



Homeschool Teacher's Guide for: **Stomp Rockets**

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.

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(Numbers in the text are **time codes**, so you can refer back to the video.)

[00:03;09]

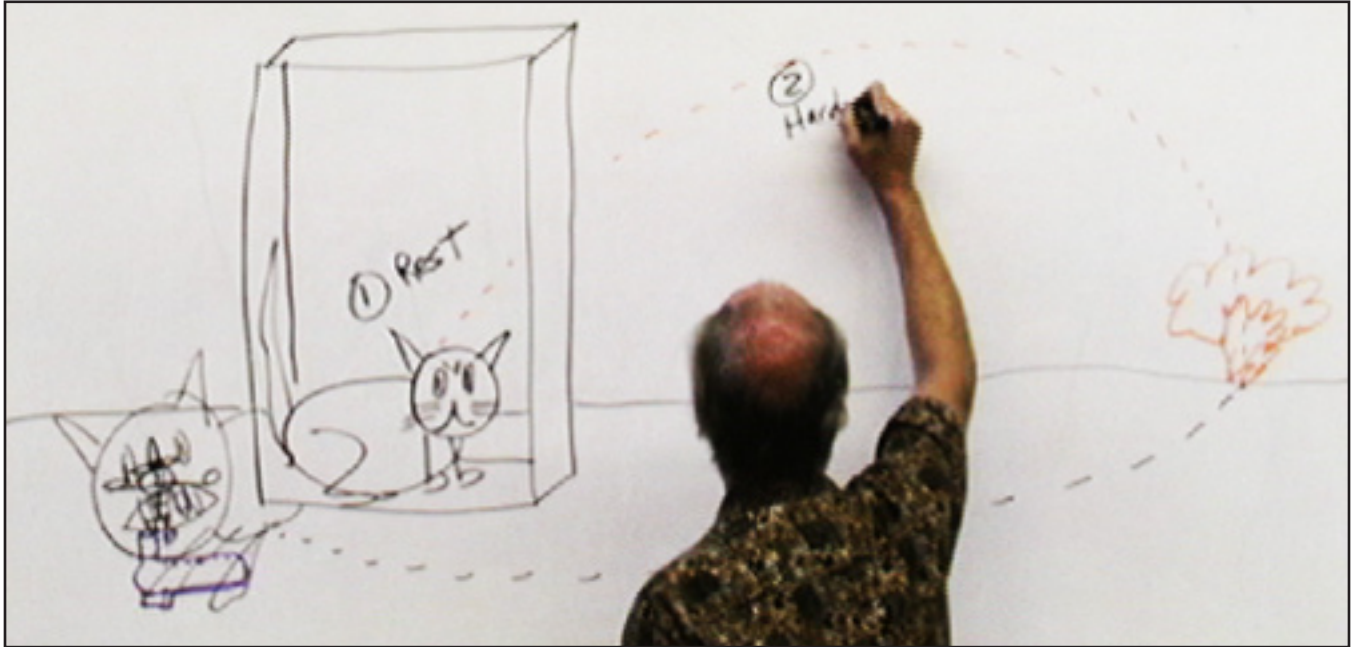
Stomp Rockets
filmed January, 2011

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Intro Quick Recap:



- Evil Mister Fred has a big cat that likes to sit in doorways and won't move.
- Evil Mister Fred had his minions build a doorway that was just a frame, with no walls around it, and the cat sat there.
- Evil Mister Fred decided he wanted to walk through that doorway, but the cat wouldn't move. It just hissed at him.
- He called the Acme Store of Everything and ordered an automatic boot that weighs ten thousand pounds. It comes with a remote control, and when you press the button, the boot moves by itself.
- When the cat still wouldn't move, Evil Mister Fred pressed the button, and the boot kicked the cat clear over the horizon.
- Evil Mister Fred started doing his happy dance and didn't notice the cat running back toward him.
- The cat bit him.
- This story demonstrates Newton's three laws of motion. The First Law of Motion is: If something's at rest, it'll stay at rest unless you kick it. The Second Law of Motion is: The harder you kick it, the further it'll go. And if you write it in mathematics, it's Force equals Mass times Acceleration [$F=m*a$]. The Third Law: For every action, there's an equal and opposite reaction (the cat coming back to eat Evil Mister Fred).

