



Teacher's Guide for: **Smoke Rings**

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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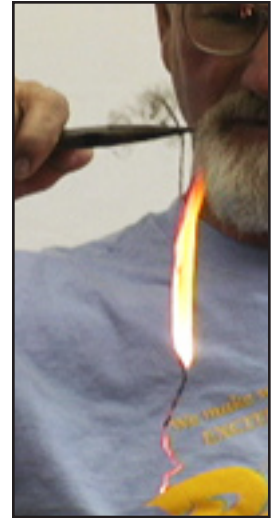
Smoke Rings
A Rock-it Science Lesson
Filmed July, 2009

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

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Intro Quick Recap: "What Makes Smoke?"

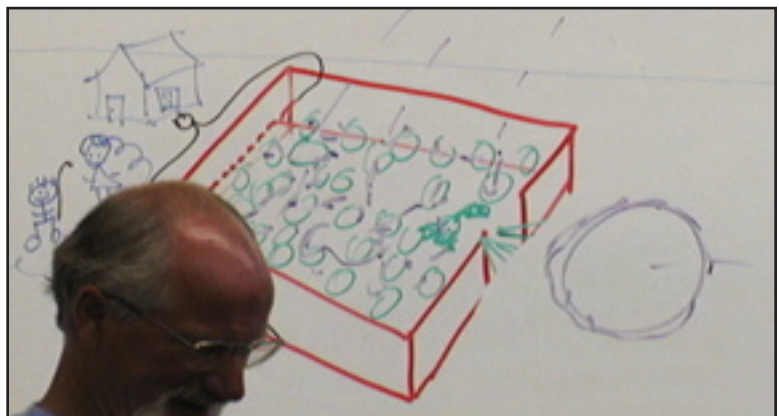
- They used to make a toy train that could make smoke come out of its smokestack.
- You'd put two drops of a special liquid in the smokestack and puffs of smoke would come out when the train ran. There was nothing inside but a piece of cloth.
- Smoke is usually stuff that isn't burned all the way. If you have something that burns all the way, it doesn't make smoke.
- Let a piece of string dangle from a pair of pliers and light it on fire to show how it smokes. Part of the burned string will glow, which means that it has enough oxygen so that it doesn't make smoke.
- Sometimes in the army, they make smoke so the bad guys can't see them.



Burning String.

Pre-Story Quick Recap: "Jack & Jill's Chickens"

- Jack and Jill had a bunch of chickens in a fenced-in area with a gate. They wanted the chickens to go out of the gate, but they wouldn't move.
- Jack jumped in and started yelling and swatting at the chickens, but they just pecked at him.
- Jack got an electrical cord, stripped off the cover (which you should never do) and stretched it across the back of the chicken coop.
- He used a dry stick to hook onto the wire, gave it a twang, and it hit some of the chickens. They hit other chickens, like a wave, and the chickens nearest the gate got pushed out.
- There was a flock of hyena birds flying overhead, chewing bubble gum. They laughed at the chickens and their gum fell out, and the chickens got covered with it.
- Next time Jack twanged the wire, all the chickens got pushed out, but instead of spreading out, they flew out in a circle because they were stuck together by bubble gum.
- The chickens represent air. If you do just the right thing to air, it'll shoot out of a hole and spin in circles.



The chickens flew out in a circle.

Demo #1 Quick Recap: "How to Make Smoke Rings"

- Light a candle and blow it out.
- Re-light the candle and hold it behind an empty 2-liter plastic bottle. Blow against the bottle, candle goes out. Ask students why they think it went out.
- Re-light the candle, put it in the same position, and blow through a straw. Candle flame flickers.
- Move the straw slightly to one side and blow gently. Candle flame bends over and almost goes out.
- When air blows around the side, it sticks to the side of the bottle, like the chickens covered with bubble gum sticking to the gate (see pre-story).
- With an assistant holding a lighted candle on the opposite side of the room, use an Air-Zooka to blow it out.
- Walk around and puff each student with the Air-Zooka so they can see what it feels like.
- What shape did the air feel like? A basketball or football? A triangle?
- If you want to know what shape the air is when it comes out of the Air-Zooka, what do you do? Fill it with smoke.
- Fill Air-Zooka with stage fog and show how it makes smoke rings. Shoot smoke rings at the students.



Blowing through a straw.



The Air-Zooka.

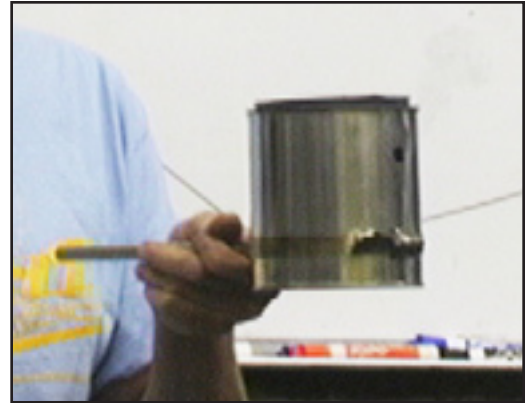


Garbage Can with paper plate cutout.

- Fill the garbage can smoke ring maker with smoke and make smoke rings. Then cover the opening with a series of paper plates, each having a different shape cut out, to see if the shape of the smoke ring changes.
- Show how smoke rings can be made from various containers: a kitty litter bottle, a shallow cardboard box, a 2-liter plastic bottle, a 1-liter bottle.

Demo #2 Quick Recap: "Smoke Can"

- When a beekeeper wants to calm down the bees, he uses something like a tin can with two holes in it, one in front and one in the bottom.
- Inside, they put something like cotton or burlap. For this demo, we're using paper towel.
- Put the paper towel inside and light it. It starts to make smoke because there's not much oxygen.
- You can get smoke to puff out the front of that. At home, you can make this out of a tin can and use it to fill your smoke ring maker.
- Beekeepers use a bellows to blow air through it to keep the fire going. Demonstrate with a foot-operated bellows with a tube attached to the bottom of the can.



