



Teacher's Guide for:
Wind Chill Factor

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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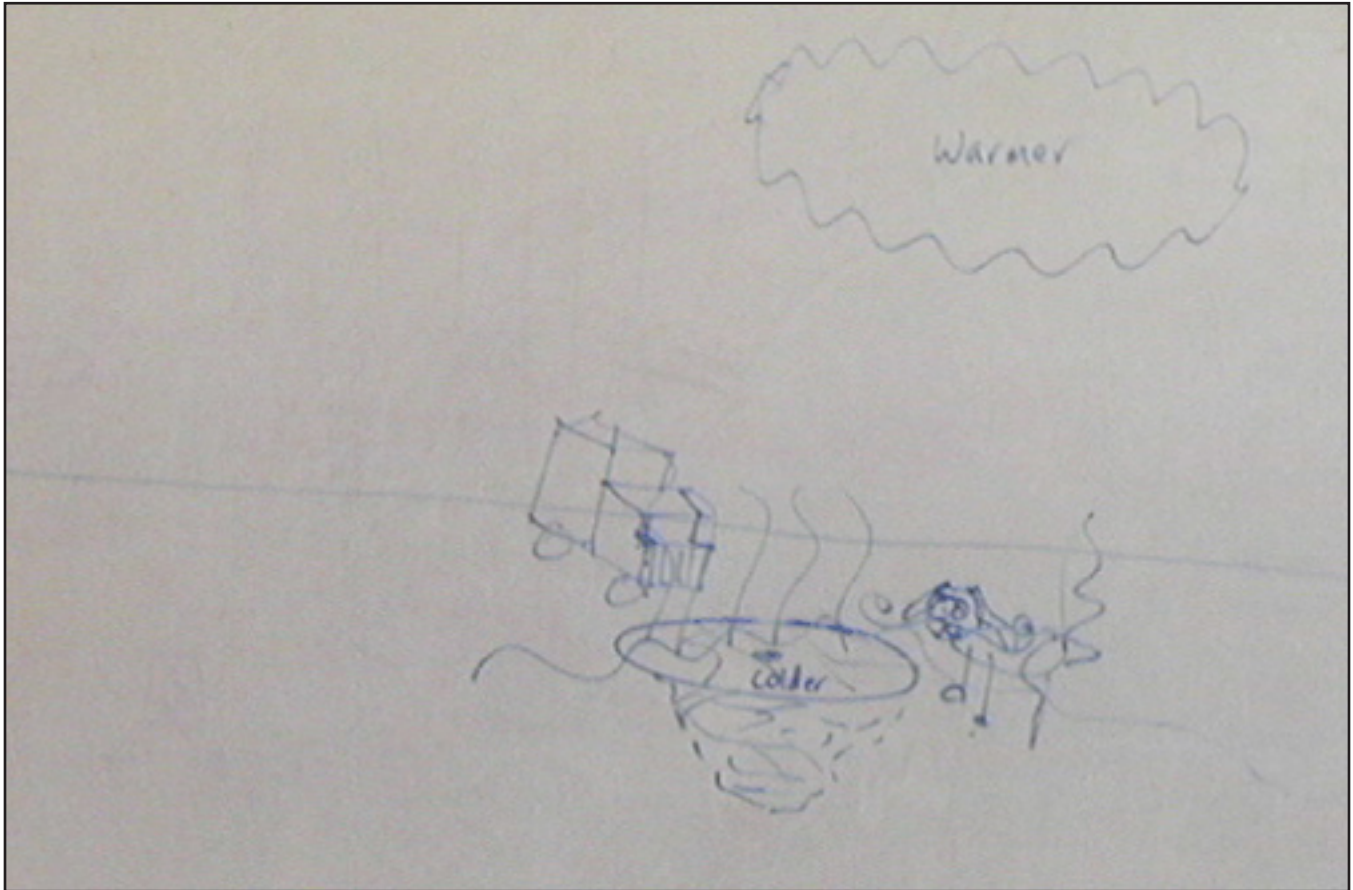
Title Page of Video

Wind Chill Factor
A Rock-it Science Lesson
Filmed July, 2009

Rock-it Science
2110 Walsh Ave, Unit F
Santa Clara, CA 95050
www.rockitscience.org

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Quick Recap



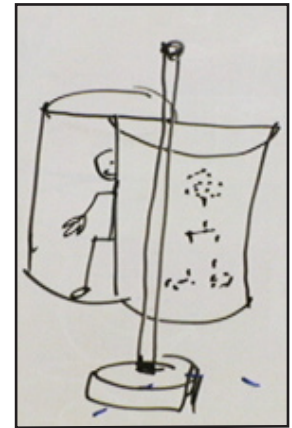
Lesson Intro: Evaporation

- There was a puddle that kept getting smaller and smaller. A dog drank some of it, a snake slithered through and got wet, and a big truck drove through and splashed some water out.
- How many other ways could a puddle go away?
- Two main ways: it could evaporate, or it could soak into the ground.
- When a puddle goes away, does it get hotter or colder?
- If I poured water on your heads and you stood outside in the wind, would you get hotter or colder?
- When things evaporate, it makes the puddle colder. When it goes up into the clouds and condenses into the clouds, the clouds get warmer. Warm things go up.