Experiment Quick Recap: "Stomp Rockets"

- Instructor demonstrates how a stomp rocket works and how to assemble it by attaching the hose to the stand with a wing nut.
- Instructor shows students four different kinds of rockets. The first is a regular stomp rocket, which has a tail and a foam head and weighs 13.3 grams.
- The second one is identical to the first, except that it has duct tape wrapped around it, and it weighs 19.1 grams.
- The third is like the first, except it has no tail, and it weighs 12.2 grams.
- The fourth has no head and no tail. A small piece of foam about the size of a marshmallow is attached to the end where the large foam head used to be. This one weighs 12.2 grams, like the third one.
- Students go outside and assemble their stomp rockets. Students work in groups of two.
- Instructor gives each group one of the standard rockets to shoot off. They shoot at will and retrieve them, then shoot again as long as time allows. After awhile, the Instructor passes out another type of rocket and students continue shooting both rockets. Eventually, each group has four rockets to shoot and compare. Before shooting the fourth rocket (the one with the foam tip removed) students put on goggles.
- When they go back inside, they vote to rank the rockets from best to worst.

Equipment List: "Stomp Rockets"

Items needed for Instructor:

Consumables:

- None

Other:

- Same as students

Items needed for Students:

Consumables (per student):

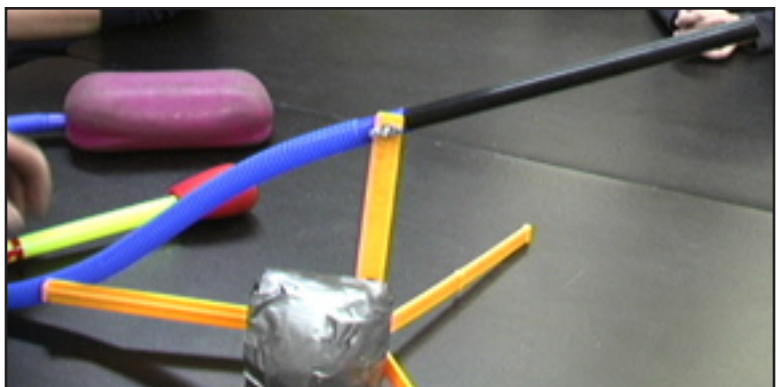
- None

Other (per group of 2 or 3 students):

- Stomp Rocket, including bag, hose, & stand.
- Set of four rockets, customized as explained in the "Experiment Recap."
- Goggles

Prep Work:

- Inspect stomp rocket assemblies to make sure all the pieces are there, including the wing nuts.
- Add weight to the base with 3 pounds of ball bearings wrapped in foam.
- Customize rockets. Repair or replace existing rockets if needed.



Assembled Stomp Rocket

Story Quick Recap: "Jack & Jill and the Helium Tree"



Part 1:

- There was a magical helium tree floating in the air. The candycanes of immortality grew on it. If you ate one, you could become incredibly smart and wise and live forever.
- Jack & Jill were down in the forest of jittery trees, looking for the answer to everything in life.
- They came upon a shape shifter who could turn himself into anything.
- They also came upon a blowhard, who could blow hard enough to lift a boulder off the ground and send it over the horizon.
- Evil Mister Fred's castle came out of the sky and landed on the ground nearby. The minions let it slip that he was looking for the candycanes.
- Jack and Jill decided to get to the candycanes first so Evil Mister Fred wouldn't get them.
- Jack got an umbrella, and the blowhard blew him up in the air. He came down in the helium tree and ate a candycane. But it didn't work on him and made him sick.
- Evil Mister Fred attached fireworks to his minions and started launching them toward the tree.

Story Quick Recap (cont.):

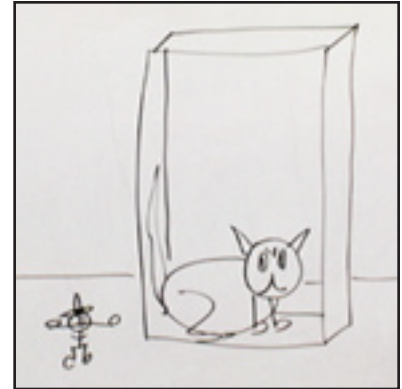


Ending:

- Evil Mister Fred's minions are flying through the air. They're supposed to jump off before the firework explodes, but some of them don't.
- Jack and Jill decide to move the helium tree to a safer spot.
- They cut the shape shifter in half, and part of him turns into a rocket, and the other part turns into a rocket launcher, like a stomp rocket with a tube.
- Instead of stomping on a bag, they told the blowhard to blow into the tube so the rocket would launch and bump the tree out of the way.
- Evil Mister Fred saw what they were doing with his telescope, so he aimed his minions straight toward the blowhard and shape shifter.
- Just as they approached, the blowhard was distracted by them, and instead of blowing into the tube, he blew toward the minions.
- This caused the minions to make a u-turn so they blew back to Evil Mister Fred's castle, and the fireworks made the castle explode.