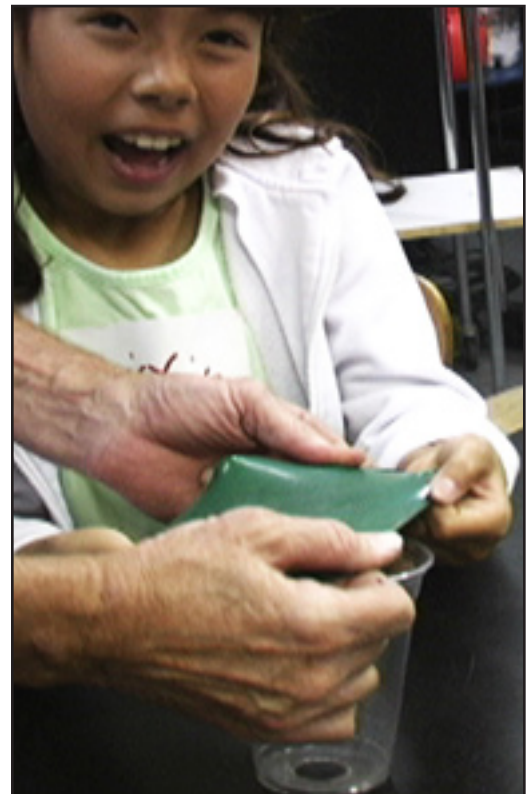
Beekeeper's smoke can.

Experiment Quick Recap: "Smoke Rings"

- Give each student a clear plastic cup with a hole in the bottom and a balloon with the neck cut off.
- Have students write their name on their cup with permanent marker.
- Show them how two people are needed to stretch the balloon over the mouth of the cup.
- Students line up to have Instructors fill their cups with smoke from the stage fog machine.
- Students walk around making smoke rings.



Filling the cup with stage fog.



It takes two people to stretch the balloon.

Equipment List: "Smoke Rings"

Items needed for Instructor:

- String, about 2 ft
- Barbeque Lighter
- Pliers
- Bucket of water
- Taper candle
- 1.5 Liter Plastic Bottle
- Drinking Straw
- Air-Zooka air gun
- Smoke Machine (for stage fog)
- Giant Smoke Ring Maker (Round plastic trash can with 1-ft hole in bottom and a plastic tarp stretched across mouth, secured with rope)
- Paper Plates with various shapes cut out of the center (square, oval, pentagon, triangle, rectangle, 2 small circles, 4 small circles)
- Large Plastic Jug (from kitty litter)
- Shallow cardboard box with small circular hole cut in center
- 2-Liter Plastic Bottle
- 1/2-Liter Plastic Bottle
- Tin Can Coal Carrier
- Bellows

Items needed for Students:

Consumables:

- 12-oz Clear Plastic Cup with 1" hole in center of base
- 11" Balloon with the neck cut off

Other:

- Colored Permanent Markers

Prep Work:

- Melt 1" hole in bottom of plastic cups
- Cut the neck off balloons
- *NOTE: See the "Prep" video on our website for helpful "how-to" instructions.*



