



Teacher's Guide for:
Shrinking Plastic

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.

Contents:

Quick Reference Sheets:

- Intropage 2
- Experimentpage 2
- Equipment Listpage 3
- Story, Part 1: *Jack and Jill and the Oil Well*page 4
- Story, Endingpage 6

Video Transcript:

- Intropage 7
- Story, Part 1 : *Jack and Jill and the Oil Well*page 8
- Experimentpage 13
- Story Endingpage 14

Title Page of Video

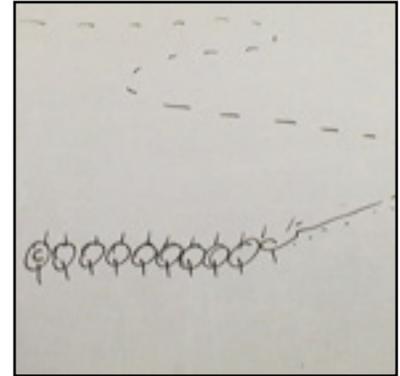
Shrinking Plastic
A Rock-it Science Lesson
Filmed June, 2009

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

(c) 2012 Rock-it Science Educationally Useful Programs. All Rights Reserved

Intro Quick Recap:

- What are you made of? Mud? Wood? Steel? Plastic? Rubber?
- Part of you is rubbery, part is squishy, some parts are hard, like teeth and bones. And you could stretch if you wanted to. There are various kinds of materials like that.
- Plastics are made out of something like really long caterpillars, made of hundreds of circles with legs.
- The circle parts are made of carbon. Carbon is ashes.
- You can take these circles and wad them up and make them small. Or you can stretch them, like fishing line.



Plastics are made of carbon "caterpillars."

Experiment Quick Recap: "Shrinking Plastic"

- Start warming up a toaster oven to 375 degrees. Be sure to use a toaster oven, NOT a microwave oven.
- When plastic gets hot, it melts and shrinks back down to its original shape.
- Use a heat gun to melt various kinds of plastic: a polystyrene cup, a polyethylene terephthalate cup, and a styrofoam cup. Each one tends to melt down into a flat piece.
- Take a plastic tray that has been colored with permanent markers and place it in the toaster oven, holding it with pliers.
- After the tray shrinks, remove it with the pliers and place it on the counter to cool.
- Pass out trays to students to color.
- When they're ready, students bring their tray to the instructor to be shrunk.
- The teacher places each tray in the oven and shrinks them one at a time. NOTE: ONLY the instructor uses the oven. Students do not insert or remove their trays.
- Optional: Punch a hole in the shrunk plastic so it can be hung by a string or ribbon.



Cup melting over hot air gun.

Equipment List: "Shrinking Plastic"

Items needed for Instructor:

- Toaster Oven (not microwave)
- Pliers or Tongs
- Hot air gun
- Various kinds of Plastic Cups: polystyrene, polyethylene terephthalate, styrofoam
- Clear Polystyrene Tray (small enough to fit easily in toaster oven), with colored designs on it

Items needed for Students:

Consumables (two or three per student):

- Clear Polystyrene Trays

Other:

- Markers, permanent, colored

Prep Work:

- None



Toaster oven

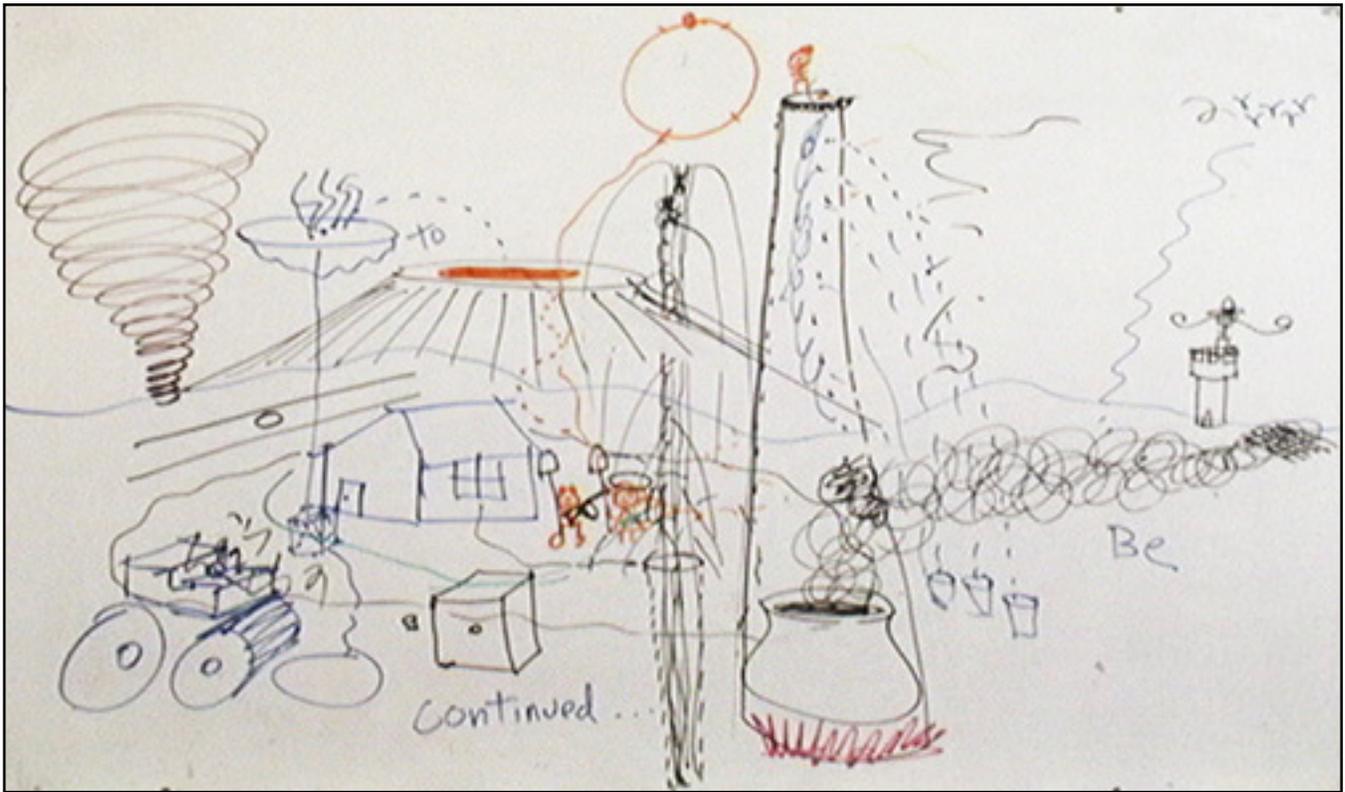


Hot air gun and plastic cup.



Plastic tray colored with permanent markers.

Story Recap: "Jack and Jill and the Oil Well"



Part 1:

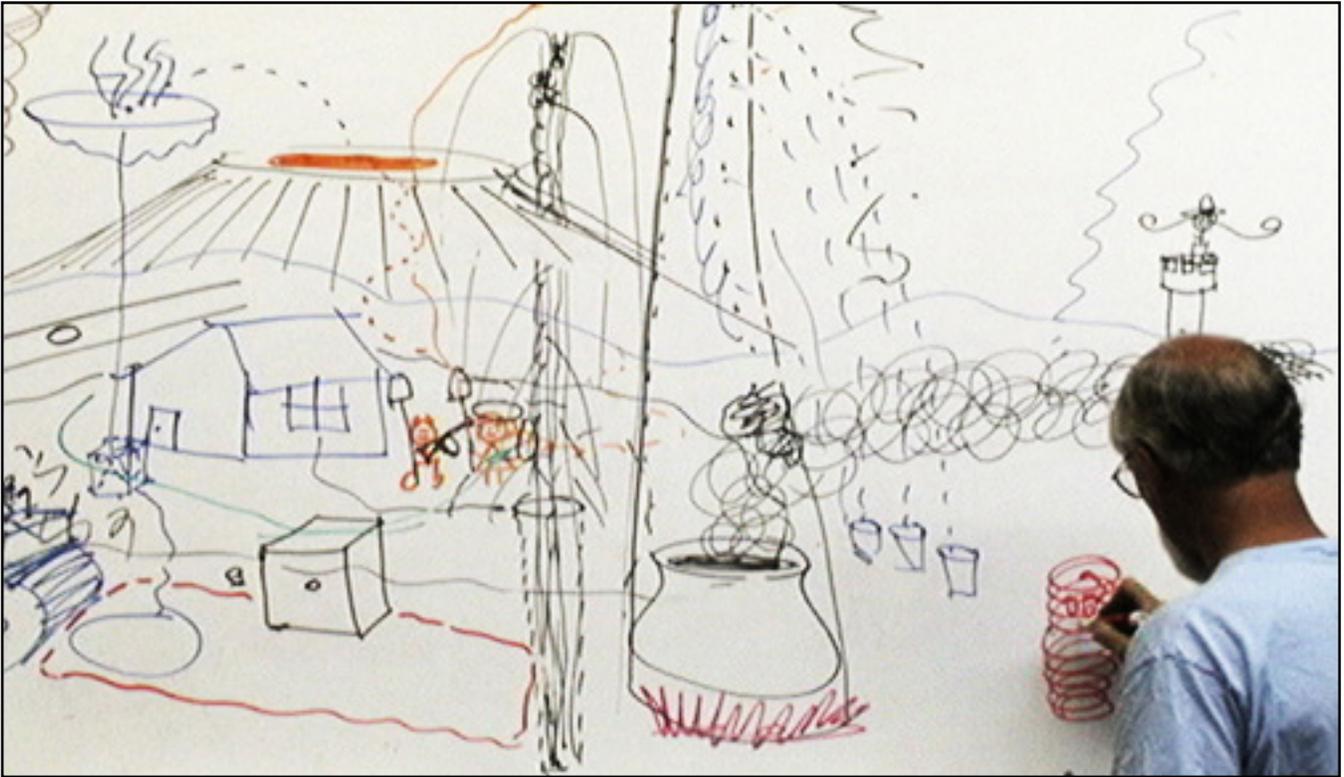
- Evil Mister Fred decided to trick Jack and Jill by making them celebrities and then destroying their reputations.
- He gave Jack and Jill a Certificate of Goodness and invited the media to cover it, so Jack and Jill became celebrities. And they had a big party for everyone.
- While they were gone, Evil Mister Fred locked them out of their house and left a couple of shovels in their front yard.
- Jack and Jill played around with the shovels for awhile, then started digging in their yard, adding water from the hose, and making mud so they could throw it at each other.
- They ended up drilling a hole a thousand feet deep, until they struck oil. And the oil spurted up in the air and carried Jack and Jill up out of the hole.
- The oil spread out all over the ground, so Evil Mister Fred told the media they had created an environmental disaster, killing animals and birds.
- The media came and took pictures and portrayed Jack and Jill as bad people.
- Then a tornado came and sucked up all the oil. A big pot fell out of the tornado, and all the oil fell into the pot.
- Jack and Jill lit a fire under the pot, and black smoke came out and spread all over the place.
- Again, the media criticized Jack and Jill for polluting the air.

Story Recap, cont.:

Part 1:

- Then a huge tube fell out of the sky and landed on top of the pot. So the smoke didn't drift over the town. Instead, it went up high and started choking the birds. Jack and Jill had to catch the birds so they didn't die. And again the media criticized them.
 - Jill grabbed a manhole cover and a welder's torch and welded the manhole cover onto the top of the pipe to seal it, so the smoke stopped.
 - The pipe got hot and started to creak and groan as if it were about to blow up.
 - Jack called the Acme Store of Everything and ordered a machine gun. He shot holes in the pipe. Flames and smoke shot out of the holes.
 - Jill called the Acme Store of Everything and ordered a firehose and squirted the pipe.
 - The flames and smoke went away, and liquids started pouring out of the holes. The hole at the top was a clear liquid, and the bottom one was black tar. Other kinds of oil were pouring out of the other holes.
 - Jack and Jill put buckets under the streams to catch the different oils.
 - One smelled like gasoline, so they tried it out in their lawnmower, and it started up.
 - Another one smelled like lamp oil, so they got an oil lamp, and it made a nice flame.
 - Evil Mister Fred said they were polluting again because they were creating petroleum products that could leak into the ground. So they got rid of the buckets.
 - They wanted to stop it completely, so Jill told Jack to drill a hole in the top of the tube. Then she told him to put his mouth over the hole and suck out all the gas inside.
 - Then Jill called the Acme Store of Everything and ordered a huge steel box with a cork in it. She had Jack blow all the gas out of his lungs and into the steel box. Then she corked it.
 - Jill threw the steel box into a volcano, but then they were afraid it would blow up.
 - Jack jumped into the lava to get the box out, but the box was so hot it was burning his hands.
 - He threw the box into the air, and it landed into a floating lake, which cooled it down.
 - Then the box fell through the bottom of the lake and landed next to Jack and Jill's house. The metal was all cracked and corroded, but there a little lump of plastic next to it.
 - Jack and Jill heated the plastic a little bit and ran over it with a steam roller.
-