Experiment Recap

Experiment 1: Hand Temperature

- Your hands have built-in thermometers.
- Set up a large fan and let the students approach it with their palms facing it to see if it feels hot or cold. They can also stick out their tongues.
- Spray students' palms with water and have them walk by the fan again to see how hot or cold it feels. Repeat with rubbing alcohol.
- In order for evaporation to take place, you need wind. At airports, they use a pole with cups on it to measure wind speed.
- A better way to measure slow wind speeds is to cut a barrel in half and put a pole through the center, and set it on a big wheel on the ground so it can spin around. If you were inside it, you'd get really dizzy. You can also make electricity with it. We're going to make something that spins even better than that.



Experiment 2: Pinwheels

- Demonstrate how to make a pinwheel (younger students need a lot of help with this):
 - Lay out material (clear plastic or mirror mylar), place the square cardboard pattern on it, and trace around the edges. Cut out the square.
 - Fold it diagonally and crease it. Then fold it on the opposite diagonal and crease it.
 - Draw a circle in the center and draw lines along the four creases from the corners to the circle.
 - Draw a dot in the center and a dot near each corner, just to the right of the line.
 - Cut along the creases from the corner just to the edge of the circle.
 - Use a thumbtack to punch a hole in each of the five dots.
 - Poke a straight pin through one of the corners, then bend each of the other corners in sequence down to the pin and thread them onto it through their holes. Then put the pin through the center hole.
 - Push the pin only partway into a pencil eraser, in order not to bend the pin.
 - Write name on pinwheel with a permanent marker.
- When students finish their construction, let them walk around moving their arms to make the pinwheel spin, then turn on the fan and let them stand in front of it with their pinwheels.



Equipment List: "Wind Chill Factor"

Items needed for Instructor:

- Large Fan
- Spray Bottle of Water
- Spray Bottle of Rubbing Alcohol

Items needed for Students:

Consumables (per student):

- Mirror Mylar or Clear Plastic Sheet (about 1 sq ft)
- Pencil (unsharpened) with eraser
- Pushpin or Thumbtack
- Round-headed straight pin

Other:

- Pinwheel Patterns
- Scissors
- Colored Permanent Markers

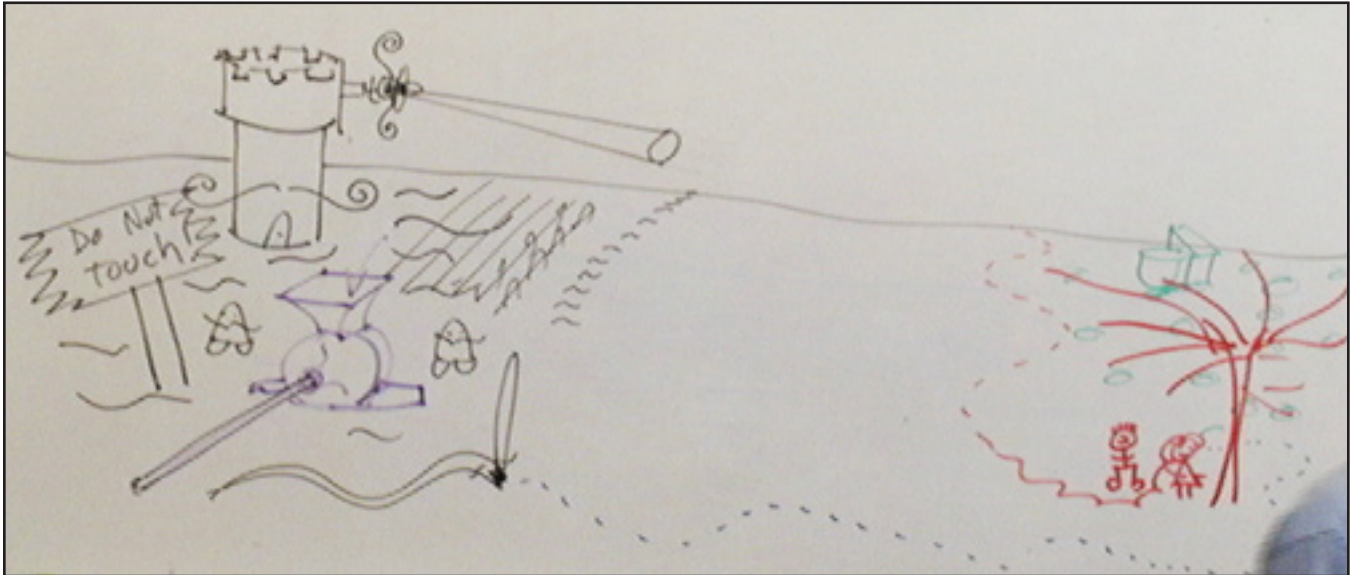


Pinwheel Pattern

Prep Work:

- Make several pinwheel patterns on cardboard:
 - Pattern is about 1 foot square.
 - Draw diagonal lines from corner to corner and a circle about 3 inches in diameter in the center. (DO NOT extend the lines into the circle. If you do, the students will tend to cut into it.)
 - Draw a hole-punch dot at each corner, to the right of the diagonal line.
 - Draw a hole-punch dot in the center.