Air-Zooka

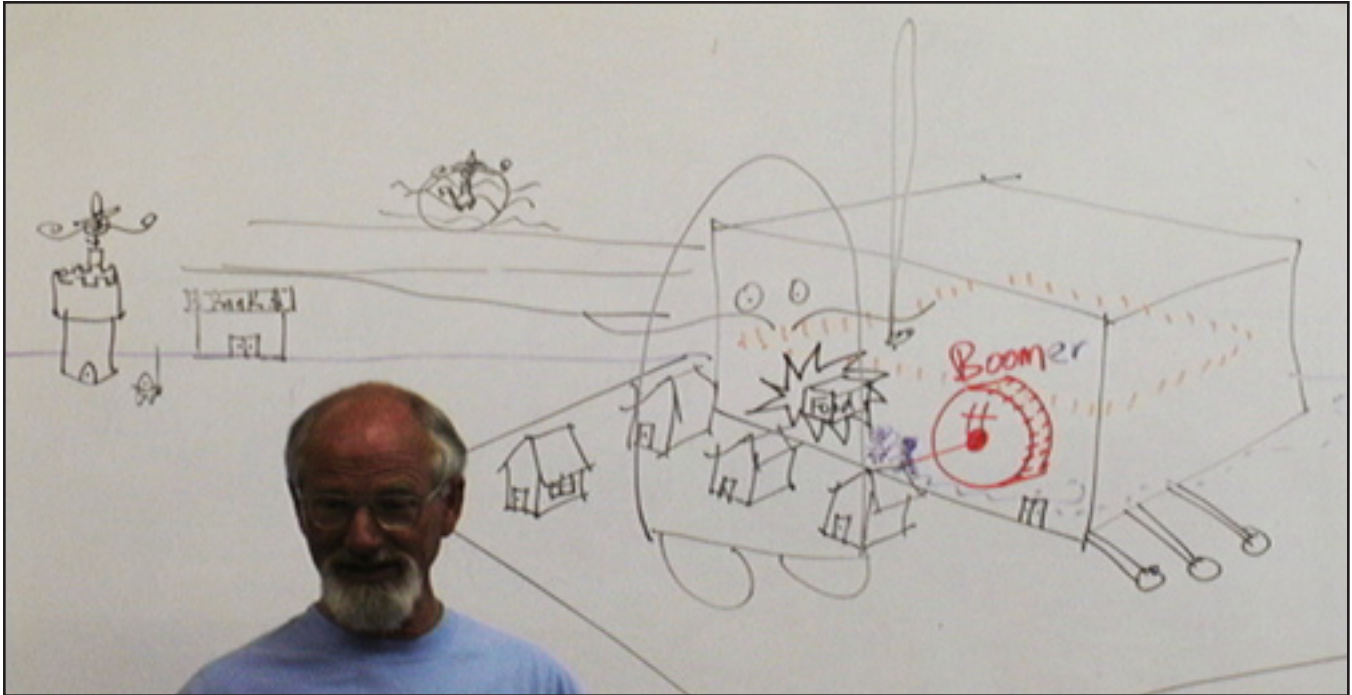


Stage Fog Machine



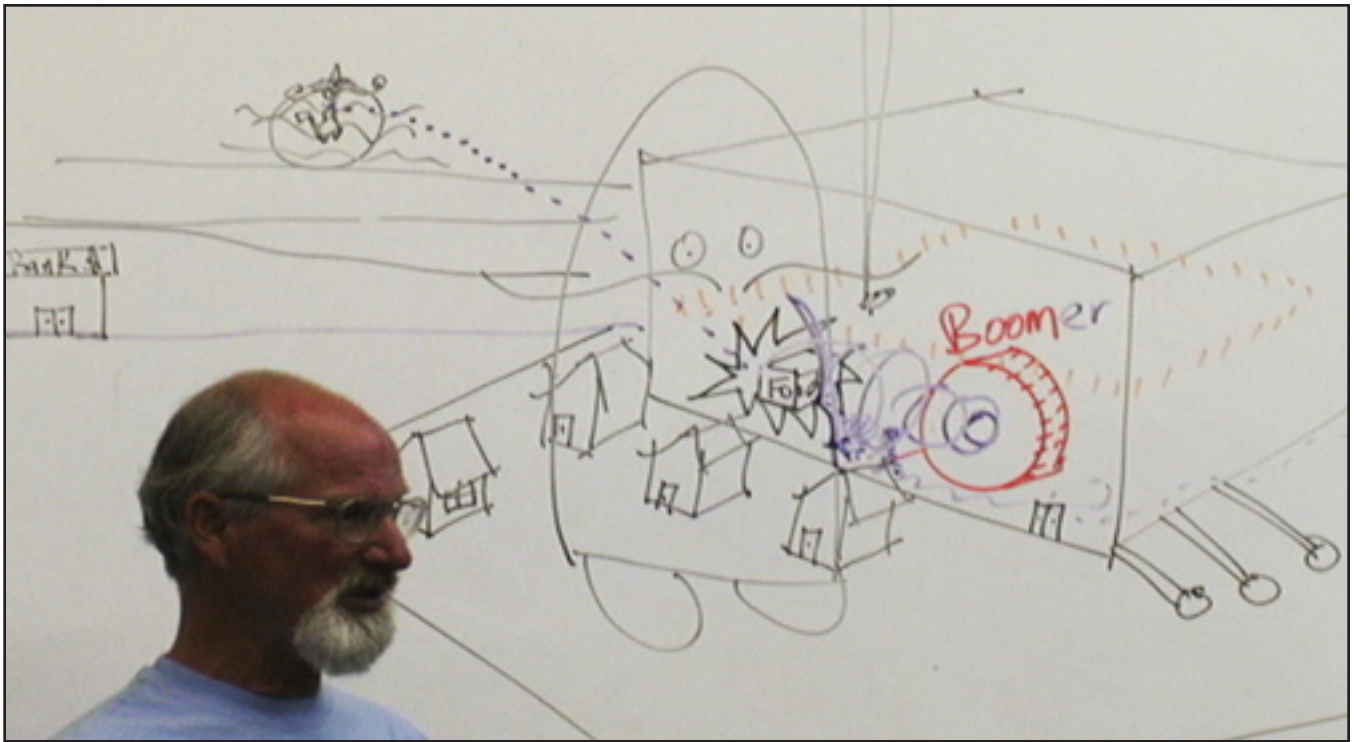
Giant Smoke Ring Maker

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



Part 1:

- Jack and Jill had a big factory where they made bass drums of all sizes. The biggest one was called The Boomer.
- Evil Mister Fred was living nearby, and he sent his minions to rob the local bank and got twenty million dollars.
- He used the money to buy up everyone's mortgages and paid them off. Then he let the people live in their houses free of charge. But once he was able to buy up all of them, he planned to make the people work for him as slaves.
- Jack and Jill wouldn't sell, so Evil Mister Fred threatened to send his giant minion, Luigi. Jack and Jill still wouldn't sell.
- Evil Mister Fred cut off Jack and Jill's phone, electricity, gas, and water. When it got dark, he flew overhead on his vacuum cleaner, and Luigi came to Jack and Jill's warehouse.
- Since they had no electricity, Jack and Jill lit candles all around the inside edge of the warehouse, up high.
- When Luigi came, Jack and Jill wouldn't open the door, so Luigi used his baseball bat to smash a large hole in the wall. He could see Jack and Jill inside because of the lit candles.



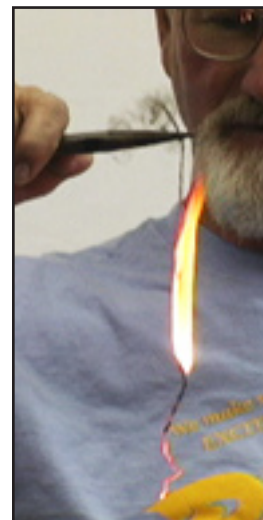
Ending:

- Jack and Jill want to put out the candles so Luigi won't be able to see them.
- Jack runs around trying to blow them out, but they're up too high.
- Jill cuts a hole in the bass drum and hits it to put out all the candles. But Luigi can still see them.
- Jill uses Jack like a bat and swings him around and hits him against the bass drum.
- The drum was pointed at Luigi. Jack hit it with so much energy, it created a smoke ring pulse that came shooting out at supersonic speed and hit Luigi in the stomach.
- Luigi was lifted right off his feet, up through the air, hit Evil Mister Fred, and landed with Evil Mister Fred underneath him.

Transcript: Intro

When I was about your age, I remember getting for Christmas a train, an electric train. It went around and around the Christmas tree. And it made choo-choo sounds, it went chug-a-chug-a-chug-a-chug-a. The cool thing about it was, it made smoke. And there was a green glass bottle that came with it, and a little squeezey thing. And you'd put two drops of this liquid in the smokestack on the train, and puffs of smoke would come out as it went around and around. And I was wondering: How did it do that? So I took it all apart and looked inside, and all it was, was a piece of cloth in there. And I couldn't tell how this thing was making that smoke.