Transcript: Intro

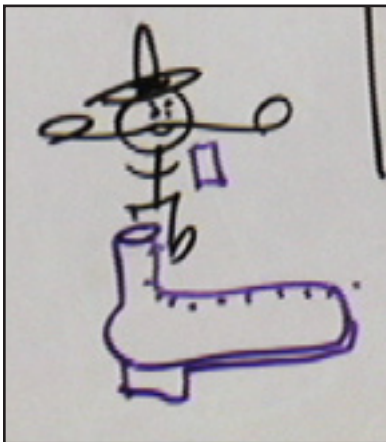
[01:00:11;02] I need to remind you of something that hopefully you will remember a little bit. Evil Mister Fred had a pet cat, and the pet cat didn't like Evil Mister Fred. And Evil Mister Fred particularly didn't like it when the cat sat in the doorway and he couldn't walk through. So Evil Mister Fred had his minions build a doorway outside with no walls, just a doorway, figuring the cat would go sit in it. And sure enough, the cat did. Well as luck would have it, Evil Mister Fred wanted to walk through that doorway. He could have walked around, but no, he wanted to walk through the doorway, and there was the cat. It was kind of a big cat, by the way.



Cat in the doorway.

And Evil Mister Fred said, "Hey, you! Cat! Get out of that doorway. I want to walk through there." And the cat went "Hssssss!" And Evil Mister Fred said, "If you don't get out of that doorway, I'll huff and I'll puff and I'll blow you out of that doorway." And the cat went, "Hisssss!"

And Evil Mister Fred said, "All right, that's it for you." And he huffed, and he puffed, and he blew as hard as he could, and one of the whiskers of the cat wiggled just a tiny bit. And the cat went, "Huuh." And Evil Mister Fred said, "Arrrrghh! I'll show you!"



Automatic boot.

So Evil Mister Fred called the Acme Store of Everything and ordered an automatic boot. Now an automatic boot isn't like a regular boot because you have to make a regular boot move by swinging your foot. An automatic boot comes with a remote control. So you push the button and the boot moves by itself. And the boot weighed about ten thousand pounds. And Evil Mister Fred said, "Okay, cat. This is your last chance. Get out of that doorway or you're going to get it with the automatic boot." And the cat said, "Hssss!"

And Evil Mister Fred said, "Okayyyyy!" He pushed the "Kick" button on his remote control. And the cat got kicked by the boot and went, "Aaaaaahhhhh!" Crash! We're going to leave him there. Mushroom cloud on the horizon.

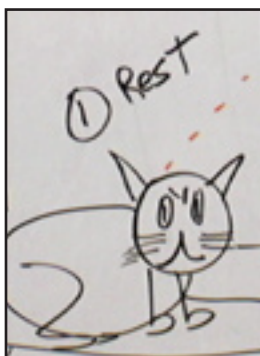


Mushroom cloud.



Inside the cat's mouth.

And Evil Mister Fred said, "Yeah!" And Evil Mister Fred's doing the victory dance. "Yeah, I'm the man, I'm the man, yeah, yeah, yeah," like that. And while he was doing that, the cat was busy running back, because the cat was mad. Next thing Evil Mister Fred knew, it was dark, because the cat had bit him. And he's inside the cat's mouth.

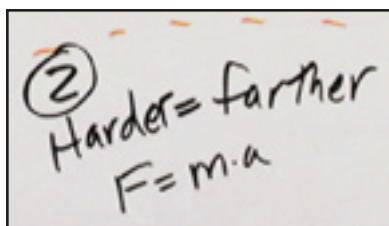


First Law of Motion

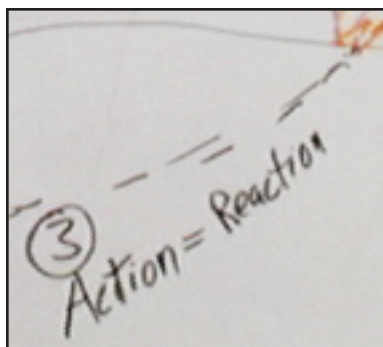
Now you know, right now, in your very own brain, Sir Isaac Newton's three Laws of Motion. Don't you feel smart? No?