Story Recap (cont.): "Jack and Jill and the Oil Well"



Ending:

- When Jack and Jill steamrolled the plastic, it made a huge sheet of really thin plastic.
- Evil Mister Fred tried to grab it away from them, but he got all stuck in the plastic, like a cocoon, and he couldn't move.

Transcript: Introduction

Are you guys made out of mud? Are you made out of wood? Skin and bones? Are you made out of steel? Are you made out of plastic? Are you made out of rubber? Well, you're kind of rubbery, you're kind of squishy, and some parts of you are kind of hard, like teeth and bones. And we could stretch you quite a ways if we wanted to. And there are various kinds of materials that are like that.

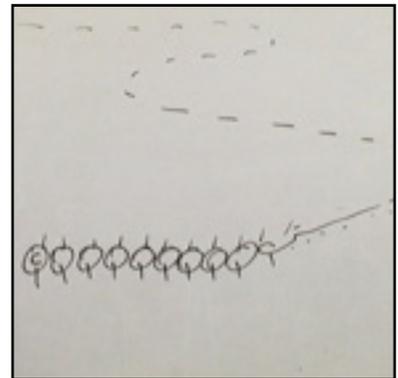
Plastics are made out of something like really, really long caterpillars. So if you had, oh, something plastic like a cup -- it doesn't look like a caterpillar, doesn't smell like caterpillars, probably doesn't taste like caterpillars. But the caterpillars they're made out of are really, really small. And they have legs. They're like a whole bunch of circles that go on and on and on and on and on, hundreds and hundreds and hundreds of circles, and the circles have legs. Like that.

And the circle parts are made out of a chemical called carbon. You know what carbon is? It's ashes. If you take your hair and light it on fire, the stuff that's left over is ashes. And that's carbon. And you can take these things, and you can wad them all up, and you can stick them in a bucket and make them small. Or you can stretch them out and make them long and straight. Strong things like fishing line, nylon fishing line, are straightened out.

Today, we're going to be experimenting with some plastics, but first we need a crazy story.



Plastic cup.



Plastics are made of carbon "caterpillars."

Story: "Jack and Jill and the Oil Well"

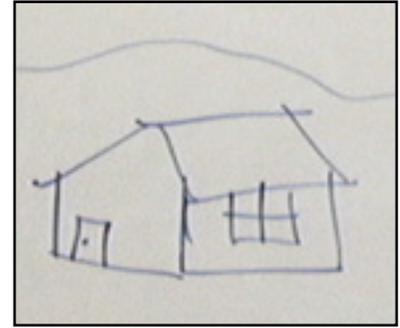
Once upon a time, Evil Mister Fred decided to cause some problems. And he says, "I know what I'm going to do. I'm going to be clever, I'm going to be crafty, I'm going to trick Jack and Jill." And so he created a beautiful certificate, a Certificate of Goodness, with a nice piece of paper like this, and it had fancy designs all around the edges. It had a gold seal on it: Circle of Approval. And it had Jack and Jill's name on it. And he arranged for the TV guys to come, and a huge crowd of people. And he said, "Jack and Jill, you're our guests of honor. You guys are so good, we're going to give you a reward for your goodness. The Jack and Jill Award of Goodness."

And Jack and Jill said, "Us? Whoa, that's really great!" Everybody cheered, and they had a big bunch of food, and double shakes, and ice cream. And Jack and Jill were celebrated because they were being good. And then, Evil Mister said, "Ah, ha, ha, my plan is laid. Let's see what happens now."