I eventually found out later that smoke is usually stuff that isn't burned all the way. If you have something that burns completely, like the gas in a lighter, it doesn't make smoke. If you have something that doesn't burn completely, like if I light some string on fire . . . And of course, anytime you're going to light something on fire, you need to have some water nearby. *[Student: Why?]* So you can pour it over your head if your hair catches on fire. *[Instructor cuts a length of string about a foot long, holds one end of it with pliers, and lights the bottom end with a barbeque lighter.]* Let's try this lighter and see how it burns. And that makes black smoke because it doesn't have enough oxygen to burn completely. So it makes all that sooty black smoke. *[Points to glowing string.]* You see that glowy thing down there? It's got enough oxygen so it doesn't make smoke.



Burning String.

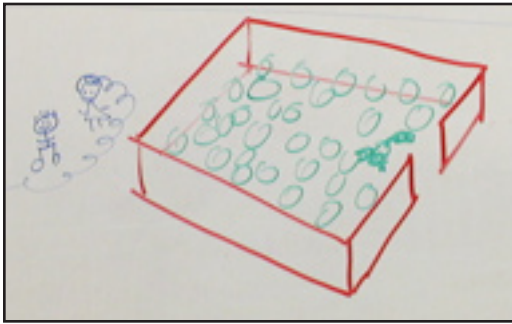
Sometimes people want to make smoke, and sometimes people don't want to make smoke. If you're in the army and there's bad guys over there, and you want to shoot them, but you don't want them to shoot you -- they have these things you can throw out there that make lots and lots of smoke. *[Student: Grenades?]* Yeah, they're smoke grenades and all kinds of smoke-making stuff that they have. And they want to make tons of smoke by making something burn not all the way. They usually use some oil.

Today you're going to be using some smoke so we can see what goes on with something else. But first, we're going to tell you crazy stories.

[Instructor swipes his finger on the table at the front of the room.] Look at those. There's soots in there. If you look around, you might find some soots near you. *[Students start to notice tiny bits of soot floating in the air, left over from the burning string.]* There's soots all over this place.

Pre-story: "Jack & Jill's Chickens"

We're going to do a pre-story story. Once upon a time, Jack and Jill had a whole bunch of chickens. And they put the chickens inside of a fenced area. The fence had like a gate on it, like that. There's our fenced area. And let's make them green chickens. A whole pile of green chickens. Do chickens come in herds or flocks or pods? *[Student: Flocks.]* Flocks? And the chickens were all in there, and the gate was open, and Jack and Jill wanted the chickens to go out. So Jack and Jill are back here, and they're yelling at the chickens, "Go, chickens! Go out! Go have fun! Play in the fields! Have a good time!" And the chickens sat there and they said, "Buck, buck, ba-daack, buck, buck, ba-daack!" And they wouldn't move. And Jack said, "What's wrong with you chickens? You're supposed to go out and have



Jack and Jill's chicken coop.

fun." And the chickens said, "No, we're not going out. We like it here."

Nearby there was a house. And Jack climbed up on the edge of the fence and he started shouting at the chickens and throwing pebbles at them. And the chickens went "Braakk!" But they didn't leave. And then Jill said, "Jack, why don't you just jump in there and swat them? Maybe they'll all go out." So Jack jumped in amongst the chickens and he started swatting them around. And the chickens went peck, peck, peck, peck, peck --

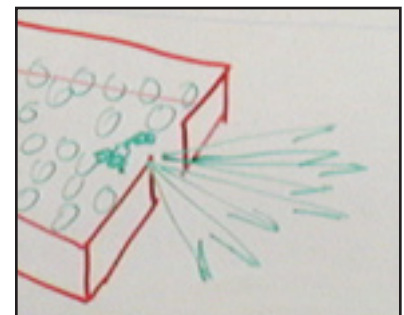
and they pecked Jack's knees. And Jack was going, "Ooh-ahh! Ooh-ahh! Ooh, stop that!" And the chickens said, "Leave us alone." So Jack jumped out. And Jack said, "Okay, that's enough of that. I've had it. We're going to have to go for the widow maker." And Jill says, "Not the widow maker!" And Jack says, Yes! The widow maker."

So Jack ran into the house, and he came out with an electrical cord with a plug on the end, with the prongs sticking out. And he took the cover off the wire, which you should never do. And he stretched the wire right across the back of the chicken coop. Like that. And Jill said, "What are you going to do, Jack?" And Jack said, "Well, I'm going to twang the wire. I'm going to just go 'twanggg.'" And Jill said, "But if you touch it, you'll die." And Jack said, "Cool!"

So he didn't really want to die, so he went and got a dry stick to hook on the end. And he says, "Okay, chickens. This is your last chance. Everybody leave the chicken coop or you're going to get it." The chickens said, "Buck, buck, ba-daack!" And they wouldn't leave. So Jack pulled the wire back and let it go. And the wire shot forward and it hit some of the chickens, and they went "BAAAKKKK!!" And they hit the other chickens, and it was like a wave of chickens going, "Bak, bak, bak, bak!" -- pushing each other. And the chickens nearest the gate got hit by the chickens behind them and went shooting out all over the place, like that. A whole bunch of chickens shot right out of that fenced-in area. And Jack said, "There you go! The rest of you chickens ready to go?" And they said, "Not a chance." So Jack went sproinggg! "BAAAAAKK!!" -- and shot another batch of chickens out, just like the first ones.



Electric Wire.



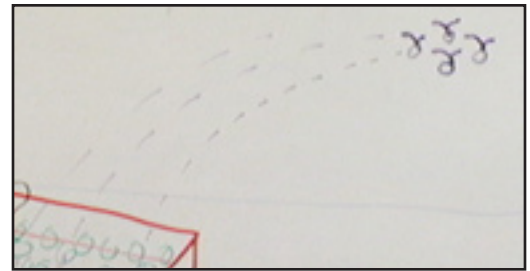
Chickens burst out.

