the same amount of water that we do sand. So when you do pour in the water, look and see what line it comes closest to. And then we'll pour in the same amount of sand, and we'll see what line it comes closest to then.

Now suppose we pour in 40 milliliters of water and then 40 milliliters of sand. Will it read 80 milliliters? *[Students: No.]* No? Why not? *[Student: It'll be about 60.]* About 60? Oh.

Well, pick someone to work with. You can work in groups of two or three. *[Instructor passes out graduated cylinders.]* Okay, every group has a thing. We need



Sand in cylinder.

one thing to measure with. Okay, here we have a handy-dandy super-accurate measuring device [*holds up a 2-oz. souffle cup*], more or less known as a cup. We have to calibrate our cup with sand. It doesn't pour very straight -- that's all right. [*Pours sand into cylinder.*] How much sand should we put in? Whatever that is, that's what's going in there. That looks to me, yeah, it's pretty close to the blue line. That's about 45 milliliters of sand. So when we put the sand in the cup, trying not to spill it, it's about that much [*holds up cup*]. It's not to the top, it's not to the bottom, it's just about exactly at that line that's there.

So I wonder if it's pourable. Oh, you know what? We have a handy-dandy pourable thing [*pours sand from cup into a cylinder using a funnel*]. Okay, so we're going to give each of you one of these cups. Fill it up to that little line that's about there, bring it back, and dump it in your cylinder. [*Instructor passes out 2-oz. souffle cups, 16-oz. cups, and funnels. Students go and get sand, bring it back to their seat, and pour it through funnels into their cylinders.*]



Pouring sand through funnel

After you pour the sand in there, find out what number it comes closest to. This one comes closest to 50. And then dump the sand into your cup. Then take your cylinder over to the water and fill it up to whatever number the sand was at. Whatever amount of sand you had, use the same amount of water. [*Students do this.*] When you come back, don't dump the water in the cup. It won't hurt, but -- [*if you've already done it*] put the funnel on your cylinder and then dump the mixture of water and sand into the cylinder.

Now you pour the dry sand into the wet water. [*Students pour the sand through the funnel into the cylinder, which now contains water.*]

[*Student: We had fifty, and now it's almost 80.*] [*Student: We've got 60.*] You have 60, what did you start off with? [*Student: About 45.*] Yeah, it should have gone to 90, and yours ended up being 60.

Now, you guys were right. Your intuition was correct. Somehow you realized that one plus one does not equal two. How come you ended up with less than twice as much? [*Students offer reasons.*] Yeah, I think there are gaps between the grains of sand. When you put two round things together, there's always a little hole between them. I think the water fills up those little holes.

Now try and get as much of the sand and water out of the funnel and into your cup by dumping, pouring, shaking, whatever it takes. Try to get it out of there. [*Students dump wet sand into large cups.*] It comes out eventually. Now send a person from your group over to the bucket of water to rinse out the cylinder.



Water & sand in cylinder.

Experiment #2: "Secret Sand with Water"

Okay, we're going to do the same thing again, except this time we're going to use a different color of sand. That'll make a difference, right? *[Students: Yes. No.]*

[Student: It's AquaSand.] AquaSand. It's blue, it must be AquaSand. I'm going to come by. Put your funnel on top. *[Instructor pours sand into funnels.]* And someone claims that this is AquaSand. Read the value of the AquaSand and then dump in the same amount of water. *[Students add water to the sand.]* *[Student: It's hydrophobic!]* You're right!

This time, did one and one make two? *[Students: Yes.]* One person says it's because it's hydrophobic. How can you tell it's hydrophobic? Oh, they're not mixing together. Is it glumpifying? Yeah.