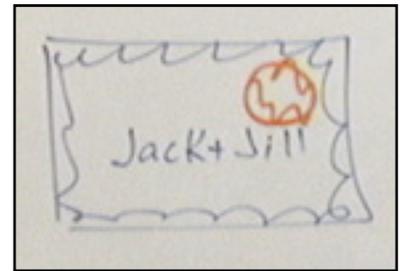
Well, Jack and Jill were at their house, and Evil Mister Fred locked them out. They couldn't get in their house. So there they were outside, it was a nice day, and there was nothing to do. So Jack and Jill looked around, and somebody had left two shovels in their front yard. And Jack and Jill picked up the shovels and said, "Ooh, cool -- swords! We like swords. And Jack and Jill began to swordfight with the shovels. They were running around trying to hit each other with these shovels. And then they discovered that it hurts when you get smacked on the head with a shovel. And Jill said, "Let's not do that anymore. Let's do something with these shovels."

And Jack said, "Okay, let's throw mud with them." And Jill said, "Good idea!" So they turned on some water and they made a big puddle there, and they started throwing mud. They'd take a big shovelful and throw it at each other. And before long, they had dug a hole in the ground a thousand feet deep. And they were throwing mud out of this hole, and they were clear down at the bottom. And Jack and Jill looked at each other when they got a thousand feet down, and said, "Whoa! We're in a deep hole!! How are we going to get out?"

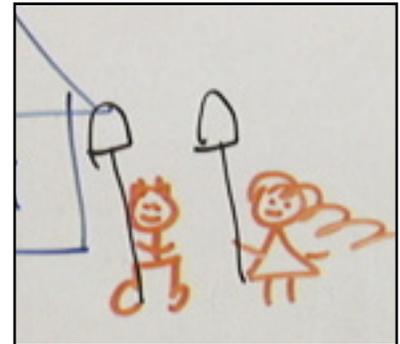
And Jill said, "I don't know. We'll find some way, but let's just keep digging." So they started digging more. And they got deeper and deeper and deeper and deeper, and pretty soon it started to get hot down there. And they kept digging and digging, it got hotter and hotter, and some black stuff started to ooze out on their feet. Slippery black stuff. Then the ground shook, and all of a sudden - kafooom!



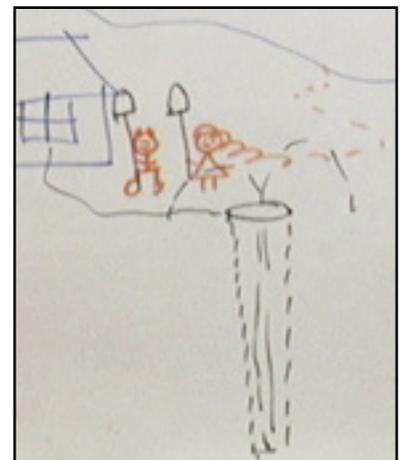
Jack & Jill's house.



Jack & Jill's Award of Goodness



Jack & Jill with shovels.



A hole a thousand feet deep.

Jack and Jill shot straight up into the air. And they were held up on a huge amount of liquid black stuff. And it squirted out and fell all over the place. They'd discovered oil. Jack and Jill were rich. (Here's Jack up here, being held up by the oil.) And here's Jill. And they said, "Wow! we're out of the hole, but now we're stuck up in the air, held up here by a bunch of oil."

And pretty soon the oil went down and down and down and down, and set Jack and Jill back down on the ground. And now the whole place is covered with oil. And Evil Mister Fred took pictures of this from his castle not far away. And he said, "Send a message to the local newspapers. Jack and Jill, who were supposed to be good, have now created an environmental disaster. They've got oil spread everywhere, all over their place, they're killing all kinds of animals, birds are getting all gunked up in it. They've ruined the environment."

And the newspaper guys came, and they took pictures, and they said, "Aw, Jack and Jill, you guys are really bad! Look at the mess you've made." And Jack looked around, and he said, "Ooooh! Oops!" And Jill looked at him, and she said, "What now?" Jack said, "Hmm -- could be worse! Could be a tornado coming." Jill said, "Jack! Don't say that! You know when you say that it happens!" And Jack said, ". . . Oh."

About that time along came a tornado. And everybody ran for their life. And the tornado came right to their house. And Jack and Jill went, "Oh, no!" They covered their heads and closed their eyes. And the tornado went in circles and circles, all around their house, and sucked up all the oil and left everything perfectly clean, including Jack and Jill. And Jack and Jill opened their eyes and said, "Whoa -- that was weird!"

