



Teacher's Guide for:

Fog and Static Electricity

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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Fog and Static Electricity
A Rock-it Science Lesson
Filmed July, 2009

Rock-it Science

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Demo Quick Recap: (same as regular Dry Ice lesson)

- Show students how to safely touch dry ice by petting it, and let them each take a turn.
- Explain how dry ice turns directly from a solid to a gas.
- Put a block of dry ice in an aquarium and blow some bubbles into it, showing how they float above the invisible layer of carbon dioxide.
- Light a candle and lower it into the aquarium, showing how the carbon dioxide deprives it of oxygen so it goes out.
- Put dry ice and warm water into a plastic bottle with a balloon attached, so the carbon dioxide inflates the balloon until it bursts.
- As the carbon dioxide continues to be expelled from the bottle, let the students feel the cold fog.

Experiment Quick Recap:

Experiment 1: "Magically" Disperse Fog

- Show students how the Van de Graaf makes your hair stand on end.
- Set up an aluminum roasting pan with dry ice and hot water so it makes fog.
- Have a student touch the Van de Graaf with one hand and point at the dry ice pan with the other, "magically" dispersing the fog.
- Let students take turns dispersing the fog.



One Hand on Van de Graaf, the other points.

Experiment 2: Explore Dry Ice (same as regular Dry Ice lesson)

- Give each student a clear plastic cup containing some dry ice.
 - Have students blow on it to make fog, and make noise with an aluminum bar that screeches on contact with the dry ice.
 - Add some hot water to each cup to make fog.
 - Later, add a few drops of dish soap to each cup.
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Equipment List: "Fog and Static Electricity"

Items needed for Instructor:

- Block of Dry Ice
- Heavy Gloves
- Chisel
- Van de Graaf Generator
- Aluminum Roasting Pan
- Water
- Insulated cable with Alligator Clips at each end
- Plastic Stepstool
- 24-gal Aquarium
- 2 Plastic Pitchers for water
- Candle bent at a right angle
- Cigarette lighter
- Hot Water
- Bubble wand
- Bubble solution
- Plastic Bottle with squeeze spout in lid
- 12" Balloon
- Rubber Band to secure balloon to bottle spout
- Large plastic tub or bucket to dump leftover water & dry ice

Items needed for Students:

Consumables:

- Dry Ice chunk
- 12-oz Clear Plastic Cup
- Hot Water, about 8 oz per student
- Dish Soap (a few drops per student)

Other:

- Aluminum Bar
- Earmuffs

Alligator clips connect Van de Graaf generator to aluminum pan.

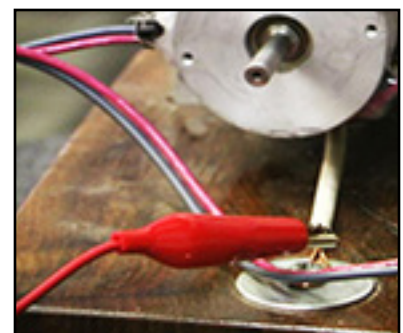


Prep Work:

- Buy Dry Ice on morning of class, solid blocks (50 lbs -- about 25 lbs per class); keep in picnic cooler
- Chop most of Dry Ice into chunks, small enough to fit into plastic cups. (Keep at least one piece whole for demo)
- Heat Water, about 2.5 gal
- Mix Bubble Solution