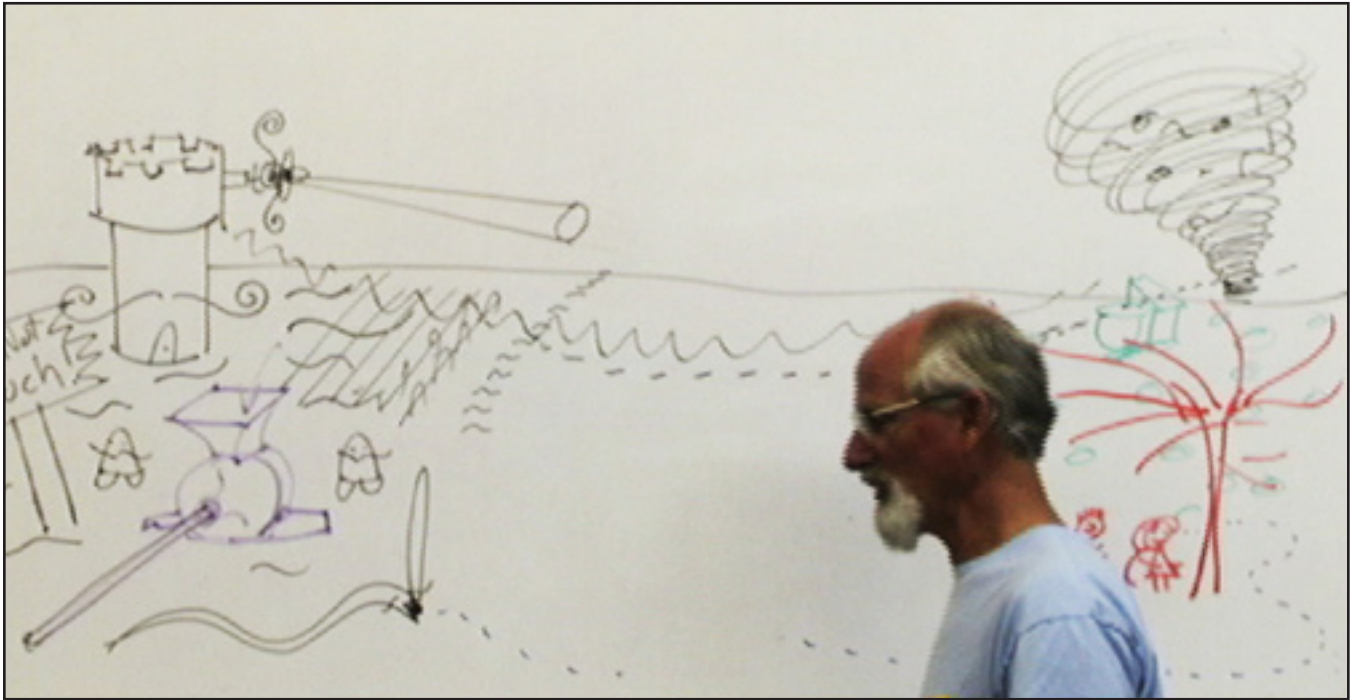
Story Quick Recap: "The Minion Snakes"



Part 1:

- Evil Mister Fred bought a sausage maker and left it sitting near his castle while he went to the store to buy some meat.
- He left a "Do Not Touch" sign on it.
- The minions couldn't read it, and some thought they were supposed to hit the machine with their baseball bats. Others thought they were supposed to jump into the top of it.
- They accidentally hit the ON switch while they were fighting and wrestling, and some of the minions fell into the machine and came out as long snakes with mustaches, holding baseball bats.
- Nearby, Jack and Jill were growing toilets on their toilet tree. Once they become ripe, Jack and Jill would take them down and sell them to hardware stores.
- Evil Mister Fred sends one of his minion snakes to sneak up on Jack and Jill and find out what they're doing.
- The snake didn't understand what Jack and Jill were talking about, so he told Evil Mister Fred that they were raising an army of robots in their tree in order to kill Evil Mister Fred and the minions.
- Evil Mister Fred sent an army of minions to destroy the robots on the tree. But when they started hitting the tree with their baseball bats, the ripe toilets fell on their heads, so the minions ran off.
- They told Evil Mister Fred they had defeated the robot army, but he looked through his telescope and saw that they were still in the tree.
- Then Evil Mister Fred sent his army of snakes with their baseball bats to beat up Jack and Jill and break all their toilets.