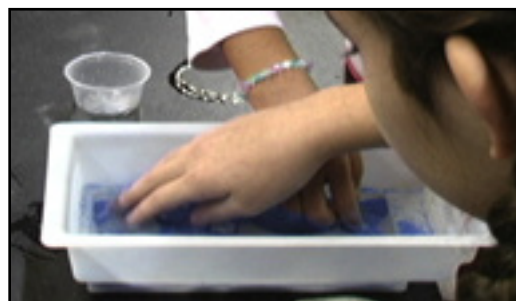
[Instructor passes out shallow plastic tubs.] Dump whatever's in your cylinder into the tub. *[Students dump the sand and water mixture into the tubs.]* Then send somebody from your group to go get more water, and dump the water on top of the sand. *[Student: How much water?]* As much as you like. Whatever you feel like. *[Student: It's like oil and water.]* Yeah. *[Students add water to the tub and feel the sand with their fingers.]* Isn't that weird stuff? *[Student: Is it AquaSand?]* It's called Magic Sand -- it's the same thing as AquaSand. *[Instructor pours more sand in each tub.]*

[Student: It's oil and metal mixed together.] It's oil and sand mixed together. No metal. Have you ever heard of silicone oil? *[Students: No.]* Well, now you've heard of it. There's a type of oil called silicone oil. Sand is siliCON dioxide. SiliCONE oil likes siliCON sand. They stick together really well. You can buy this kind of sand at science places. It's about six bucks a pound. *[Student: You can buy it off commercials on tv.]* You can buy it off commercials on tv.

Now try and pour the water from your tubs into there *[indicates a medium-size plastic tub]*, but keep your sand in that *[their own tub]*. *[Instructor passes out a medium tub to each two groups.]* We're trying to get the water into the big tub and keep as much sand as you can in the little tub. Some of the sand that floats will escape, but the rest of it will stay. When you get your sand more or less separated, I'm going to collect the sand. *[Instructor goes around and pours the sand from each tub into its original container.]* Don't wash your hands yet. Your hands are going to get even dirtier. *[Instructor collects tubs and pours the water into a bucket.]*



Secret Sand in water.



Feeling the Secret Sand in the water.

Experiment #3: "Fire Extinguisher Powder"

This is a fire extinguisher. This thing has the alphabet on the side, at least ABC. Why would they put ABC on a fire extinguisher? *[Student: Caution. To show you the steps.]* Okay, it could be to show you the steps instead of step one, step two, step three. It could be caution. But it's not. A is if your hair catches on fire, this will put your hair out. If your clothes catch on fire, this will put your clothes out. If your shoes catch on fire, it will put your shoes out. If wood catches on fire, it'll put wood out. It's things that usually burn, paper and stuff like that, is an A-type fire. And this'll put it out.

The B-type fire is liquids, like if your car catches fire, oil, gasoline, frying turkey fat. This'll put out a B-type fire. B stands for the oil.

C-type fire is electrical fires. So if your computer catches on fire, the batteries are burning up, you can put it out with this. You don't want water on an electrical fire because you'd get electrocuted. But this'll put out electrical fires.



ABC Fire extinguisher.

The powder that is in here is the same powder that you can put in breads and cakes to make them rise. Monoammonium phosphate. You guys don't snack on monoammonium phosphate at home for snacks? Some bakeries use it to put in their food. That's the main ingredient, but the second ingredient is mica. The third one is ammonium sulphate -- that's fertilizer. Then there's talc -- baby powder. And then there's "nuisance dust." That's what it says -- nuisance dust. Where do you buy nuisance dust?

Well, I emptied these two guys *[indicates fire extinguishers]* into a container, and if you open it up -- nuisance dust. It's a really, really fine powder. Don't blow into it when I bring it by. Otherwise, it'll cover your face with nuisance dust. But you can see it. *[Student: Can we touch it?]* You'll get to feel it in a minute, but don't reach in there. *[Instructor walks around table with open container so students can see it.]* It should smell like monoammonium phosphate. This is fire extinguisher powder. Doesn't smell all that bad.



Fire extinguisher powder.

Well, they don't want it to sit in your fire extinguisher and turn into a big lump. So they put some stuff in there that absorbs water, but still it would lumpify. So they coated all the chemicals with a little bit of silica gel kind of stuff, which is the same thing that that blue sand is coated with. But this is really, really fine powder. So it does something bizarre. Let's go outside and I'll show you what it does. It's bizarre.