Now, flying overhead there happened to be a flock of hyena birds. Hyena birds are like -- have you ever heard of laughing hyenas? They laugh a lot. Well, these hyena birds weren't laughing because they were chewing bubble gum. And they were blowing big bubbles, like that. And when the hyena birds saw Jack and Jill making the chickens shoot out of the fenced-in area with the wire with electricity in it, they thought this was the funniest thing they ever saw. They started to laugh, going "Aw, haw, haw, haw," as they were flying along. Have you ever tried to chew gum and laugh at the same time? Well, the gum falls out of your mouth. And the hyena birds' bubble gum fell out of their mouths and landed on the chick

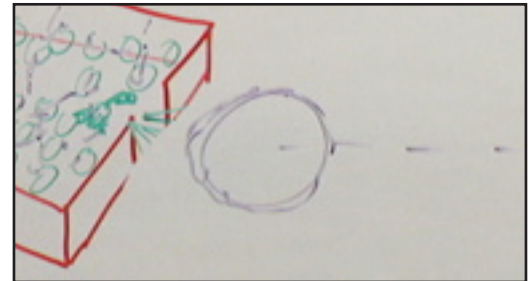
ens. So now you've got chickens covered with bubble gum -- stringy, sticky bubble gum. And the chickens were trying to get it off, and the more they tried to get it off, the more bubble gum they got on themselves. So now there's a sticky bunch of strings of bubble gum connecting all these chickens together.

And Jack said, "This should be good." And he pulled back the wire and he let it go -- twannnggg!! And the chicken went "BAAAAAAKK!!" And this time chickens, instead of just going spreading out everywhere, they're kind of connected with bubble gum. And they came flying out in a circle, like that. And the circle went across the field that way. And Jack and Jill said, "Whoa, that was weird!"

Well, that's science. And you say, "What? How is chickens covered in bubble gum science?" It's science because the chicken represents air. If you do just the right thing to air, it'll shoot out of a hole and it'll spin in circles, like that. Weird. So today we're going to do some experiments with air. But first we need the real story.



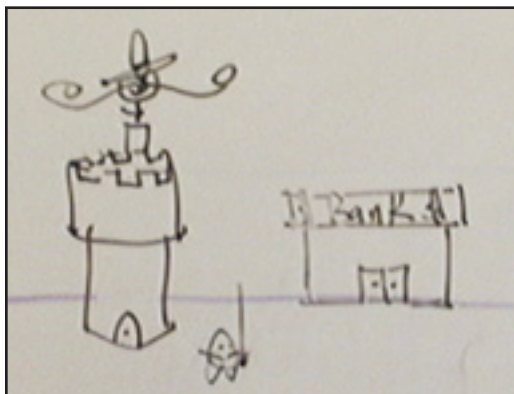
Hyena birds dropping bubble gum.



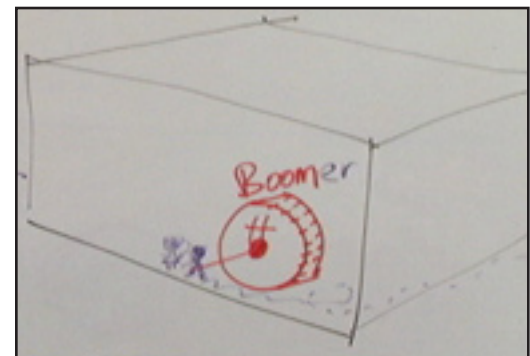
Chickens flying out in a circle.

Story: "Jack & Jill and the Giant Minion"

Once upon a time, Jack and Jill were making musical instruments. The instruments they were making were bass drums. The bass drum is a big cylinder, and it's got some material stretched over it so that when you hit it with a stick, it makes a boom sound. Like that. And Jack and Jill made all sorts of bass drums. And Jack and Jill had a big factory to make drums. A huge building in a city, and they made all sizes of bass drums. This one they called "The Boomer." And The Boomer is pretty big because . . . that's Jack, and that's Jill. And they make little



Minions robbed the bank.



Jack and Jill's drum factory.

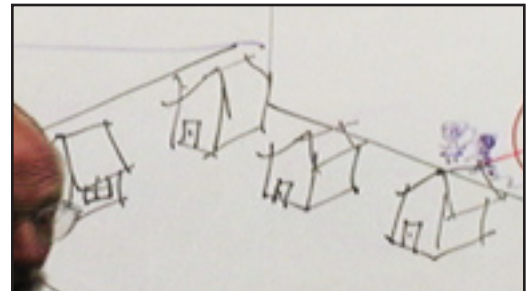
bass drums, and medium size bass drums, they make all kinds of bass drums. And it was a good business. They could make as much money as they liked. They didn't have to work too hard.

Evil Mister Fred was living over here in his castle. Evil Mister Fred hardly ever had much money. He was trying to make money, but his plans usually backfire. So he didn't get very much good food to eat, the minions were always grouchy, and he was always searching for some way to make a quick dollar . . . and usually failed.

But on this occasion, there was a bank nearby. And Evil Mister Fred one morning woke up and he said, "Minions, go over to that bank and steal all their money and bring it back." And the minions said, "Okay, boss." And they grabbed their baseball bats and they ran over there and they said, "This is a stickup. Give us your money or your lives." And they were running around with their baseball bats, and everybody in the bank said, "Oh, no!" And they started throwing money at the minions. And the minions gathered up huge piles of money and they took it back to Evil Mister Fred. And they said, "Evil Mister Fred, we tried to rob the bank, but all they did was throw this useless paper at us. What are we going to do with this? Should we burn it?" And Evil Mister Fred said, "What? Those are hundred dollar bills. We're rich! This is great! This is the first time you did anything right." And they counted all their money and they had twenty million dollars. And Evil Mister Fred said, "Whoa, that's cool!" And he says, "We've got to do something evil with this. Twenty million bucks -- we could do lots of evil with that."

And he looked over and he saw Jack and Jill's town. There was a whole town there with houses and businesses of all sorts. And Evil Mister Fred said, "You know, look at all those people working hard every day, making money, going out on picnics, going to school and sporting events. They live pretty good lives. They're pretty happy with themselves. But I'm going to make them happier." And the minions said, "What? You're supposed to do evil!" He says, "Don't worry, we'll get to the evil part. We'll make them happy first."