Story Quick Recap



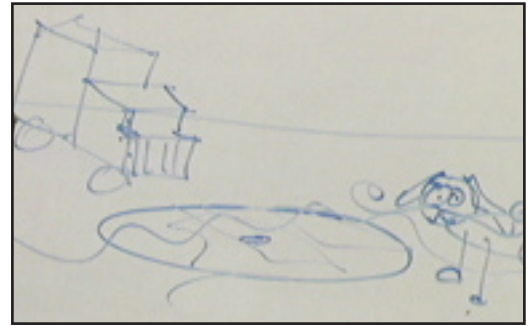
Ending:

- Jack and Jill saw the army of snakes coming and didn't know what to do. Jack said, "It could be worse -- there could be a tornado."
- And a tornado appeared, and headed straight for the toilet tree.
- It almost missed the tree and just took a few toilets off the edge.
- Then it went across the field and sucked up all the snakes, which made them dizzy and angry.
- The tornado kept going over to Evil Mister Fred's castle.
- The snakes got all wrapped around his head, and a toilet landed on top of his hat.

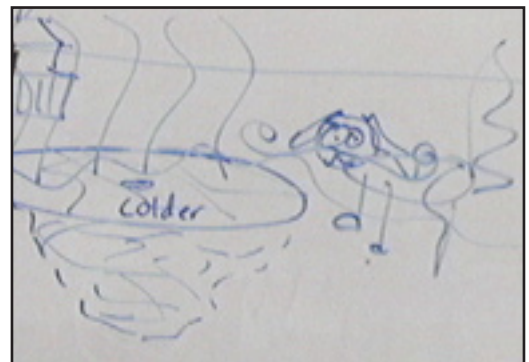
Transcript: Introduction

Once upon a time there was a puddle. There's our puddle. It was a perfect, nice puddle. Everybody enjoyed that puddle. And the puddle kept getting smaller, and smaller, and smaller. One day, a dog came along and drank some of the puddle. Another day, a snake slithered through and got all wet and took some of the water that way. And then a big truck came along and ran right through the puddle and splashed the puddle all over the place. Before long, that great big nice puddle was just a little tiny puddle of a big mess. How many ways could that puddle go away if there were no dogs, snakes, or trucks? *[Students make suggestions, including evaporation and soaking into the ground.]* Well, those are the two main ways. The puddle can evaporate into the air, or it can soak into the ground. The ground is always thirsty, like that.

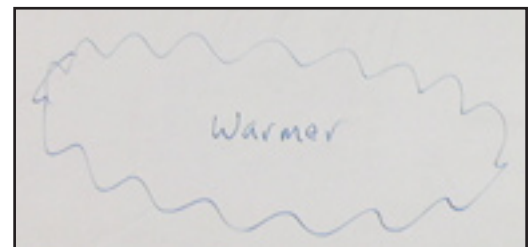
Now, when a puddle goes away, does the puddle get hotter or colder or stay the same? *[Students guess both hotter and colder.]* Well, there's a test we can do. What we could do is, I have a bucket of water here. I could pour it over all your heads and then you could stand out in the wind and see if you get hotter or colder. Colder? Okay, colder. We'll kind of test that out later. Usually when things evaporate, it makes the puddle colder, like that. When they go up into the clouds and it condenses in the clouds, the clouds get warmer. Isn't that weird? Remember, warm things go up? So all the water that made the puddle colder makes the cloud warmer, and a warmer cloud wants to go up and creates wind and things up there. So today we're going to be goofing around with warmer and colder things.



Puddle with Dog, Snake, and Truck.



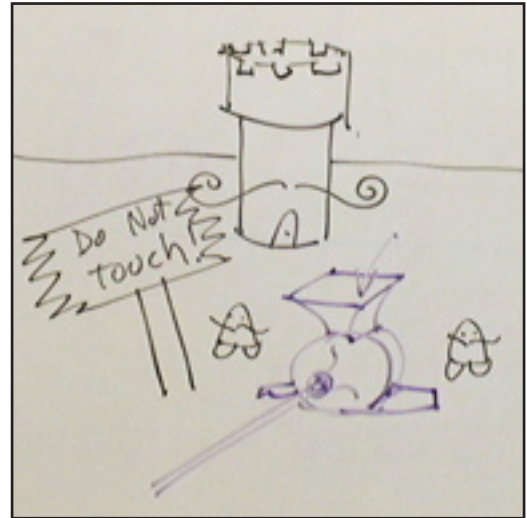
Water can evaporate or soak into the ground.



It gets warmer when it's in a cloud.