[Outside, Instructor has a large clear plastic tub about half-full of water.] I'm going to pour a little bit of our nuisance dust on the water. I hate this stuff. Smelly, smelly stuff. *[Pours some of the dust on the surface of the water.]* There. We've got a little coating of that. And we'll let the dust get kind of blown away. Now, we don't want you to stick in your hand and go splashy-splashy-splashy, because it doesn't

work if you go splashy-splashy-splashy. But if you take your hand and you put your fingers in *[Instructor slowly places his fingers into the water.]*, then take your fingers out -- your hand's dry! So you can do like four people at once if you each choose a side. *[Instructor pours powder into a second tub of water so more students can get to it. Students take turns putting their hands into the tub.]* Look at that. It does look like metal, doesn't it? After you've dipped your hands, go in the restroom and you can wash your hands.



Instructor's hand dips through powder.



Now suppose you're cooking in your house. You're making french fries. And you've got the oil in the frenchfrying pan, and the potatoes in there, and they're sputtering and everything, and the doorbell rings. Ding-dong! So you go over there to answer the door. And you're talking to the people at the door, and they're telling you this story, and then you remember: "Ah! My french fries are still on the stove." And you glance toward the kitchen, and you see the glowing, flickering light of flames. So you run into your kitchen and you say, "Ahhhhhhh!!!"

And now you have to decide: Should you use your fire extinguisher and fill your entire house with powder that sticks to the walls, floors, ceilings, curtains, dogs, cats, rats, bats, elephants, everything that's in your house, to put out the fire and save

your house? Or should you run outside and scream? Well, you can put out a frying pan fire by turning off the heat and putting a lid on it, but you usually burn your arm a bit when you try to put the lid on, because the flames scoot out from under it. So if it's a small fire, you have to think carefully about squirting this all over your house. If it's a big fire, that isn't going to put it out anyway. So the first thing on your mind should be 9-1-1. Get out of your house. Call from your neighbor's house. Because they can get there usually within two minutes and have it out within another two minutes. If it's a small fire, go for it. That won't put out a Christmas tree. If your Christmas tree catches on fire, you can spray that till you're blue in the face. The Christmas tree will keep going. It won't go out, unless you have a really big fire extinguisher. Christmas trees are like little bombs. They're amazing.

End of Story

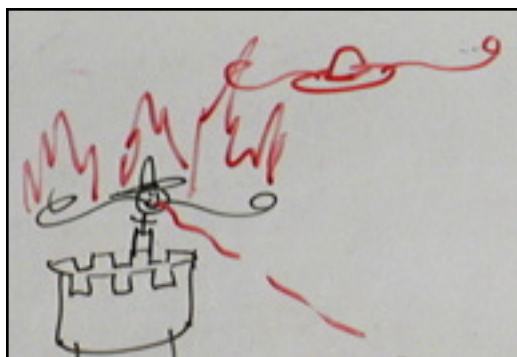
*** DO NOT *** *present this part of the lesson until after the experiments!*

So Jack and Jill are out there, Evil Mister Fred has had his minions dig all those holes, there's water down in the holes, so people in Starvingville are thirsty. And there's lasers that burn up stuff that tries to go down into the holes. So Jack and Jill said, "Hey, I read about this in a story once. There was a fox that invited a stork over to dinner and gave the stork food that the stork couldn't eat, like french fries. And then the stork said, "I'll show him!" And he invited the fox over to dinner and put the fox's soup in a long skinny bowl with a little tiny hole in the top. The stork could stick his beak down and drink the soup, but the fox couldn't.

So here we have a long skinny hole with water at the bottom and they want to get water out. Jack and Jill could buy beaks for all the people in Starvingville, or really long straws, and they could stand out there and try and suck the water out. And the laser would chop the straws to bits. But what did the fox do to get the soup out of the bowl? *[Student: Rocks.]* Rocks! Did he hit himself with rocks? What did he do with the rocks? Right, he threw the rocks in there so the soup would come up.