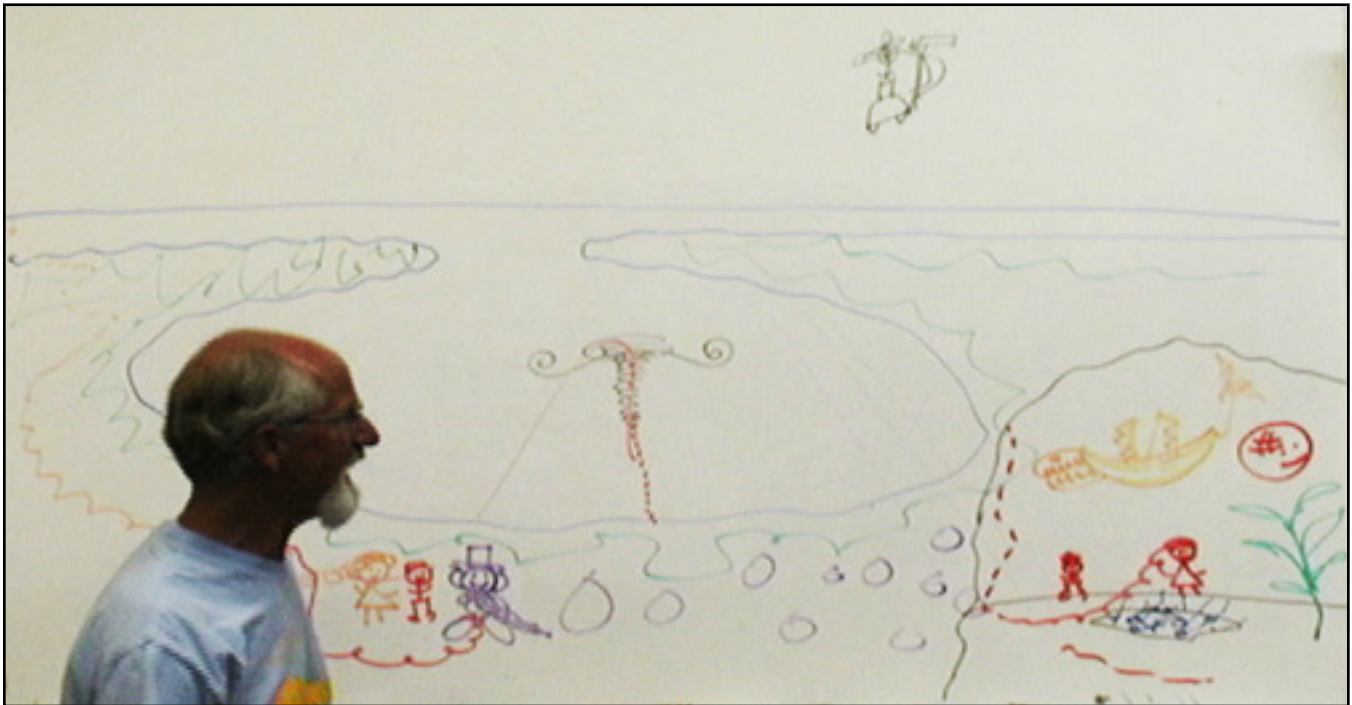


Van de Graaf generator



Alligator clip on Van de Graaf

Story Recap: "Jack & Jill and the Giant Whirlpool"



Part 1:

- Jack and Jill are at a lagoon in the Pacific Ocean, where a group of leprechauns are on vacation.
- Leprechauns like to compete with each other, and one of them challenges another to a swimming contest. As they try to swim across the lagoon, one gets sucked down into a giant whirlpool with a mustache on it.
- Jill ties her hair to the second leprechaun and throws him into the whirlpool so he can rescue the first one.
- As the leprechaun fell deeper and deeper, they had to keep feeding Jill's hair into the whirlpool.
- Jill tied her hair to a rock, and she and Jack jumped in, too.
- Evil Mister Fred thought the whirlpool just went down to the core of the earth where everything dies. But he saw them all jump in, so he thought they must know something he didn't know. So he followed on his vacuum cleaner.
- At the core of the earth, there was a huge chamber with land, lakes, trees, dinosaurs, and all kinds of weird creatures.
- Everyone started growing younger, until Jack jumped into the boiling cold lake and returned to his normal age. Jill and the leprechauns also jumped in and became older again.
- Evil Mister Fred had become a little baby, but Jack and Jill decided to put him in the lake instead of letting him shrink into nothing. He came back to his normal age, and mean as ever.
- Evil Mister Fred decides to tie up Jack and Jill and leave them at the earth's core so he can take the weird animals back up and get rich.