Story: "The Minion Snakes"

Well, Evil Mister Fred was browsing around through a catalog one day. He found a sausage maker. It's a machine that you put meat in, and a motor turns -- rrrrr, rrrrr, rrrrr -- grinds the meat up, and squirts it out in a long tube. He had that sitting over at his castle. So he's got his castle there, like that. And it's got a door, and we'll give it a mustache, too. And we need a horizon. There you go. And he's got the sausage maker. It's a pretty big machine. It has an opening in the top to draw in meat and stuff, it's got a big old grinder thing that grinds it all up, and it's got a nozzle that comes out, with a hole in it. And you throw the stuff in there and out here comes sausage, like that. And Evil Mister Fred put a big sign on it that said, "Do Not Touch." And he went away to go buy some meat.



Evil Mister Fred's sausage maker.

And the minions came around and they saw the sign that said, "Do Not Touch." Now, the minions looked at this and they said, "Oh, look, a sign -- with words. We can read words. We're not as dumb as people think. I know what that says." And one minion said, "Yeah, that says, 'Hit it with your baseball bat.'" So they started hitting it with their baseball bats. And another minion said, "No, that's not what it says. You're totally wrong! It says, 'Jump in the box on the top.'" And so one of them jumped in the box on the top, and they're all fighting and wrestling and everything, and while they were goofing around fighting and wrestling, somebody pushed the ON button. And he turned a whole bunch of minions into sausage. They popped out of there, and now he's got minion snakes with their mustaches, carrying baseball bats.



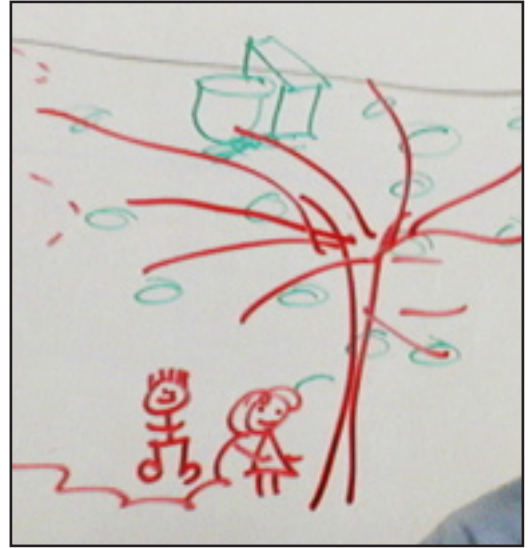
Minions turned into snakes.

When Evil Mister Fred came back he said, "Wait a minute. Where did all my minions go?" And they said, "I don't know, boss. We didn't do anything. We're good. We didn't put them in that machine you bought. No, sir, not us. We've been good." And Evil Mister Fred looked at them and he said, "You what? You put minions in my sausage maker? Where'd they go?" And the other minions said, "I don't know," and they tried to get away. And Evil Mister Fred saw all these snakes running around with mustaches and baseball bats. He said, "Oh, no. You turned my minions into snakes. Oh, well, I guess I'll keep them. You never know when you're going to need a good snake."

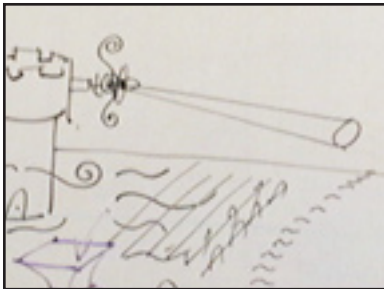
Now, not far away, Jack and Jill are playing around with . . . What would be a good occupation for Jack and Jill? [Student: *Cleaning toilets.*] Ah, Jack and Jill are cleaning a whole field full of toilet bushes. There's toilet bushes out there. And they get nasty smelling and everything. So there's toilets everywhere out there. Where do you think toilets come from? They've got to grow, right? [Student: *Maybe there are toilet trees.*] Maybe they grow on toilet trees. That would be better. Here's a tree with toilets growing on it. Like that. And Jack and Jill are tending to them to see if they're ripe or not. And once they're ripe,

they should take them down and sell them in the hardware stores. Somebody's got to buy them. How do you get a toilet in your house? Do they just grow in your house, too?

And they were minding their own business, and Evil Mister Fred said, "What are those two doing down there? They've got trees with toilets growing on them. That's the strangest thing I've ever seen. I need someone to go over there to sneak up and see whether they're trying to do something in secret or not." And so he told one of his snakes, "Go over there and slither around in secret. Don't let anybody see you. And find out what Jack and Jill are doing." So the snake went over there, and he listened, and he watched, and he doesn't ever get anything quite right. He heard what Jack and Jill said. And then he came back and said, "Boss! I heard everything. It's terrible! They're raising these robots on that tree. And the robots are going to march across this field, they're going to attack the castle and kill all of us." And Evil Mister Fred said, "Jack and Jill are raising an army to kill us? With robots? Ooooooh, that makes me mad!" And so Evil Mister Fred said, "We'll show them!"



Jack and Jill's Toilet Tree



Evil Mister Fred with telescope and army of minions & snakes.