And Evil Mister Fred went from house to house in the town and said, "Hello, people! I'm rich now, and I'm going to help you guys out. I'm going to share my money. I'm going to buy all your houses, pay off your mortgages, and let you live there for free." And the people said, "Really? Free?" And Evil Mister Fred said, "Yep, for free." And the people said, "Yeah, let's do it!" So Evil Mister Fred bought all their mortgages. They didn't have to pay for their houses anymore. They got to live in their houses for free. And Evil Mister Fred said, "Look at that. I bought all the houses except one." Jack and Jill wouldn't sell their house to Evil Mister Fred. And Evil Mister Fred said, "Ohhh, that Jack and Jill. They're going to ruin my plans. As soon as I own all the houses in the town, I'm going to make those people work for me and become my slaves. But I need all of them."



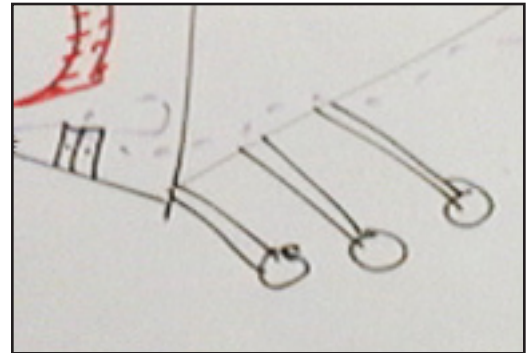
Evil Mister Fred bought all the mortgages.

And he sent himself and his minions over to Jack and Jill's front door, knocked on the door, and Jack and Jill came out. Evil Mister Fred said, "Well, I hear you guys have a good business." Jack and Jill said, "Yep!" And Evil Mister Fred said, "You have to pay for the building, huh?" Jack and Jill said, "Yeah, but we can do it." And Evil Mister Fred said, "Well, I'll pay for your building for you and let you live here for free." Jack and Jill said, "No, thanks." Evil Mister Fred said, "Arrrr! What's wrong with you? It's free!" And Jack and Jill said, "No, thanks." And Evil Mister Fred said, "If you don't let me buy your building and let you live here for free, I'll send Luigi." And Jack and Jill said, "That's okay. You can send Luigi." And Evil Mister Fred said, "You know Luigi, don't you?" Jack and Jill said, "I've heard about him. He's about sixty feet tall, weighs about twenty tons, carries an enormous stick, and kills anybody you tell him to." And Evil Mister Fred said, "Right!" And Jack and Jill said, "No, thanks." And

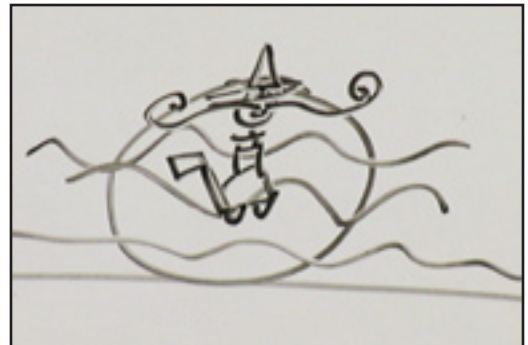
Evil Mister Fred got really mad and ran away. He says, "Just you wait!"

Well, after he left, Jack and Jill said, "Uh, oh, we've got a problem. He's going to send Luigi. Who knows what's going to happen. We'd better be prepared." So Jack and Jill put some food in their place, they put a bunch of candles in there, and they stored up some water. And they got ready. First thing Evil Mister Fred did was, he cut the telephone wires to their house so Jack and Jill couldn't call for help. And then he turned off the water to the place so they've got no water. He turned off the gas so they wouldn't get any heat. And he turned off all the electricity so they wouldn't get any light. And Jack and Jill said, "Wow, that guy really is mean. He turned off everything."

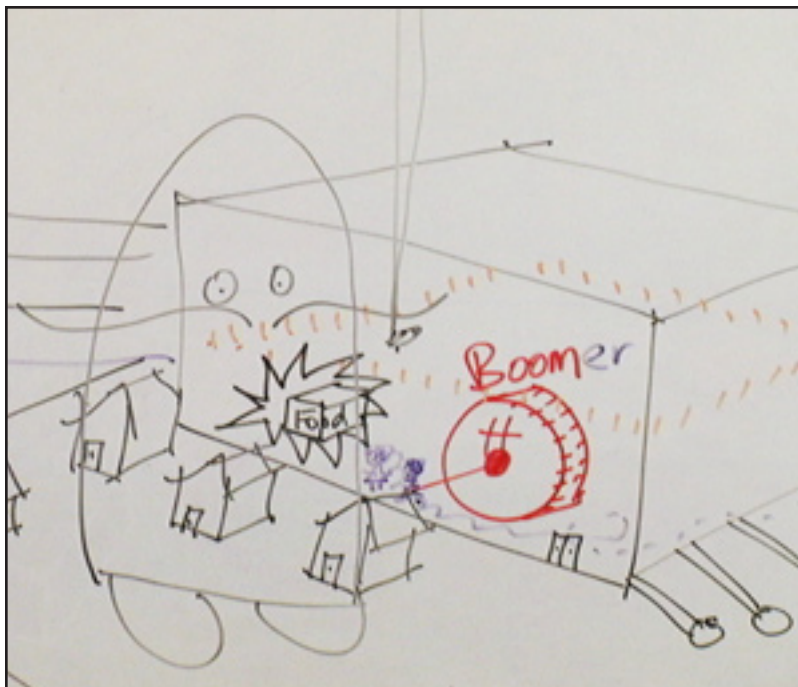
And then it got dark. There was a full moon, and there were some wisps of cloud over the moon. And Evil Mister Fred was flying overhead on his vacuum cleaner. And Jack and Jill were inside and they felt the ground shake -- boom, boom, boom -- and they knew that Luigi was coming. And they lit candles all around the edge of their house, way up high, so they could see even though the electricity was off. And Luigi came to their front door. And he said, "Fee, fi, fo, fum, I smell (sniff, sniff) Jack and Jill! If you don't come out, I'll huff, and I'll puff, and I'll blow your warehouse down." And Jack and Jill said, "Not by the hair of my chinny-chin-chin." And Luigi said, "Okay, that's it for you guys." And he took his big baseball bat and he went smash! -- and he smashed a big



Evil Mister Fred cut off the power.