Story Recap (cont.):



Ending:

- Evil Mister Fred's evil was so apparent that the core of the earth sucked him down into the hot lava. But he gave the earth a stomach ache, so it spit him back out.
- Jack and Jill and the leprechanus decided to escape, and they started climbing Jill's hair back up through the whirlpool. Evil Mister Fred started to follow them.
- When Jack and Jill got to the dock, they felt Evil Mister Fred tugging on her hair, so they cut it.
- The hair went back down the whirlpool, like a giant toilet, and Evil Mister Fred was stuck in the core of the earth.

Transcript: Intro

This thing generates static electricity just like going down a plastic slide. It makes your hair puff up. If you stand on a plastic container, it fills you up with static electricity and you get all puffed up. And if you point at somebody, they back away. Now, the static electricity likes to jump off of sharp points, and it does something weird that you can use if you're a magician and you're wearing a top hat so your hair doesn't just go poof up into the air. *[Instructor steps down.]* I'm going to discharge.

I have here a tray. We're going to put some water in there. Dry ice makes fog. If I charge myself up, it still makes fog, right?

The same amount? Let's see, do any of you guys have puffy hair? Stand on there. Okay, put your hand on the ball. *[Student's hair puffs out.]* Oh, perfect. Okay, you can sit down.



Van de Graaf makes your hair puff out.

Experiment #1: "Magically" Disperse Fog

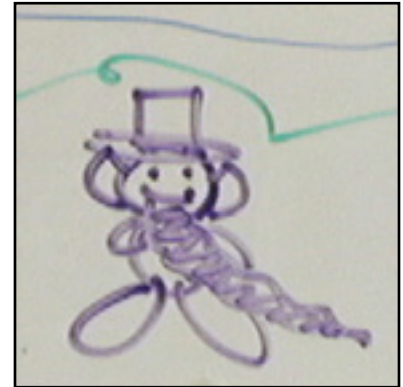
We need a volunteer from the audience to do the same thing. *[Student's]* going to stand up there. Wait a minute, I'll put my hand there first. Okay, now you put your hand. We'll see if his hair stands up. *[Student: What's happening to the dry ice?]* The dry ice is turning into foggy foggy stuff. I'm going to set the dry ice on this chair. Can you see the fog from where you are? If you can't see the fog from where you are, stand up. *[To student]* Point your finger at the fog. Now, *[student]* is killing the fog. Just do it with one finger -- it usually works better. The dry ice is trying to make fog really, really fast. And if I point my fingers at the fog, it doesn't do anything. But *[student]* can kill it. I'm going to move the fog a little closer to him. *[Student]* has superhuman powers. He's like Thor up in space. He can make clouds disappear at command -- whishhh -- and they all drift away. If you want to try that, you can take turns. Okay, step down and we'll see if someone else would like to try that. I guess we'll have to work our way around. *[Students take turns standing on the plastic stool, putting one hand on the Van de Graaf, and pointing at the fog to disperse it.]*



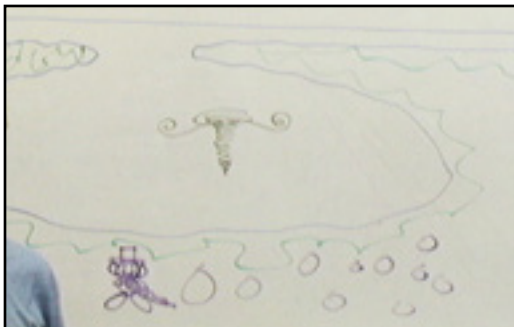
Teacher's finger (at left) doesn't affect the fog. Student's finger (at right) disperses it from a distance.