So he trained his minions to form lines and how to march. And he took all the minions that weren't snakes and he said, "Okay, you guys, you're going to go across that field and you're going to destroy all those robots they've got growing on that tree." And so the minions came marching across the field -- dum, dum, dum, dum -- with their bats. They came to the toilet tree and they started hammering on the toilet tree. Well, some of the toilets were ripe. And when you bang on a toilet tree and there's ripe toilets, the toilets fall off, and they were hitting the minions on the head and knocking them down. And the minions said, "Aaaaaaa, attack of the robots!" And they ran away, because they were afraid.

And they came back and Evil Mister Fred said, "Well, did you defeat them? Did you kill all those robots?" And the minions said, "Uh, yeah, Boss. We did. We killed them. Every one of them. Yeah, that's right, we killed them all." And Evil Mister Fred said, "Uh, I don't think so." He got out his telescope and he looked across the field, and sure enough, there was still a bunch of toilets on the tree. He said, "Oh, man, you guys can't do anything right. I'm going to send my snakes over there. They'll think of something."

So he had thousands of snakes by this time, with their baseball bats. And he's going to send them across to beat up Jack and Jill, break all their toilets -- can you imagine life with no toilets? -- and create havoc and mayhem. And Jack and Jill happened to glance across the field, and now there's an entire army of snakes coming to get them. If you were Jack and Jill, what would you do?

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: "Hand Temperature"

[Instructor has a large fan and points it toward the students.] You can probably feel some wind. Does my voice sound the same out here as it does from back here? *[Moves behind the fan as he speaks.]*
[Students: No.] The same here? *[Students: No.]* No? *[Student: Your voice vibrates.]* My voice vibrates? Well, we want to see if this wind changes the way your hands feel. I'm going to put it back here. By the way, this is a gyroscope. If I move it up or down, or left or right, it doesn't do anything. However, if I go *[tries to turn sideways and the fan makes a grating noise]*, it talks. It doesn't like that *[places the fan on a stand]*.

So what we're going to do is . . . Does everybody here have two hands? *[Students: Yes.]* You know your hands have thermometers built in? *[Students: Yes.]* Yep. Your nerves in your fingers. You're going to approach the fan with your hands and feel them and then walk around this way and see what it feels like. You can stick your tongue out, too, when you come. See if your tongue feels hot or cold. Don't lick the fan. So everybody line up. You're going to walk up here, feel the fan, and then go around and get at the end of the line. *[Students take turns walking up to the fan with their palms forward to feel the wind.]*



Students feel the wind from the fan.

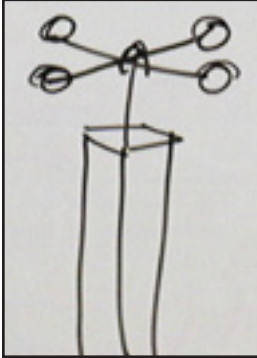


Spraying water on hands.

Now, before you go over there, I'm going to spray water on your hands. And then you hold your hands up the same way and see if they feel warmer or colder. When you come to me, put your hands down like this so I don't spray your face too much. *[Students take turns getting water sprayed on their palms and then going up to the fan again.]*

This time we're going to use rubbing alcohol. Put your hands down flat like this so I don't spray it in your eyes. *[Students take turns getting rubbing alcohol sprayed on their palms and then going up to the fan again.]* Okay, you can sit down where you were because everybody's got their alcohol and water and their regular hands.

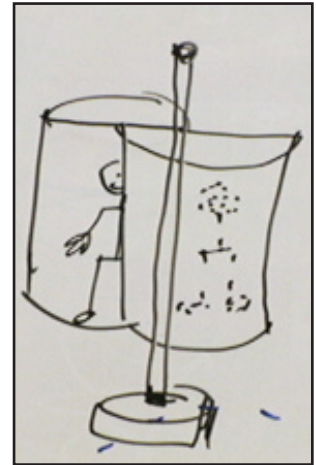
Experiment 2: "Pinwheel"



Wind Speed Machine.

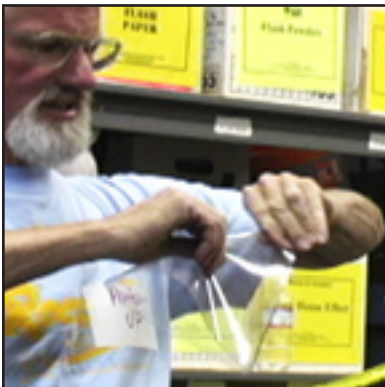
Now, in order for evaporation to take place really well, you need some wind. Wind works terrifically good for that. And scientists like to measure wind speed. Usually, they have -- have you ever been to an airport? There's a pole there with some cups on it. There's a little thing there with a wheel, and it's got some legs, and just little round cups. When the wind blows -- see, there's kind of a thing behind these guys, like that. When the wind blows, it makes the things spin round and round in circles. And they hook it to a little machine that monitors how fast the wind blows. Well, somebody invented a much better way to measure slow wind speeds. And if you wanted to get energy from the wind to produce electricity, this would be a good way to do it.