Evil Mister Fred in front of the moon.



hole in the front of the building. Here's a hole in the front of the building, like that.

And Jack and Jill saw him out there, a giant minion, like that. That's Luigi and his huge baseball bat, like that. And Jack and Jill said, "Uh, oh, we're in trouble now. It's dark everywhere, but he can see us inside because we've got all these candles lit. We've got to do something right away to get out of here." If you were Jack and Jill, what would you do?

Luigi smashed a hole in the factory wall, where Jack and Jill have candles lit.

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 #1: "How to Make Smoke Rings"

[Instructor holds a candle, an empty 1.5-liter plastic bottle, and a barbeque lighter. He lights the candle.] If I want to blow out this candle, it's pretty easy, huh? I just make a wish and go pooh! [blows out candle] -- and it goes out. [Relights candle.] If I put a bottle between me and the candle and blow, will it go out? [Students: No.] [Instructor blows, and candle goes out.] Why did it go out? [Students: Wind goes in every direction. It went around the bottle.] That's pretty weird that it went around the bottle. I'm going to do it with a straw. [Relights candle, puts the bottle in front of it, and blows through the straw at the bottle.] Okay, I'll blow gently. [Candle flame flickers.] I'm pointing the straw directly at it. You can see the candle wiggle. I'm going to go a little bit off to one side. [Blows gently, and flame bends over and almost goes out.] Did you see how the candle goes now? Turns out, when I go off to one side, the air sticks to the side of this bottle, just like the chickens sticking to the gate because they were covered with bubble gum. [Blows again, harder, and the flame goes out.] So air tends to stick to edges as it flows by. And for our experiment, we're going to let some air stick to edges to make something else happen.

We've got an Air-Zooka here, and [assistant] has a candle way over there. [Assistant holds a lighted candle on the opposite side of the room.] And I'm going to try to blow a puff of air at the candle and see if it will blow it out. Oh, should I use the aimer? Okay, there's the aimer. We'll aim right at that. Okay [fires a puff of air and puts out the candle] -- ta-daa! Now I'm going to puff you with the Air-Zooka and see if you feel any air [walks around the table, firing a puff of air at each student]. When the air hit you, did it feel like it was the shape of a ball? [Students: Yes.] Did it feel like the shape of a basketball or a football? Did anybody think it felt like the shape of a triangle? No? No triangles? Did anybody feel the shape of a dodecahedron? Or a triangular prism? [Student: It felt like a rocket.] Well, what if I



Blowing through a straw.



Air-Zooka

really wanted to know what shape the air was when it came out of here. How could I tell? *[Student: Put smoke in it.]* Put smoke in it, yeah.



Stage Fog Machine.

This machine makes smoke like they use on stage plays. They call it stage fog. It's got a button. It's harmless smoke. We can put some in there. *[Fills Air-Zooka with smoke.]* Now I've got smoke in it. It's kind of like a volcano. The smoke is warm because it rises a little bit. Remember, warm air goes up? I'm going to give it a little puff. *[A smoke ring rises into the air with each puff.]* Let's just see how far it goes. *[Holds Air-Zooka at an angle and fires it. The smoke ring sails over the shelves on the opposite side of the room.]* Let's try for the furthest light way over there. *[Instructor refills Air-Zooka with smoke and walks around table, shooting a puff at each student.]*

[Instructor fills garbage can smoke ring maker with smoke and sends a large smoke ring across the room with each puff, then shoots a few at the students.] Now, this is a round hole, and we got round rings out of it. Let's try a different shaped hole. We'll try a pentagon *[places a paper plate over the opening with a pentagon-shaped hole cut in it]*. Okay, here goes the pentagon. Let's try that and see what it does. *[Students: Circle.]* Is it a wobbly circle or a perfect circle? *[Students: Wobbly.]* Okay, now we'll try a rectangle. Here goes. *[Students: Nothing.]* Did you see it wobble? *[Student: It's an oval.]*

Here we go with an eyeball. Okay, let's see what the eyeball does. *[Students: Oval.]* And the last one is a triangle. Let's see



Smoke ring from giant smoke ring maker.



Giant smoke ring maker with paper plate cutout.

if we get a triangle. *[Student: Oval.]* We'll try two holes. Will it make two? *[Students: Two circles.]* If you do it really, really soft, you can get two circles. You have to just barely puff it. Let's try it with four. Here goes four. Aw, with four it all just mixes together, because it's like sticky birds. They all get stuck together.

Can you make smoke rings with a bottle that kitty litter comes in? *[Students: No. Yes. No.]* Let's try it and see. *[Fills bottle with smoke and taps the side to make smoke puff out of the opening. It creates smoke rings.]*

Can you make smoke rings with a box? *[Students: Yes.]* Here's a box. *[Fills a shallow box with smoke and taps the back to make it puff out of a small round hole in the front, creating smoke rings.]*

Can you make smoke rings with a bottle? *[Students: Yes!]* *[Fills a 2-liter bottle with smoke and taps the side to make smoke rings.]* I used to have an uncle that smoked a pipe, and he could blow smoke rings. He'd blow a slow one, and then he'd blow a faster one and make the faster one go right through the inside of the slower one. If you can get a slow one *[taps the side of the bottle]* -- no, this one doesn't do too well with slow ones. Let's see if we can make a slow one. *[Picks up kitty litter bottle again and fills it with smoke.]* We'll make a slow one with this. *[Taps gently to make a slow-moving ring, then harder to make a fast-moving ring that goes through the first one.]* If you watch the smoke rings, they actually spin on their doughnut shapes. See how this one spins around its edge? If you can get another one to come by, the spinning motion will suck it right inside of the first one. So when you do it, you can try to make one smoke ring go right inside another.

Can you make a smoke ring with a really little bottle *[holds up a 1-liter plastic bottle]*? *[Students: Yes.]* *[Fills bottle with smoke and gently squeezes it to make smoke rings.]*



Other containers that can make smoke rings.