Story: "Jack & Jill and the Giant Whirlpool"

So, we need a quick crazy story, and then we'll do some more experiments with dry ice. Do you want a story with caves, traps, leprechauns, or a story with banana fish? Okay, we're going to mix together some stuff. Let's suppose that there is a lagoon. A lagoon is like a bay out in the Pacific Ocean. There's the horizon. And there's green stuff here on the land, like that. And there are leprechauns there from Ireland who are on vacation in the south Pacific. Leprechauns are little chubby guys, and they have hats like that, like a snowman hat. There's a leprechaun. [Student: Big beard.] Oh, big beard, okay. There, we've got a leprechaun. There's lots of leprechauns, and you never can put together a group of leprechauns without someone saying, "I'm better than you!" at something. There's always someone who's better than somebody else at everything. And one leprechaun said, "I'm better than you at swimming." And the other leprechaun said, "Oh, yeah? Well, show me. I challenge you to a swimming contest."



Leprechaun near the Lagoon



Whirlpool with Mustache in the Lagoon

So they dive in and they try to swim across the lagoon, and one of them gets sucked into a big whirlpool, and he gets drawn down to the core of the earth. So here's a whirlpool. And the whirlpool happens to have a mustache. [Student: Evil Mister Fred.] Yeah, he's created this whirlpool. And another leprechaun says, "What are we going to do? Our buddy just got sucked down to the core of the earth." And some other leprechaun says, "Well, I can solve problems better than any of you guys. I'm going to go rescue him and bring him back."

And so Jill happened to be there, and she said, "You know what? You're going to get sucked down to the core of the earth, too." And he said, "Yeah, I might. But, boy, I'll be famous, because I'm so brave." Jack said, "Stupid is more like it." And Jill said, "I have an idea. We'll tie a big old rope around your neck and throw you into the whirlpool." And Jack said, "What? You're going to tie a noose on his neck and throw him into the whirlpool? He'll choke to death and die." "Okay, let's tie it on his ankle, then." So they tied a bunch of Jill hair on the ankle of the leprechaun, then threw him into the whirlpool -- whish-hhhhh. And down and down and down he went, taking Jill's hair with him. Jill's hair is infinitely long and they had to keep feeding it in, and feeding it in, and feeding it in, and it grew and grew and grew, and Jack said, "Wow! He's way down there. I want to see where he is."

So Jack grabbed some hair and -- shoom -- right after him he went. And Jill said, "Woah, that's really cool!" So she tied her hair to a big rock that was sitting there, and she jumped in -- shoom! So now you've got Jack and Jill and a leprechaun who's supposed to be a rescuer, and the first leprechaun -- froom -- all down a deep deep hole. And Evil Mister Fred -- he's flying around on his vacuum cleaner up here -- and he said, "Wow! Those guys are crazy! What on earth are they doing? They must



Evil Mister Fred on Vacuum

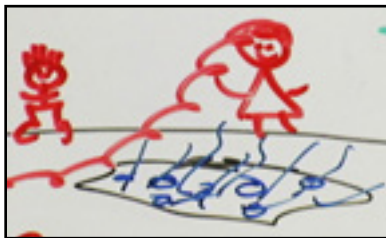
know something I don't know. I thought that was the endless whirlpool that goes down to the core of the earth and everything dies. But they all just dove in like they were going to a party. I think I better check this out." So Evil Mister Fred took his vacuum cleaner and shroom! -- down into the whirlpool he went.

Well, they came down to the core of the earth. And they found a huge open chamber down there. There was land, there was lakes, there were tall tall trees that look like flowers. [*Students: Dinosaurs!*] Okay, there were dinosaurs. Flying banana dinosaurs. Then Evil Mister Fred pops up, and there are all kinds of weird weird creatures. There was a dinosaur flying through the air that looked like a giant banana. There was another dinosaur that looked like a big silver ball. And there were all kinds of creatures crawling around on the ground. There's Jill's hair growing back up.