And then, a big pot fell out of the tornado and landed on the ground. A huge pot like this. And then all the oil that had been on the ground fell right into the pot. And Jack and Jill said, "That's the strangest tornado I've ever seen." And Jack said, "That's pretty good! We got a big pot. Let's do a witch's thing! Let's light a fire under the pot." So they lit a fire under the pot. And Jack and Jill danced around the pot, and they said, "Double, double, toil and trouble, fire burn and cauldron bubble!" And it began to bubble and boil. And black smoke came out. And the black smoke was full of soot, and it smelled terrible. And it went all over the place, and it got in the eyes of the people in the city. Like that.

And everybody was coughing and choking and gasping because of the smoke. And Evil Mister Fred called the newspapers and the TV stations again, and he says, "Good boy and girl in town do it again. Now they're choking everybody to death with pollution over in the city." And Jack



The oil squirted out of the ground.



Jack & Jill being held up by the oil.



Evil Mister Fred on his castle.



A tornado sucked up all the oil.



Big pot filled with oil,
and a fire under it.

And smoke, smoke, smoke, smoke, smoke. And Jack said, "Boy, that was fun!" And Jill said, "But you're making a mess."

So she called the Acme Store of Everything and ordered a firehose. And she squirted the whole pipe. She cooled off the pipe with water, and the flames went out, and the smoke went away, and pretty soon some liquid started coming out of the holes. There was a nice clear liquid coming out of the top hole, and they put a bucket under it, and there was liquid coming out of the next hole, and they put a bucket under that, and there was liquid coming out of the next hole, and they put a bucket under that. And there were all these holes. And the bottom hole didn't have very much coming out of it except tar. Black tar. They cover roads with tar.

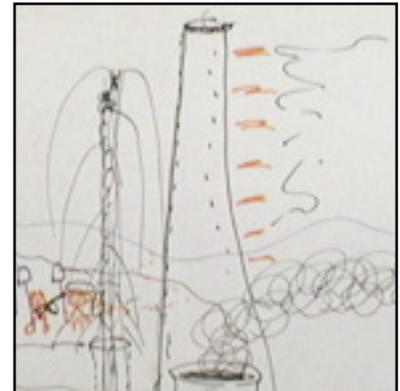
And Jack went and smelled one of the buckets and said, "This smells like gasoline." And Jill said, "Probably is." So Jack took some and poured it in his lawnmower and vroommm! Sure enough, they made gasoline. And then Jill smelled the next one. She said, "Aw, this is lamp oil. I know what this is." And she went and got a lamp, and she poured the oil in the lamp, and it lit and burned and made a nice flame like the old days. You know those kind of lamps?

And each one of these things had a different kind of oil in it, and then there was tar. And they said, "That's pretty good. We did okay." And Evil Mister Fred came along, and he said, "You're polluting again!" And Jack and Jill said, "No, we're not! We're being good." And he said, "You're creating petroleum products, and if they leak into the ground, you're going to be in deep trouble." And Jack and Jill said, "Oh, okay." So they got rid of these tanks that catch all this stuff. And they said, "We've got to stop it." And Jill said, "I've got an idea." And Jack said, "I don't like your ideas." And Jill said, "But it's going to be fun! Jack, take an electric drill and go to the top and drill a hole in the top." Jack said, "Why?" And then Jill said, "Don't worry. After you drill the hole in it, put your mouth over the hole. And then, whatever's inside, suck it into your lungs." And Jack said, "Yeah, I like that idea!"

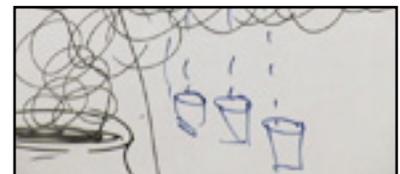
So Jack climbed to the top, and he drilled a hole in the top, and there was something in there, and he sucked it into his lungs. And Jack became big. Like that. And he's floating around. Luckily, Jill tied a string to his arm so he wouldn't float away. And then, Jill called the Acme Store of Everything and she ordered a big steel box. A huge steel box, with a little hole in it, and a cork. And she brought Jack back down, and said, "Okay, Jack. When I say go, you're going to put your mouth on that hole. And whatever's in you, blow into the hole." And Jack said, "Mmmh, mmmh!"