Experiment: "Smoke Rings"

Now, you guys are going to make your own smoke ring maker. It's going to be a cup. Here's a cup with a hole in the bottom. And we need to put something on the back, like a balloon. In this case, it takes two people to put on the balloon. One person is going to stretch it this way, and the other person is going to stretch it sideways. *[To a student:]* You can be the sideways stretcher. So she's stretching sideways -- pull really hard -- and then you put it over the cup. *[Taps the balloon that's now stretched over the mouth of the cup.]* And you have a drum. And it becomes a smoke ring maker, of course. *[Fills the cup with smoke and taps the balloon repeatedly, making many small smoke rings.]* When you're doing it, if you just hit it really hard, you lose all your smoke and you don't make smoke rings. So if you just want to beat somebody with smoke, you can do that. But if you want to make the rings, if you do it just right, and in the right spot, you'll get rings out of it. You can play games with the rings.



If you try to do it by yourself, and you say, "I can do this by myself, I don't need any neighbors," and you stretch the balloon and try to put it over it, and the cup gets crushed and torn and broken and you come back and say, "Mister Maaaac, it's broken! I don't know how it happened. It just did." I'll say, "Well, looks like you tried to put that balloon on by yourself." Then you'll have to try and find somebody to help you so you don't waste all of our cups, okay? *[Instructors pass out cups, balloons, and permanent markers.]* There are markers on the table. Write your name on your cup. *[Students assemble their smoke ring makers, then line up to get them filled with smoke.]* *[Assistant:]* This tip is very hot. Once you get your smoke, move away. *[Students walk around making smoke rings and come back for refills as needed. After several minutes, students put their smoke ring makers away and return to their seats.]*

It takes two to stretch the balloon.



Filling the cup with smoke from the stage fog machine.

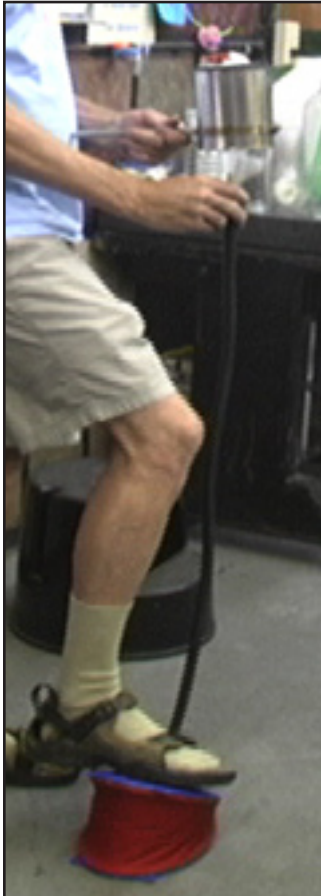


Making smoke rings.

Demo #2: "How to Make a Smoke Can"

When a beekeeper needs to make smoke to calm down the bees, he has something like a tin can with two holes in it.

[Holds up a tin can coal carrier.] This one has a hole here in the front, and it's got a hole on the bottom. And they put



Bellows.

something in there like cotton cloth or burlap bag. I'm just putting ordinary paper towels inside. And then you light them on fire and it starts to make smoke because there's not a whole lot of oxygen in there. *[Puts the lid on.]* Now, you can get smoke to puff out the front of that. But at home, if you have a tin can, you can poke a hole in the bottom and a hole in the side, put a paper towel in there, and you can get smoke to do your smoke ring maker. Be sure your parents are there, because if you set this down on the sofa and go watch tv, you'll come back and find your sofa on fire. And you should always have some water when you're doing it.

Beekeepers have a thing called a bellows that they blow air through to keep the fire going. So you can blow puffs of air inside just to make sure it doesn't go out. *[Uses a foot-operated bellows with a tube that goes to the hole in the bottom of the can.]* You can use this to fill up your smoke ring maker at home.



Tin can with two holes in it.



Lighting the paper towels in the can.

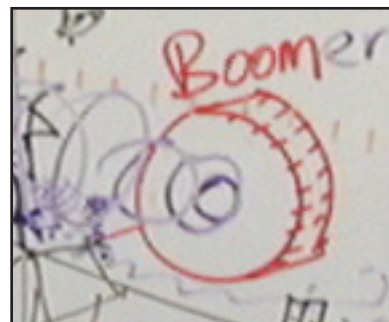
End of Story

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

Now, Luigi is outside. Luigi can see them perfectly because they have candles all around the edge. And Jill says, 'We've got to put out the candles! Quick, Jack, blow them out!' So Jack's running around going foof, foof, foof, and he's not blowing out any candles because they're too high up. And Jill says, 'I've got an idea.' So she took out her pocket knife and cut a hole in the bass drum. And she took the bass drum, and she went boom, boom, boom, boom, boom, boom, and put out all those candles, quick as a flash. Jack said, 'Good job!' And then Luigi says, 'But not good enough.' He says, 'I can still see you. You can't stop me.' And Jack and Jill were running around in there trying to stay away from Luigi. And Jack said, 'We've got to do something quick.' And Jill said, 'We need some power. We need lots of energy.' Jack says, 'I've got energy.' Jill said, 'Good idea.' So she grabbed Jack by the ankles and started swinging him around like a big Jack-bat. And then she took Jack, took the bass drum, pointed the bass drum right at Luigi, and went wham! on the bass drum with Jack. And Jack hit that bass drum with so much energy, it made the biggest boom you ever saw and created a smoke ring pulse that came shooting out of there at supersonic velocities. And it hit Luigi right in the stomach -- ooofff! And Luigi was lifted right off of his feet, up through the air, and boom! -- hit Evil Mister Fred right in front of the full moon. And Luigi kept going -- 'Aaaaaaaaah' -- with Fred underneath. 'Aaaaaaaaah' -- splat onto the ground. Poor Evil Mister Fred. You could make pancakes out of Evil Mister Fred. And they all lived happily ever after, except Evil Mister Fred.



Jill's pocket knife.



A supersonic pulse.

End of Lesson

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