Well, his First Law of Motion is: If something's at rest, it'll stay at rest unless you kick it.

The Second Law of Motion is: The harder you kick it, the further it'll go. And if you write it in mathematics, it's Force equals Mass times Acceleration. $[F=m \cdot a]$



Second Law of Motion



Third Law of Motion

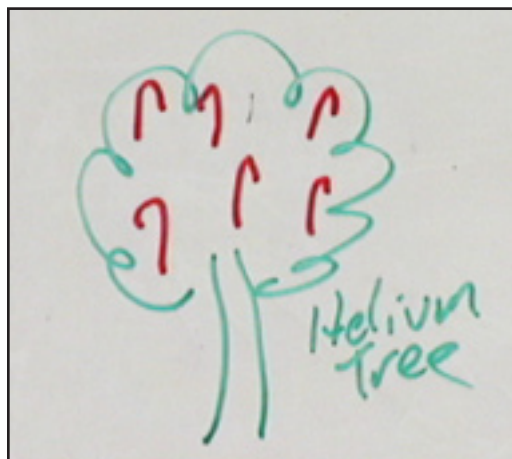
And the Third Law you probably heard of before: For every action, there's an equal and opposite reaction. And the cat came

back, of course. And his reaction was to eat Evil Mister Fred.

So we're going to use some of those laws today in our experiment, but first we need a crazy story.

Story: "Jack and Jill and the Helium Tree"

[01:05:01;12] Once upon a time there was a magic tree that floated up in the air. Yeah, we could have a tree floating in the air. What kind of tree would float in the air? *[Students: A tree tied to balloons. A helium tree.]* A helium tree, yeah. There, like that. And the tree grows candycanes. There. Candycanes. And these are the candycanes of immortality. If you eat one of these candycanes, you'll live forever, and you could become incredibly smart and wise. But the tree is pretty quick. People have tried to go up there floating on balloons and stuff. The tree would just go zoop -- zoop -- this way and that way, and they can't grab the candycanes.



Helium tree with candycanes of immortality.



Jack & Jill and the jittery trees.

Now, down on the ground we've got

... As long as we've got a magical tree, we should have a magical forest. There's a magical forest. There's a blue spruce tree. There's another blue spruce. And we need some redwood trees. Maybe they should have eyes. That's creepy. *[Student: Why are the eyes red?]* They stayed up too late last night. They drank too much Red Bull, and they're all jittery, too. How do you draw a jittery tree? *[Student: Put lines around it.]* There. There's a jittery tree.

And Jack and Jill happen to be down there in the forest, wandering around. And the tree said, "Hey! What are you doing here?" Jack and Jill said, "Whoa! Talking trees. This is strange." They said, "Well, we're on a journey. We're looking for something valuable, something that will give us the answer to everything in life." The tree says, "Well, I already know the answer to that. It's forty-two." And Jack and Jill said, "No, it's not!" And the tree said, "How do you know? I say it is." And Jack and Jill said, "Well, can't argue with that."

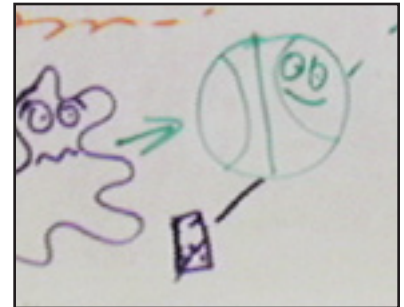
And while they're wandering around looking for the answers to life and everything, they came across, oh, let's see -- a guy who was all out of shape. Ever been out of shape? You know, you wake up in the



Shape shifter.

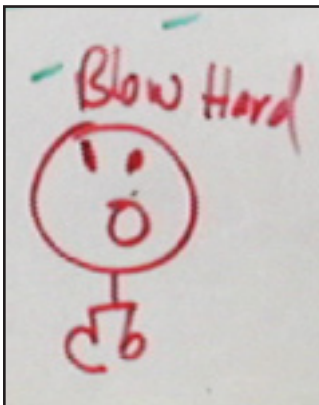
morning and you just don't feel quite right? This guy's all out of shape. There, like that. He looks kind of sad. And Jack and Jill said, "Oh, what's the matter? You look all out of shape." The guy says, "Yeah, I am. I don't feel good." And Jack and Jill said, "Well, that's because you look like a blob. Why don't you shape yourself up?" And the guy says, "Okay." And he says, "What should I be?" And Jack and Jill said, "Well, uh, why don't you be, uh, a basketball?" And the guy said, "Fine!" And he turned himself into a basketball. And he says, "Hey, I feel better already." And Jack said, "Yeah. Let me try you out."