And Jill looked at Jack and said, "Jack! Look at you! You're getting shorter and shorter and shorter." And Jack said, "By golly, I am!" And then Jill started to get shorter and shorter and shorter. The leprechauns were short to begin with. Their beards started to shrink into their face. And they were getting younger, and younger, and younger as they were down there. And Evil Mister Fred began to start crying like a little baby. He went, "Ahhhhh, I want my mommy!" And Jack and Jill said, "Uh, oh, we'd better get out of here before we turn into little babies and can't even walk. We've got to do something."



Chamber at the Core of the Earth.



Boiling Cold Lake.

And they looked in the lake, and the lake was bubbling. It looked like it was boiling hot. There was steam coming off. And Jack said, "Well, before we go, I want to go for a swim in that lake. That looks cool." And Jill said, "You'll die! It's boiling hot." And Jack stuck his toe in there and he says, "No, it's freezing cold." And Jack dove in and whooshh -- and he popped out, and he was big again. And Jill said, "Hey, you just got older." And Jill dove in -- whooshh -- and she was big again. She said, "Wow, this is great!" Then they threw the two leprechauns in --

whooshh, whooshh -- and they came back to a big size again.

Evil Mister Fred, on the other hand, was now a little tiny baby, and he was crying. And Jack and Jill said, "Well, what should we do with this little kid? Should we just wait until he turns into nothing?" Well, they decided to throw him in the lake, and he got back old again. He came back mean as ever. And Evil Mister Fred said, "That just shows you. Now I'm going to take over this place. I'm going to get these animals back up. I'm going to show them to the whole world and become rich. And you guys are going to get nothing, because I'm going to tie you up down here and you'll never ever get out." If you were Jack and Jill, and you'd just been threatened by this Evil Mister Fred, what would you do?

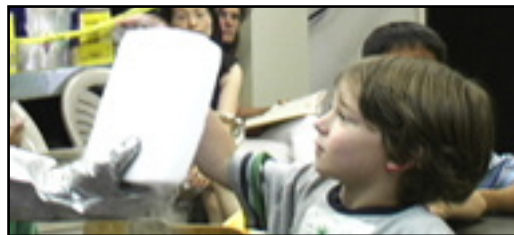
Imagination and Brainstorming Time

[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 . . .

Demo: "Dry Ice"

Dry ice is made out of carbon dioxide, it's 109 degrees below zero . . . [Student: So it burns you.] It could burn you. If you put your hand on this, you're going to scream like little babies, and your hand will be stuck forever, and we'll have to bury you with dry ice stuck on your hand. Ready? Get set. I'm going to die. [Strokes the side of the dry ice block.] Awww, it's like petting a cold cat. It turns directly from a solid into a gas without ever being a liquid. If it had become a liquid, my hand would have gotten stuck to it, and I would have gone, "Aaaaaahhh!" and I would have had to put hot water on it to get my hand off. But since it's always changing into a gas, it puts a layer of gas between my fingers and it. So it's sitting there, turning directly from solid carbon dioxide into a gas. If I bring it by, you can pet it like this -- don't grab it. When I bring it by, if you want to pet it, you can. Don't grab it. If you hold your fingers on it for twelve seconds, you get something called frostbite. We tested that with hot dogs. Twelve seconds gets you a frozen hot dog. So when I come by, you can pet it if you like. [Instructor lets each student pet the dry ice.] [Student: Mr. Mac, why are you wearing that glove?] Well, am I holding it for more than twelve seconds? Yeah.



Petting the Dry Ice



Trying to break the Bubbles with a Candle.

oxygen and dies. The bubbles are full of air. And the air is lighter than the carbon dioxide, so it floats on it.

Now, I suppose you guys want an explosion . . . [Gap in the tape here. Instructor puts dry ice and hot water in a plastic bottle, screws on a lid that has an open stem on it, and attaches a balloon to the stem. The carbon dioxide starts to inflate the balloon.] Sooner or later, it's going to get big



Balloon attached to Bottle.