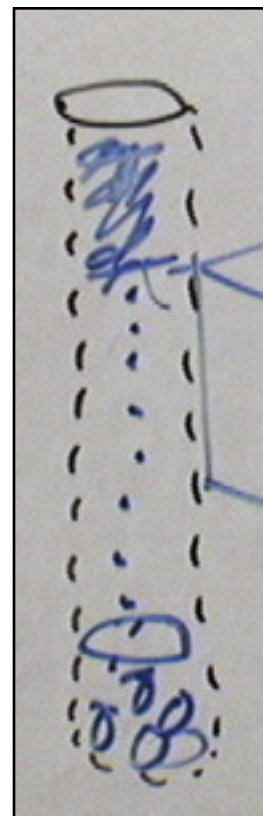
So Jack and Jill went out there and they had all the Kick-Mes jump into the water. And Kick-Mes sink. And the water level went up and up and up and up and up and shorted out the laser beam (I like that -- somebody had that idea). And when the water got to the top, they said, "Whoo-hoo, we've got water!" grabbed buckets, and ran back to Starvingville and gave people the water to go along with the deserts they were eating off of the Kick-Mes.

Now, Evil Mister Fred was watching this, and he was getting madder, and madder,



Evil Mister Fred's mustache on fire.

and madder. He said, "You can't do that!" And they said, "But we just did." And one of the Kick-Mes was over here, and he had coated himself with fire extinguisher powder because he's an idiot. And he jumped in the water and he became all shiny. And he jumped right in, and the laser hadn't gotten dead yet, and the laser hit him. And he went, "Oh, that tickles!" And the laser beam bounced off his shinyness. Where's the laser going to hit? *[Student: Of course!]* And it hit Evil Mister Fred, and his mustache caught on fire, and his hat. And he blew up. There was just a hat with a mustache left over. And they all lived happily ever after, except Evil Mister Fred.



Kick-Mes in hole.

End of Lesson

If you have questions about this lesson, please ask them through the [online Teacher Support Forum](#) on our web site.

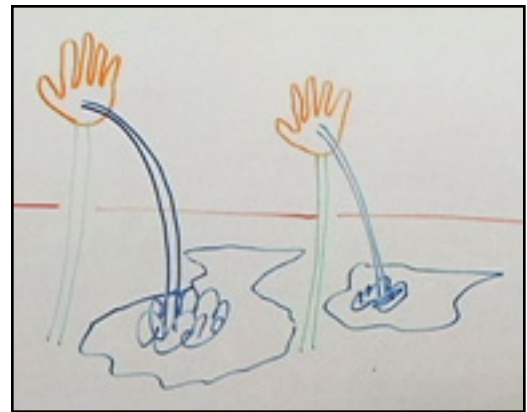
(An alternate story for this lesson begins on the next page.)

Alternate Story: "Jack & Jill and the Palm Springs Contest"

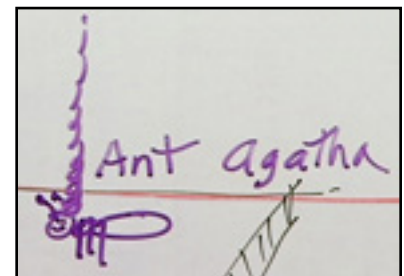
[NOTE: Mr. Mac never tells a story the same way twice, and sometimes he changes it completely. Here's a different story he told when he presented the "Secret Sand" lesson to another group of students several months after this lesson was originally filmed. Feel free to use this one in place of the "Dessert Desert" story if you like.]

Once upon a time, there was a desert. And there were palm trees in the desert. And they were in Palm Springs. So the palm trees had to have springs coming out of them. These are springs of water rather than boing springs. There we go -- springs of water, and water forms big pools, like that. It's nice to have water out in the desert. People can go swimming and stuff.