And so Jack ran up and kicked him. And he bounced all over and went, "Woo-hoo! Great!" And Jack and Jill said, "Well, why don't you come along with us? Can you change shape into anything?" And the guy says, "Yeah, I can be anything I want to be." And Jack said, "Really?" The guy said, "Yeah." And Jack said, "Well, turn yourself into an iPod Four." And he said, "Okay," and vwoop! -- turned himself into an iPod. And Jack poked the keys, and there was a screen and everything. He could be anything he wanted to be. Jack said, "Whoa, this is great."



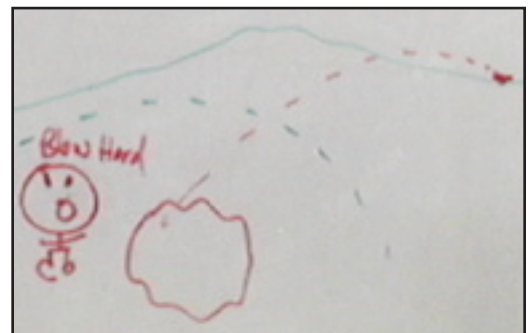
Shape shifter turned into a basketball and an iPod.

A little while later, they came further down and they met a guy that was a blowhard. So this guy's going to be a shapeshifter, and this other guy's a blowhard. A blowhard can't change shape. But he can blow



Blowhard.

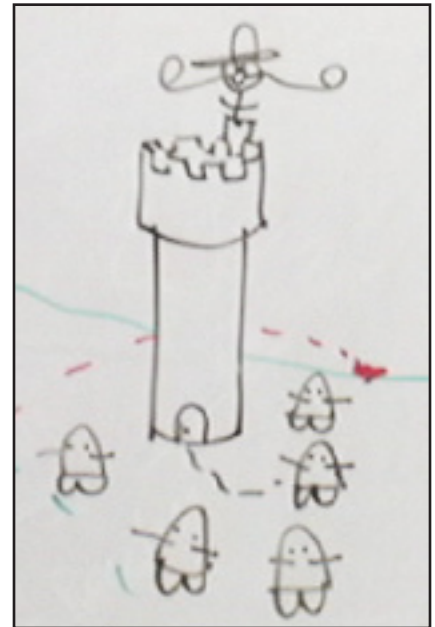
really hard. And Jill said, "Hey! Why is your mouth shaped like that?" And he said, "So I can blow hard." And Jill said, "You can't do anything like that." And the guy says, "Watch." There was a boulder there, and he says, "Okay, watch that boulder. Here goes." He blew on the boulder, and the boulder lifted right off the ground and flew clear over the horizon. And Jack and Jill said, "Whoa, that's good! Why don't you come along with us?" And the blowhard says, "All right!"



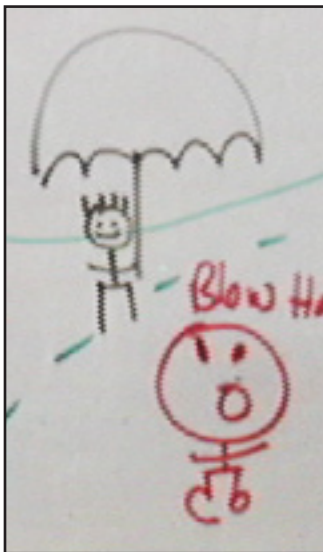
Blowhard blew a boulder over horizon.

Well, they were wandering around, and they looked, and you know, it never fails -- you're having a good time, minding your own business, and clunk! Right in front of them came smashing into the ground, an Evil Mister Fred castle from the sky. He never gives up. He's always there. And Jack and Jill said, "Can't you just leave us alone?" And Evil Mister Fred said, "No. It's my job. Somebody's got to do it." And Jack and Jill said, "Well, what are you up to?" And Evil Mister Fred said, "Me? I'm not up to anything. I'm just out here for a little vacation, rest and relaxation, minding my own business."

