

## Teacher's Guide for:

# Flash Paper & Powders

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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Flash Paper & Powders 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:

#### **Lesson Intro:**

- Magicians use fire because people like fire.
- When we use fire, we always have water available.
- Some chemicals make things burn slowly, some medium, some fast. Some burn with colors.
- We're going to do some painting with chemicals and burn them to see what happens.

## **Experiment/Demo Quick Recap:**

#### **Experiment Intro:**

- Tilt up an aluminum pan so students can see it.
- Put a small piece of paper towel in the pan and light the two upper corners.
- Watch to see whether it burns all the way.
- Don't blow on the burning paper.
- Don't add any other items to the burning paper.
- We're going to put chemicals on tissue paper: Rubbing Alcohol with Sodium Nitrate; Water with Strontium Nitrate; and Water with Potassium Nitrate.
- We'll use hair dryers to get the papers dry after painting them with chemicals.
- Students work in groups of three.
- Demonstrate how to light a match safely, holding it sideways.



Light the top two corners of the paper.



Always hold the match sideways.

## **Experiment/Demo Quick Recap (cont):**

### **Experiment:** Burning Chemically Treated Papers

- Give each group of students a small piece of paper towel in their aluminum pan.
- One student in each group lights either a match or a butane lighter, then lights two corners of the paper. Only one student at a time does this experiment, and only with the Instructor standing beside him or her.
- Give each group a piece of tissue paper. The Instructor uses a cotton swab to brush it with the Alcohol and Sodim Nitrate solution.
- Students or instructors use hair dryers to dry the paper.
- One student at a time lights their paper to see how it burns.
- Instructor holds a piece of flash paper with tweezers over the aluminum pan.
- Turn out the lights.
- Student lights the butane lighter and the Instructor brings the paper into contact with the flame.



Lighting the Paper Towel.



Lighting the Flash Paper

### **Demo:** Burning Powders

- Use tiki torch with small cup attached to hold powder. A stomp rocket stomper is attached to blow the powder across the flame.
- Put Coffee Creamer in the cup, turn off the lights, and stomp.
- Repeat with Flour, then Baking Powder, then Aluminum Powder.



Tiki Torch with Powder Cup and Hose



Tiki Torch with Coffee Creamer

# Equipment List: "Flash Paper & Powders"

#### **Items needed for Instructor:**

- Aluminum Roasting Pan
- Cup of water
- Wooden Matches
- 1/2 sheet Paper Towel
- Tissue Paper, small scrap
- Sodium Nitrate in Rubbing Alcohol
- Strontium Nitrate in Water
- Potassium Nitrate in Water
- Cotton swabs for spreading chemicals on paper
- 3 Hair Dryers
- Power Strip for Hair Dryers
- Flash Paper, about 2" x 2"
- Tweezers
- Tiki Torch with powder burner
- Coffee Creamer
- Flour
- Baking Soda
- Aluminum Powder
- Scissors

#### **Items needed for Students:**

#### Consumables (per 3 students):

- Scrap of Paper Towel (about 1/8 sheet)
- Tissue Paper (about 3" x 4")
- Wooden Matches (2 per student)
- Flash Paper (about 2" x 2")

#### Other:

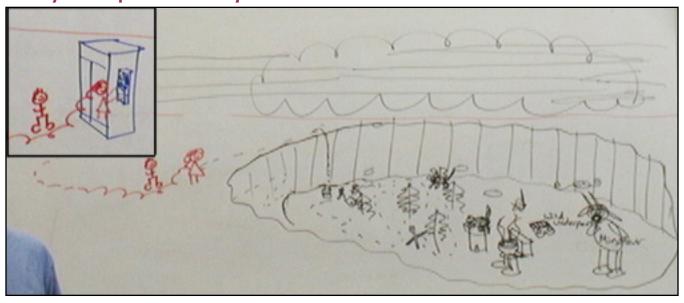
- Aluminum Roasting Pans (1 per 3 students)
- Butane Lighters
- 16-oz Plastic Cups (1 per pan) for water

#### **Prep Work:**

- Mix chemicals if necessary
- Tear Paper Towels into pieces
- Cut Tissue Paper into pieces
- Build and test tiki torch apparatus
  (See the Prep video on the "Flash Paper & Powders" Lesson Video page
  for instructions on how to construct
  it.)