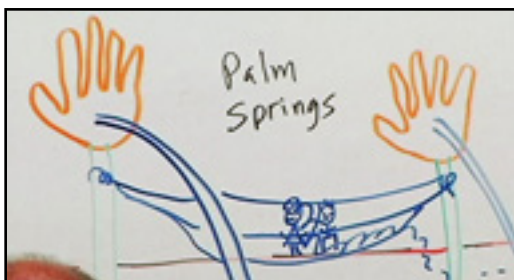
So now this is an oasis out in the desert. People go there and cool off, sit under the shadow of the palm trees, and somebody discovered how nice this was there and they said, "Why, we can't have this out here for free." So they bought the land with palm trees and springs, and they put a fence around it, and they locked it all in. And they called it Palm Springs. And people could stay there and swim in the water and enjoy the sunshine -- for a price. And the price was \$500 a night. And it was run by Jack and Jill's Ant Agatha. They never had an Ant Agatha before. And she's got tall hair. And she ran Palm Springs. People would come there, and she was really nice. She'd cook food for them, she'd find places for them to sleep. If they wanted to, they could sleep in hammocks. There's people sleeping in hammocks. Let's put Jack and Jill there.



Palm trees with springs coming out.



Ant Agatha



Jack & Jill in a hammock.

Now, she was doing pretty good. People came from all over the world to go to Palm Springs. They had games, you could go golfing, you could play tennis, you could play croquet. And things were good. Well, of course, whenever things are good, who should show up? [Students: Evil Mister Fred.] Evil Mister Fred.

So they were charging \$500 a night. And he said, "Well, that's a good price." And he went over to Ant Agatha, and he said, "Hey, Ant Agatha, this is really a nice place. Do you work here?" And she said, "Yep, been working here every day, seven days a week for thirty years." And Evil Mister Fred said, "Well, that's too much work for any one person to do. You should take a vacation from your vacation." And she said, "You're right. I should take some time off. I think I'll go work in a factory in Minnesota, in the wintertime." And Evil Mister Fred said, "Perfect! And I'll take over for you while you're gone, make sure the lawns are mowed and the pools are kept clean. Everything will be just fine when you return." And Agatha said, "What?"

Thank you, young man. You're a charming person. I'll do that." So Ant Agatha went to Minnesota to work in a factory.



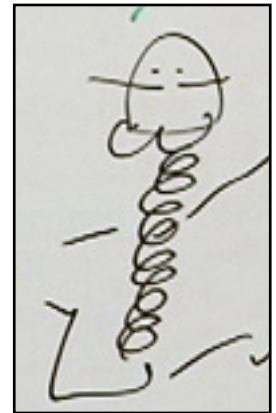
Minions guarding the fence.

Now Evil Mister Fred is in charge of Palm Springs. So of course, first thing he does is build a castle. Or, makes his minions build a castle because he's too lazy. And now Evil Mister Fred notified everybody that was there that there was going to be a slight price increase. If they wished to stay, they had to pay a little bit extra money. They said, "Well, how much is it? Ten dollars?" He says, "Oh, no, no, a little bit more than that. Instead of five hundred a night, it's now five thousand dollars a night." And everybody said, "What? You can't do that. That's robbery. We just got here. We're not going to pay five thousand dollars for a night." And Evil Mister Fred said, "Take it or leave it. And by the way, there's a fence all around here, and there's minions guarding the fence, and they have machine guns." They don't really have machine guns because they'd shoot each other. They just have big baseball bats.

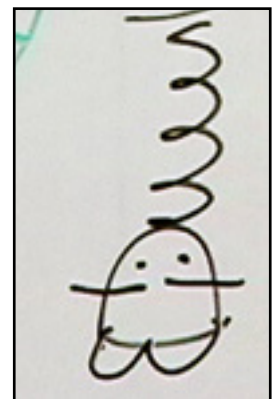
Now the people are trapped inside. And they said, "Evil Mister Fred, you really are evil." He said, "Thank you." And Jack and Jill said, "Yep, I guess we're stuck. We'll have to pay that Evil Mister Fred." And they said, "You know, we've got to entertain ourselves here. How about we have a contest? You against us." And Evil Mister Fred said, "Okay, a contest. I could beat you at anything. I don't care what you do, I can do it better than you." And Jack and Jill said, "Huh, okay, let's have a contest. We'll have a running contest where you have to hop on one leg a hundred yards, and whoever gets there first wins." And Evil Mister Fred said, "Okay, minions." And one of his minions came out. And he had a big spring on the bottom of his left foot, and he won the contest.