And the minions came running out the door and said, "Boss! Where's the magic tree with the things, you know, the round hook things, the shepherd crooks or whatever they were?" And Evil Mister Fred said, "Shhhh! Be quiet, you morons!" And Jack and Jill said, "Uh-oh. You're not after the candycanes, are you?" And Evil Mister Fred said, "What candycanes? I don't see any candycanes. No candycanes here." And Jack and Jill said, "Uh, everybody knows you want to get the candycanes of immortality, and they're up there, and you can't get them." And Evil Mister Fred said, "I'm not even going to try." Well, his plan is to wait for Jack and Jill to get them and then to steal them.



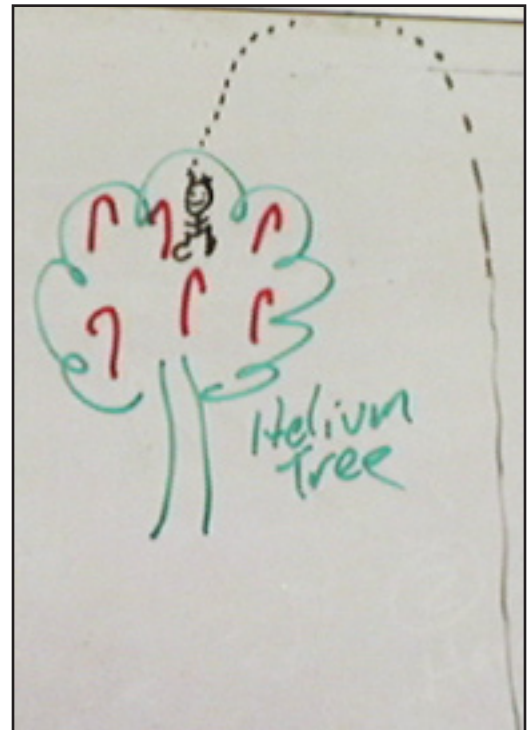
Evil Mister Fred and minions.



Jack & umbrella.

And Jack and Jill said, "We'd better get some of those, because sooner or later we're going to need some wisdom from those things." And Jill said, "Well, I tell you what, Jack. Why don't you go get an umbrella?" So Jack got an umbrella and he said, "Well, okay, I got an umbrella. What am I going to do with the umbrella?" And Jill said, "Just stand there." And Jack did. And Jill said, "Blowhard guy. Go stand under Jack's umbrella. I'll take your picture." And so the blowhard guy went and stood under the umbrella, and Jill pretended to take their picture.

And she said, "Blowhard guy, why don't you just kind of sneeze upwards?" And the blowhard guy said, "All right." And he went poot! A little blow. And Jack took off like a rocket -- pshewww! And he was going, "Aaaaaaahhhh!" And Jill says, "Hey, Jack! On your way down, grab one of those candycanes." And Jack's flying back down. The tree is watching this, up in the stratosphere. He came down and landed right in the tree. There's Jack. And Jill said, "Whoa! I don't believe it! You're in the tree!"



Jack landed in the helium tree.

Grab one of those candycanes and eat it.” And Jack did. Grabbed a candycane -- chomp, chomp, chomp. And Jack said, “Wow! Pi R Square. The square root of the hypotenuse of a triangle is equal to the sum of the squares of the two sides.” And Jill said, “That’s not right.” And Jack said, “I feel sick.” And he threw up. And then he became dumb again and the tree kicked him out -- “Aaaaaaaahhhhhh!” -- splat! And Jill said, “Jack, I don’t think you’ve got it. I think there’s something about you the tree doesn’t like. You were close, but no. You didn’t get it.”

Now Jack and Jill are down there. Evil Mister Fred, of course, watched this. He says, “Hey, this’ll work.” So he called the Acme Store of Everything and he ordered some fireworks, strapped them to minions with duct tape, and he started launching minions at the helium tree. And Jack and Jill said, “Ohh, what if one of those minions has what it takes and gets one of those candycanes? And Evil Mister Fred gets it? Uh-oh. I wonder what’s going to happen.” Now, if you’re Jack and Jill, and you want to stop Evil Mister Fred from ever getting any candycanes, what would you do?



Firework on minion.