One way that's pretty close is you take a great big barrel. Have you ever seen a big barrel that looks like that? *[Student: Does it have toxic in it?]* Sometimes, yes, that's the kind of barrel. If you cut one in half longways, and then take the other half and move it over here, now you have two barrels -- two half-barrels. You could get inside of it. This could be half of your head with one of your eyes and part of your smile, and here's part of your shoulder, and here's one of your legs and your foot. There's you inside. Now, let's put a pole through the center of this thing. *[Student: What about the other half?]* There's somebody else hiding in the other half, on the other side. You can't see them because they're hidden. And put something that'll let it spin on the ground, like a big wheel. Now you've got two people in something that'll spin. And you can go fwoo, fwoo, fwoo, fwoo, fwoo, fwoo, spinning around, and they get really dizzy. If they get out of it, and the wind blows, that thing will spin really well, and you can make electricity with it.

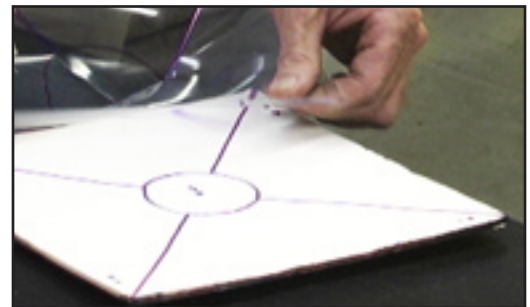


Half-barrel wind speed machine.

The thing you're going to make today actually spins better than that does. I'm going to show you how to make one. You can either make it out of clear material and color it, or out of silvery material and color that. You get your choice of clear or silvery. You're going to need a long pin as part of it, and a thumb tack, and some scissors. We'll show you how to make it. We'll put this stuff here. *[Places materials on table.]* To do this, you decide what you're going to use.



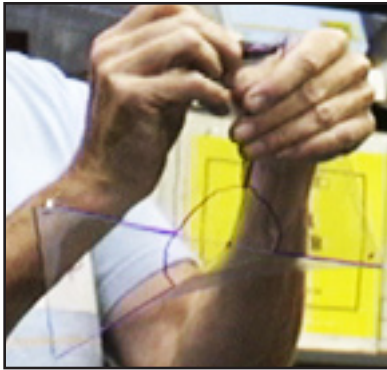
Let's suppose I decide to make it out of clear stuff because I'm here and you guys probably want to use the silver stuff.



Cardboard pattern for pinwheel.

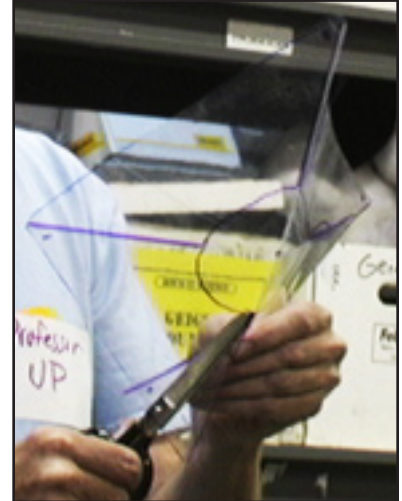
I'll put my piece of cardboard on it and draw around the cardboard, like that. And then I'm going to cut around it with scissors and make a square, more or less a square. When you've got a square, then you're going to fold it into a triangle, crease it, and it makes like a line on it.

Creasing the diagonals.



Drawing the dots.

And then you fold it another way and go [creases it], and you've got a plus sign, like that. Or it could be a hat. Then you're going to use your marker pen, whatever color you like, and you're going to draw on it a pattern like that one [holds up cardboard pattern]. That's not too hard to do. And draw a circle in it -- doesn't have to be a perfect circle. Then you draw a line on the fold marks, out to the edges. You put a dot in the middle, and then you hold it up and you put a dot on the right side here, and you put a dot on the right side there, and you put a dot on the right side there, and you keep putting dots on the right sides until you come down to a spot where there's already a dot. And then you take your scissors and cut along the folds until you reach the circle and stop. If you keep going, you end up with four triangles and say, "Mister Maaaac, I made a mistake. I got four triangles instead of a thing." [Cuts along the fold lines.] There. Now you've got a weird-looking thing.



Cut only up to the circle.



Punching the holes with a tack.

Then we'll take some thumbtacks. Try to pick one that still has a point on it. And then you poke a hole wherever there were dots. There was a dot in the center, so I'll poke a hole there. There was a dot on the right side of that one, so I'll poke a hole there. There was a dot on the right side of that one, so I'll poke a hole there. There was a dot on the right side of that one, so I'll poke a hole there. There was a dot on the right side of that one, so I'll poke a hole there. And then I ran out of dots. Can you tell what it is yet? [Student: A pinwheel.]