And Jack and Jill said, "D'oh!" And they said, "Well, okay, we'll have another contest. Jump from the palm tree, bounce on the ground, and land back on top of the palm tree." And Jill said, "Well, I can do this. I've got my cushiony hair. I'll just jump off his palm tree, and I'll bounce right back up. I'll win this for sure." And Evil Mister Fred brought out another one of his minions. This time the minion had a spring on his head. And he won the contest. Jack and Jill said, "D'oh!"

And Jack said, "Well, I'm tired of these contests. We always lose. I'm going swimming." And Evil Mister Fred said, "Well, there you go. There's a contest. All you've got to do is jump in the pool, swim around, and jump back out. If you can come out perfectly dry, I'll let you live." Now, if you were Jack and Jill and had to jump into a pool, swim all around, and come out perfectly dry, how would you do it??



Minion with a spring on its foot.



Minion with a spring on its head.

[Pause for Imagination and Brainstorming time.]

End of Alternate Story

**** DO NOT * present this part of the lesson until after the experiments!***

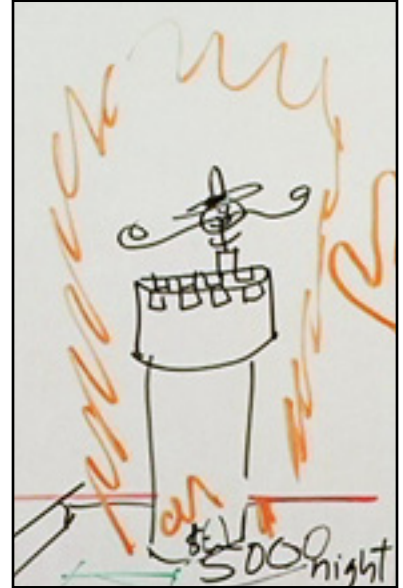
So Jack and Jill want to escape from the Evil Mister Fred. They had to go swimming and come out perfectly dry. Well, well, well, you know the trick, don't you? And Jill said, "You know, I have an idea. I think we can pull this off. But first, we need some fire." And Jack said, "Yeah, I like fire. Fire is good." So they called the Acme Store of Everything and ordered some fire. And at the Acme Store of Everything, of course, they asked, "Where would you like your fire delivered?" And they said, "Right to Evil Mister Fred's castle, please." And they said, "Okay, be right there." And of course, fire appeared all around Evil Mister Fred's castle.

And Evil Mister Fred said, "Nooooo! And Jack and Jill said, "Never fear! Jack and Jill are here. We will save you." So they got the fire extinguisher and started squirting it at the swimming pool. Evil Mister Fred said, "No, no, put out the fire in my castle!" And Jack and Jill said, "Oh, sorry." They put out the fire on Evil Mister Fred's castle just before his mustache caught on fire. And Jack and Jill said, "See? Aren't you grateful? We just saved your life." And Evil Mister Fred said, "No. Okay, on with the contest."

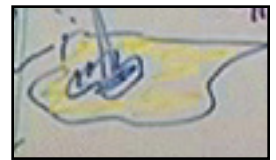
And Jack and Jill said, "All right." So they jumped into the swimming pool, right through the fire extinguisher powder. And they swam through the water a little ways, popped back up, brushed off the powder, and there they were, perfectly dry.

And Evil Mister Fred said, "I don't believe you. It can't be true. This is -- this is -- this is just --" His eyes started to bug out big, and then his head exploded. And they all lived happily after, except Evil Mister Fred.

End of Alternate Story



Castle on fire.



Yellow powder
on the water.