And dry ice can fill up things invisibly. And we can show that it's invisibly filling it up by putting things in there. [Puts dry ice block in the bottom of an aquarium, then blows bubbles into the aquarium. They float above the dry ice.] Looky here, we've got flaming stuff. [Picks up a lighted candle and lowers it slowly into the aquarium.] If I put the flaming stuff in the carbon dioxide, will it explode? Here goes. [Flame goes out.] Ohhhh, it went out. Let's try again. I want to pop a bubble with the candle. I'm going to pop that bubble. Here goes. Ohhh, it went out before I got there. Turns out, carbon dioxide pushes oxygen away. So the poor little candle runs out of

enough to pop, right? Try not to blink when it pops. Stare at it, pry your eyelids open, say I'm not going to blink when that pops. *[Balloon pops, and fog continues to blow out through the stem in the lid. Instructor walks around, letting students feel the cool fog blowing on them.]*

[Lights a butane lighter.] Will it put out the flame? [Students: Yes.] [Brings lighter close to bottle, and the flame goes out.]



Cold Fog blows out of the Bottle.

Experiment #2: "Explore the Properties of Dry Ice"

We're going to give you some dry ice in a cup. You don't get to stick your face in the cup or your hands or your fingers. There's dry ice in there, and we're going to give you a singing bar. The idea is to make the bar sing loudly when you get it in the cup. Also, blow into it and fog your face.

[Instructors pass out clear plastic cups containing dry ice. Then they pass out aluminum bars, and students experiment with them to make noise on the dry ice. After awhile, Instructor adds some hot water to each cup, making fog. When the fog slows down, Instructor adds a little more dry ice to the cups. Later, Instructor adds a few drops of dish soap to each cup and students play with the fog-filled bubbles.]
We're going to make one giant one, so when *[assistant]* comes by, just drop the whole cup inside. *[Assistant walks around with a large bucket, and students drop their cups into it.]*



Making the Aluminum Bar Scream.



Playing with Fog.



Playing with Bubbles

End of Story

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

If you remember, Jack and Jill [had jumped into a whirlpool that took them to a chamber at the core of the earth]. And Evil Mister Fred, who put it there, said, "They must know something I don't know," so he went down through it on his flying vacuum cleaner and found an entire different world there, with flying dinosaur bananas, all kinds of weird stuff, and a bubbling lake that was boiling cold. They discovered that they were aging backwards very rapidly and getting younger and younger and younger. Then Jack and Jill jumped into the lake and started getting older. And Evil Mister Fred was getting



Evil Mister Fred with Jack & Jill in the Chamber.

so young that they thought he was going to just disappear. But Jack and Jill saved his life. When they tossed him into the lake, he became older again. But he didn't show his appreciation. He was going to take over and take some of these animals and become rich and famous by showing them off in the real world. His evil was so apparent that the world said, "Whoa! I can't stand that guy!" And Evil Mister Fred was sucked up by the earth down into the hot lava. And the hot lava went, "Ooohhh, I've got a stomach ache! Burp! Ptooo! Aaaahh! Ooohh! Hairy Evil Mister Fred and his mustache!" And it spit him back out again. Couldn't take it. And Evil Mister Fred said, "Yeah! I'm the man!" And Jack and Jill said, "We've got to get out of here." And they started climbing Jill's hair back up through the whirlpool. And Evil Mister Fred said, "I'm going, too!" As soon as Jack and Jill got up to the dock, they were swimming toward the beach, and Jill felt something tugging on her hair. And she says, "Uh, oh." So she grabbed some scissors and went "snip." And the hair went wrrrrr, just like down a giant toilet. And Evil Mister Fred was stuck in the bottom of the earth, forever. And everyone lived happily ever after, except Evil Mister Fred.

End of Lesson

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