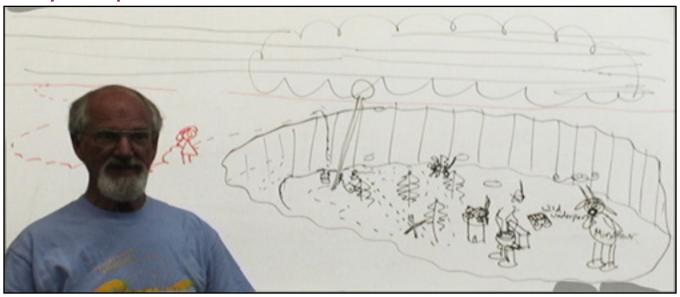
# Story Recap: "The Deepest Darkest Forest"



#### Part 1:

- Jack and Jill find an old phone booth and put some money in it.
- The phone gives them a message to find the treasure in the Deepest Darkest Forest, or the world will be destroyed.
- When the message finishes, the phone booth disappears.
- Jack and Jill find a big hole with the Deepest Darkest Forest in it, along with all sorts of weird creatures. There's a glass of water at the bottom, so Jack and Jill dive into it to get to the bottom of the hole.
- They find a piece of paper that says "X marks the spot," but they don't have a flashlight and can't find it. They're also trying to avoid the creatures.
- Jack and Jill don't know that Evil Mister Fred is also down there, and his minions are following Jack and Jill around because Evil Mister Fred knows they'll find the treasure eventually.
- The night is dark, a storm comes up and blocks out the moon, and there's no light to use to find the X spot.

## Story Recap (cont.)



## Ending:

- Jack and Jill decide to cut off a was of Jill's hair and make a torch out of it so they can see.
- Evil Mister Fred has been following Jill's hair so he could catch her. So he's got a big bundle of hair in his hands, and the minions are collecting it, too.
- Jack calls the Acme Store of Everything and orders a match. But they make a mistake and send a giant match.
- Jack strikes the match on the side of the cliff, but when he tries to put it on Jill's hair, he accidentally hit the wad of hair that the minions are holding.
- It lights up the entire forest like magician's flash paper, and all the creatures run away.
- Jack sees the X, and Jack and Jill stand on it.
- Jill clicks her heels three times, says "I wish I was home" three times, and grabs Jack.
- There's a big flash, and Jack and Jill and all the treasure end up in Kansas.

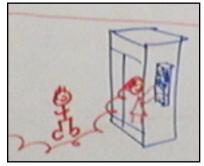
# **Transcript: Introduction**

Magicians like to do things with fire because people like fire. When we use fire, we always want to have some water available. I always keep just a jar of water or a bucket of water, depending on the fire I'm going to be using. So if I catch my hair on fire, I can pour the water on my head. And today we're going to be using some chemicals to make things burn. Some chemicals can make things burn really slow. Other chemicals can make things burn medium. Some can make them burn real fast. Some chemicals can burn with colors. Some chemicals will burn green, some blue, some orange, some red. You just never know.

The stuff that we're doing today is reasonably safe, but if you put your hands in fire, it usually hurts. You're going to get to do some painting with chemicals and we'll try to burn them a little bit just to see what happens. In the process, we'll learn how cigarettes are made. [Student: Tobacco.] Yeah, but they add something to it. If you just make a cigarette out of tobacco, it doesn't burn very well. It keeps going out. First we need a crazy story.