Bending the corners to pin them.

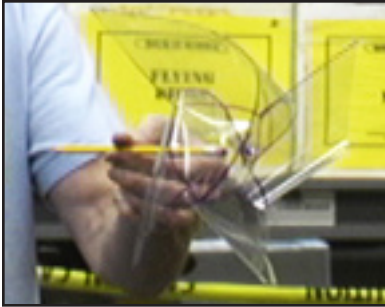
to go through that last one -- there it goes, through the last hole.

Then you're going to take a pin and stick it through one of the holes. Now you've got a pin sticking out there. And if you bend this over and point it toward the center, it's ready to stab a hole in your belly button. You want to be standing up, you want the pin pointing at your belly button, and try not to bump into your neighbors. Then you take the next one and bend it over and put the pin through that one. And then you take the next one and bend it over and put the pin through that one. And then you take the next one and bend it over and put the pin through that one. Now you've got something that looks kind of like a propeller. You have



Put pin through center hole.

Now, you're only going to stick it a little ways into the eraser. Usually in a class of twenty people, I tell them, "Stick it a little ways into the eraser." Ten of them say, "Not me! Un-uh! I'm gonna stick it all the way through that eraser!" So they put that in there, they just shove as hard as they can, and discover at the end of the eraser there's wood. And they keep pressing, and pressing, and pressing, until they bend that poor little pin into an S shape. And the little guy complains and hollers.



Finished pinwheel on pencil.

Now you've got a pinwheel. It's kind of a frictiony one because it's rubbing against the rubber eraser, but we'll try it anyway. If you leave it like an airplane and can turn yourself in circles it should pinwheelize.

So, put your square right next to their square, trace his, then trace yours, so we don't waste a lot of material. If you're doing mylar, there's some patterns on some of it, you can choose whatever you like. Try and fit as many squares as you can onto the mylar, trace it out, and cut it. So first we'll pass out the cardboard pieces and some marker pens. We'll spread out some mylar and some clear stuff wherever you guys are, and you can

trace yours and cut it out and then go back to where you can do the rest of it. If you need help with any part of it, all you need to do is say, "Chirp, chirp, chirp!"

[Students start tracing and cutting out their patterns, then fold, mark, and cut them and use the thumb-tack to punch the holes. The younger ones need help folding and creasing and drawing the circle and the dots. Many of the students also need help punching the holes and getting the straight pin put through the holes properly. They tend to bend the corners in the wrong direction and/or in the wrong order. Then they put the straight pin into the eraser to complete the pinwheel. After the pinwheels are made, students walk around moving their arms to make the pinwheels spin. Then the Instructor turns on the fan so students can come up and see how the wind turns their pinwheel. Then they write their names on them.]



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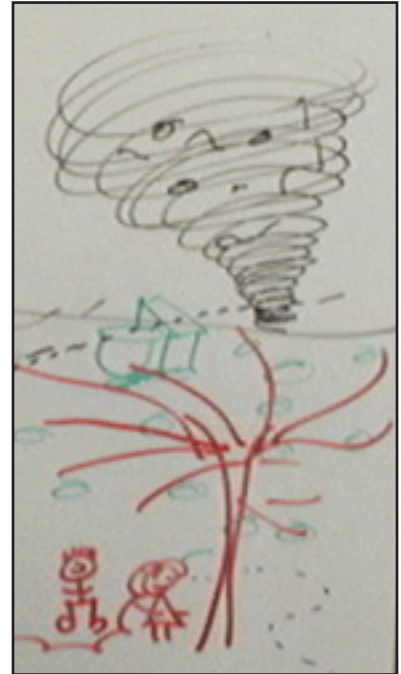


End of Story

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

Jack and Jill said, "We have no way to defend ourselves. Look at those vicious snakes. They're going to come here and bite us, and we'll have to run away. We'll probably get poisoned. This is terrible." And Jill said, "Jack, what should we do?" And Jack said, "I don't know. Could be worse." And Jill went *[puts hand over mouth]*, "Jack, don't say anything! Whenever you say something could be worse, then it happens." Jack said *[mumbling]*, "There could be a tornado." Jill said, "Ohhhh, no, Jack! You said tornado! Ohh, what are we going to do now?"

Sure enough, along came a tornado. And Jill looked up and she said, "Ohhhhh!" And the tornado zoomed by, heading straight for the toilet tree. And it just missed it, took a few toilets off the edge, went across the field, and sucked up all the snakes. Now you've got a few toilets floating around and a whole bunch of snakes in the tornado. And the snakes are really dizzy and angry. And it kept going, right over to Evil Mister Fred's castle. And the snakes got all wrapped around Evil Mister Fred's head, and a toilet landed right on top of his hat. And everybody lived happily ever after, except Evil Mister Fred. And some of his snake minions



The tornado picked up the snakes and toilets.

End of Lesson

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