Jack's machine gun.



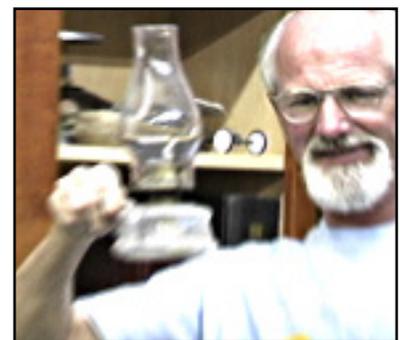
Flames and smoke came out of the holes.



Buckets caught the liquids.



Black tar came out of the bottom hole.



This kind of lamp burns lamp oil.

So Jack put his mouth on there and he went, "Whoosh!" And Jill went thoonk! And plugged up the hole. And Jack said, "Wheeew! Boy, that was stinky stuff!" And he said, "What are you going to do with that?" And Jill said, "What anybody does with a box full of stuff. You throw it into a volcano." So Jill grabbed the box, threw it over her head, and it landed in a volcano. There's the volcano. And Jack said, "Why'd you throw it into a volcano?" She said, "I don't know. See if it blows up."

So Jack and Jill ran to the top of the volcano, and there it was, sitting there in the hot lava, getting cooked. Jack said, "It's going to blow up, Jill. Then we're going to be in even more trouble. Hot lava, explosions, shrapnel everywhere." And Jill said, "You're right. We'd better get it out. Jack, swim over there and get it." So Jack said, "All right." He jumped in the hot lava, swam over there, grabbed the thing, and he was going, "Ooh, ah, ooh, ah! It's hot!" Then he threw it up in the air because it was burning his hands.

And it landed in a floating lake. This is a lake floating in the sky. Ssssss. And after it was all cool, it fell out of the bottom of the lake and landed right next to their house. And Jack and Jill ran down to see what it was. And the metal was all cracked. It was all rusted and corroded. And Jack said, "Wow! There wasn't much left of that safe." And he went whoow! And it went pfft!. And sitting on the ground was a little lump. There was no more gas inside. What do you think the lump was? Plastic! He made plastic. And Jack and Jill took the plastic out, and they heated it up a little bit, and they ran over it with a steamroller.

And we're going to stop the story right there. To be continued . . . And we're going to see how it ends.



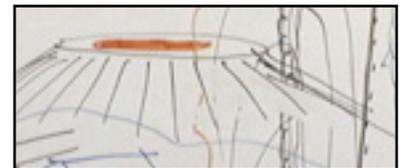
Jack drilled a hole in the top of the pipe.



Jack sucked up all the stuff from the pipe and became big.



Jack blew the stuff into the steel box.



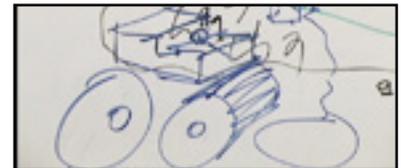
Jill threw the box into the volcano.



Jack threw the box from the lava into the floating lake.



The box landed near their house.



They ran over the plastic with a steamroller.

Imagination and Brainstorming Time *(NOTE: Since this story was very long, the Instructor didn't include brainstorming for this lesson.)*

[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.)

Experiment: "Shrink Plastic"

We're going to turn on this toaster oven. It's not a microwave oven. And we'll put it at 375 degrees. While it's warming up, we're going to turn on a hot air gun. I'm going to get a pair of pliers so I don't burn my fingers. *[Holds up a plastic cup]* What's the cup made out of? *[Students]* Plastic!

Plastic? Yep, you're right. *[Holds cup with pliers in one hand]* Plastic. *[Holds hot air gun in other hand]* Heat. *[Holds plastic cup over hot air gun. Cup softens and crumples up.]* When you get plastic hot, it melts and kind of shrinks back down, trying to get back to its original shape. Its original shape was flat. It's kind of rubbery when it's hot. When it gets cool *[taps it on table]*, it gets hard. We'll let it sit here for a minute to cool off. That kind of plastic is called polystyrene. Polystyrene has a recycling symbol with a number 6. *[Draws recycling symbol on board]* Have you seen the recycling symbol before? The number 6 with "PS" stands for polystyrene, or it stands for "Please Shrink me."