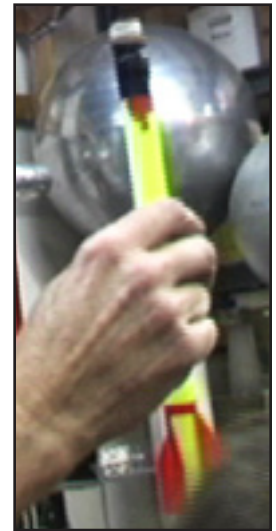
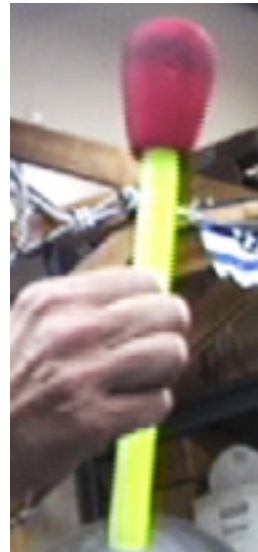
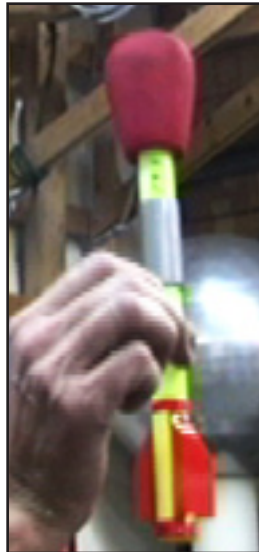
Imagination and Brainstorming Time

[01:14:46;05] *[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.)

Okay, we’ll leave this “To be Continued . . .”

Experiment: "Stomp Rockets"

Left to Right:
Rocket One (regular), Two (duct tape),
Three (no tail), and Four (no head).



[01:18:14;17] Okay, we're going to do experiments with stomp rockets. A regular stomp rocket looks like this, and if you weigh them, it's 13.3 grams. It's got a nice tail and a foamy tip.

Then, if you wrap duct tape around one, it's heavier now. This one is 19.1 grams, and it's still got the tail and head. So, a regular size one and a heavier one.

This is 12.2 grams. The tail is gone. And compare it with no tail.

And this guy over here has the head gone. I put a piece of foam that looks like a marshmallow on the head. And it weighs 12.2 grams as well.



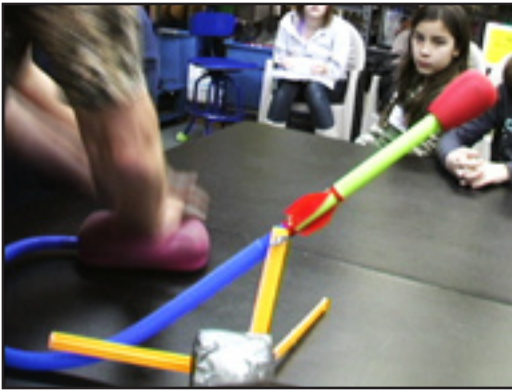
Stomp rocket assembled, with extra weight on base.



Wing nut attaches hose to base.

We're going to first test these out -- the regular ones. You're going to shoot them a bunch of times and then go get them and bring them back and shoot them again and bring them back and shoot them. And see if you can make them go far.

To do the shooting, we have purple bags that you jump on. And we have some stands with weights on them. And then there is a wing nut on here. You put the wing nut onto the stand, and it kind of sits like that. And you, of course, slide this on here. And then you jump on the pad and hope it goes somewhere. *[Shoots off rocket.]*



Demonstrating how to fire the rocket.

So you're going to need a partner for the experiment. *[Organizes students in pairs or groups of three.]* Okay, let's take the stuff outside. *[Wheels the equipment outside on a rolling cart and sets up the stands in a row about six feet apart.]* Don't touch anything.

Okay, each group get a purple bag and fasten it to a stand. Don't take rockets yet. *[Students fasten a bag to each stand. Then Instructor gives each group one of the standard rockets to shoot off. They shoot at will and retrieve them, then shoot again as long as time allows.]* You're shooting for distance.