This one *[holds up another cup]* has a recycling symbol with the number 1 and the name Pete -- "P-E-T-E" under it. That stands for polyethylene terephthalate. *[Holds cup over hot air gun]* Now we've made a hat. A hot hat.

[Holds up another cup] This cup is made out of styrofoam. It's polystyrene plastic again, number 6, but it's got air bubbles in it so it's light. *[Holds cup over hot air gun]* It's like a marshmallow.

And Jen has spent the whole class making this beautiful tray *[Holds up a plastic tray that has been colored with marking pens]*. Poor Jen. All this beautiful work. We're going to wreck it for her. Don't tell her. We're going to cook it in the toaster oven. *[Places tray in oven with pliers, closes door]* Bye-bye. *[After several seconds, opens door and removes shrunken tray with pliers, places it on counter to cool off.]*

[Trays are passed out to students, who color them with permanent markers, then bring them up to the oven for the instructor to shrink for them. ONLY the instructor uses the oven.]



A plastic tray shrinking in the oven.



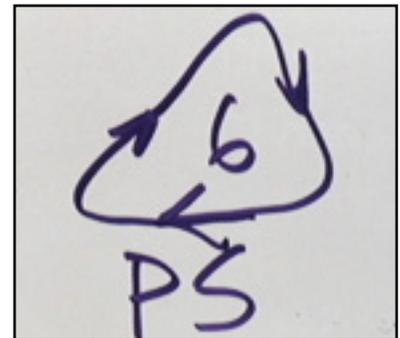
Plastic tray before shrinking



The same tray after shrinking.



Cup melting over hot air gun.



Recycle symbol for polystyrene.



P-E-T-E cup melts into a hat.



When the styrofoam cup melts, it looks like a marshmallow.

End of Story

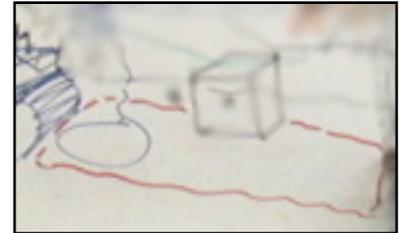
**** DO NOT * present this part of the lesson until after the experiments!***

So Evil Mister Fred was trying to trick Jack and Jill. He made everybody give them a hero's kind of "I'm a really good guy" kind of award. And then he made them mess up. And Jack and Jill managed to clean up all of their messes after them. The people in town said, "Wow, you sure did make a lot of messes. First you made an oil well shoot up all over the place. Then you boiled all the oil and made smoke everywhere. And then you put a smoke stack on it and almost killed all the cool birds. And then you shot holes in it with a machine gun and made all kinds of stuff like gasoline. But you cleaned up everything after yourself. This is great! We're going to give you another award." And Evil Mister Fred said, "No, you can't do that!" And they said, "Sure, we can. We're going to give them the Saran Wrap award." And Evil Mister Fred said, "What's that?" And they said, "Oh, they wrap up all their messes and don't leave anything laying around." And Evil Mister Fred said, "Nooooo!"

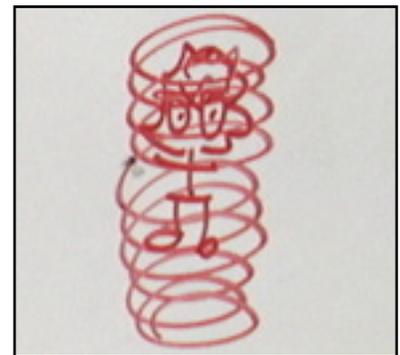
And when they had steamrolled their plastic, it made a huge sheet of really thin, thin plastic. And Evil Mister Fred ran over there to grab the plastic to take it away from them so they couldn't have it as an award. Evil Mister Fred ran out onto the plastic and started to grab it and pick it up. And he got all stuck in the plastic. It got all wrapped around him until he looked like he was in a cocoon. So Evil Mister Fred was in this thing. A couple of eyes sticking in there, and his mustache all crinkled up on top of his head. And everybody 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.



Steamroller turned plastic into a thin sheet.



Evil Mister Fred got all stuck in the plastic.