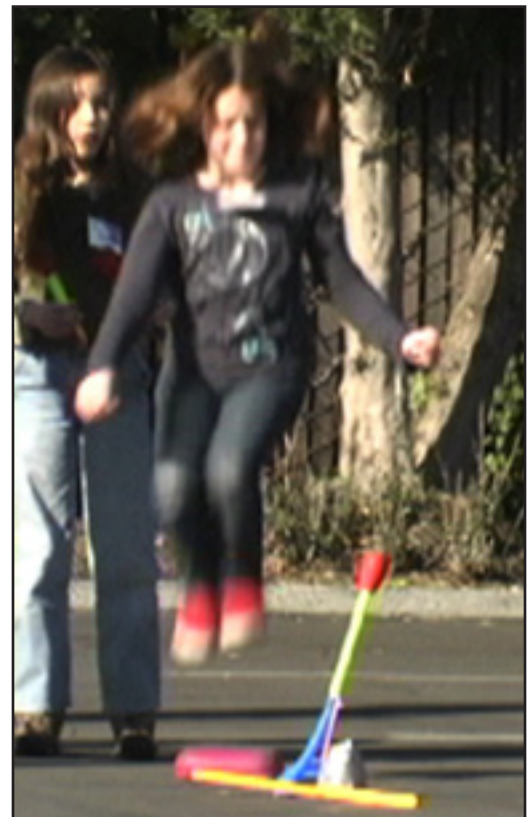
Students assemble their rocket launchers.

[After awhile, the Instructor passes out another type of rocket and students continue shooting both rockets. Eventually, each group has four rockets to shoot and compare. Before shooting the fourth rocket (the one with the foam tip removed) students put on goggles. Finally, they get to aim at the Instructor, who stands at the far end of the parking lot.] Time's up! Go collect all the rockets. There should be four rockets for each group. Take your launch pad apart and put the pieces on the rack.



One rocket just misses the Instructor's elbow. Good shot!

[Back in the classroom.] All right, which one was worst? The one without the head? The one with the duct tape? The regular one? Or the one with no tail? *[Students vote on the sequence of best to worst rockets. The worst was the one with no tail, next was the normal one, then the one with duct tape, and the best was the one with no head.]* So this one is the best. Why? *[Students: Because it's lighter. Because the tail gives it balance, but the nose doesn't drag it down so it goes up. It's more aerodynamic.]* Yep, this one is more aerodynamic, it's one of the lighter ones, and it's got a nice tail, so it can really fly far.



Jumping on the bag to launch rocket.

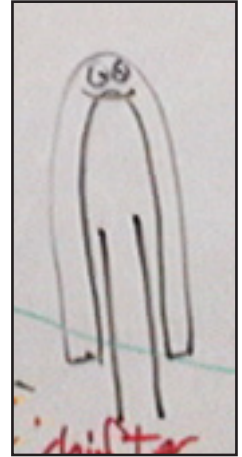
End of Story

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



Minions on fireworks.

[01:42:37;28] Now we need an ending for our story. So Jack and Jill have a shape-shifter, they have a blowhard, Evil Mister Fred has fireworks, and he's trying to get some of the candycanes of immortality from the helium tree. So he lit off the fireworks, and now there are minions flying through the air. They're supposed to jump off the firework before it explodes, but some of them don't. So now it looks like Fourth of July up there. And Jack and Jill said, "We've got to get that helium tree into a safe spot." And so they say, "Hey, shape shifter, turn yourself into, oh, maybe a long tube with a rocket on the end." So the shape shifter forms a tube. And Jill has to cut him in half with a saw so the other piece of him can make



Shapeshifter rocket.

a rocket, like that. So now the shape shifter is a rocket, like your stomp rocket. But instead of stomping on something, they've got blowhard. And Jill says, "Hey, blowhard, give a good blow on that tube, and you'll launch your buddy up there. Maybe you can knock the helium tree out of the way so Evil Mister Fred can't get him."

And Evil Mister Fred was up here with his telescope, watching things, and he saw what they were planning to do. And he said, "No, you can't do that!" And he took all of his minions and he pointed them downwards, aimed them right at blowhard and shapeshifter. And he set off his last minions with all their fireworks. And the minions took off. Jack would have to duck.

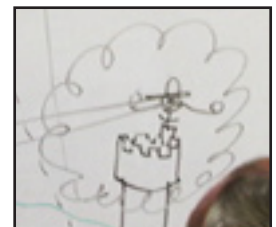


Evil Mister Fred's telescope.



Blowhard blew the minions back to the castle.

And right at that instant, blowhard blew real hard. But he was distracted by all the fireworks. Instead of blowing into the tube to knock the helium tree out of the way, he just happened to turn around and went (blows) that way. And now all the minions and their fireworks make a quick u-turn. [Student: Right around Jack's head!] Right around Jack's head. Yeah, that would be good. They race around Jack's head. And hit Evil Mister Fred's castle, and it explodes. And they all lived happily ever after, except Evil Mister Fred.



Castle explodes.

End of Lesson