# Story: "The Deepest Darkest Forest"

Once upon a time Jack and Jill found an old-fashioned phone booth. In the days before cell phones, if you wanted to make a telephone call you had to find a phone booth. In those days a phone booth was just a tall skinny box, like that, that had doors on it. The doors kind of folded open, kind of opened in a weird way. On the back wall was a black tall telephone. And you could put ten cents into it and make a phone call. And it had a hand set on the side, and curly cords like that. And at the bottom, your change would come out if you put in too much money. And they made sounds when you put in the money. It would go ding! when the money went in. And then you'd hear a dial tone. And in order to dial

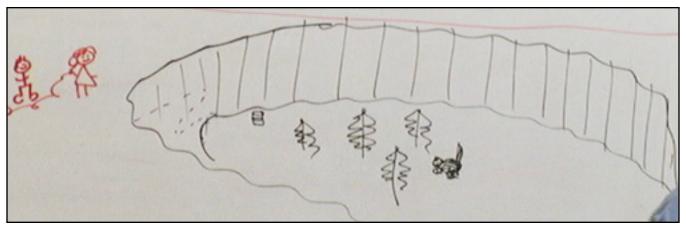


The Phone Booth

it, you had to put your finger in a hole and twist a knob and go zhoop-click-c

Well, Jack and Jill found one of these things, and they said, "Wow, look at that! That must be fifty years old." There's Jack. And let's put Jill inside. They said, "Let's try it out and see if it works." So Jill's trying out the telephone. And she puts some money into it, and it went ka-chinggg! And then smoke started coming out of the phone, and the lights started to blink on and off, and she put it up to her ear, and it said, "This is your mission, should you choose to accept it. If you don't choose to accept it, you'll immediately be killed." And Jill said, "Oh, okay, we accept." And it said, "Now, all you have to do is go into the deepest, darkest forest where evil creatures live, flying monkeys, and things that crawl up your leg and bite real hard. And find the treasure, and bring it back. If you bring it back successfully, then you will save the world. If you fail, then Evil Mister Fred will take over and the world will be destroyed." Jill said, "Cool. We'll do it." And it said, "Okay, your next instructions will come when you least expect them." Click. And the phone booth went poof! and disappeared, leaving Jill standing out in the middle of an empty place with her hand by her head.

Jack said, "What just happened?" And Jill said, "I don't know. But it's really weird. We've got to go to the deepest darkest forest and see what happens." And they walked a little further and they found a big



The Deepest Darkest Forest

hole in the ground. And they looked down inside and sure enough, there was the deepest darkest forest down there. With black trees and black dirt and black rocks and black and white animals that smell bad. Like a skunk. There's a skunk down there.



Jack & Jill with Water Glass and Map

Jack said, "Well, how are we going to get down there?" And Jill said, "Well, there's a trail, but that's no fun." Jack said, "You're right. That is no fun." And they looked down at the bottom, and there was a glass of water down there. They said, "Look -- way down there at the bottom. There's a glass of water." Jack said, "Cool!" He ran over to the edge, right above it, and dove in. "Ahhhhhhhhh" -- ploosh! This is Jack's feet sticking out there. He pried himself out of the glass of water and he said, "Yeah, it worked! Your turn." So Jill dove down -- ploosh!

And now Jack and Jill are in the deepest darkest black forest. They can hardly see a thing. They neglected to bring a flashlight. Weren't too prepared. And they saw a piece of paper on

the ground, and the piece of paper said, "X marks the spot." Jack and Jill said, "Hey, this is like in the movies. Find the place where the X is, that's where the treasure is, dig up the treasure, bring it back, somehow get it back up the cliff -- we're set."

So they started running all over the place looking for the X. But it's dark, and it's a black X, and they're having problems trying to find the X. Not only that, there's holes in the ground, there's holes in the walls, there's caves everywhere, and there's vicious smelly creatures. There are flying monkeys, diabolical flying monkeys with big ears. There are skunks. What other kinds of diabolical creatures would you expect to find in the deepest darkest forest. [Students shout ideas.] Wild underpants! Okay, there's wild underpants with teeth, and eyes. There. What other kind of crazy creature? Poisonous toilets! Okay, there's a poison toilet. It probably smells bad, so those are bad smell lines. With feet, like that. A minotaur! Oh, half bull, half man. Man's legs, a bull torso and head, and they have ears that flop down at the sides. One more creature. [Student: A skunk castle.] A skunk castle. We have a skunk. He can hop around on a castle.

Now, Evil Mister Fred is down there with his minions. And his minions are all running around with baseball bats. Minions can't use swords, they can't use arrows, they can't use knives because they kill each other. And then Evil Mister Fred has to glue them back together again. They can only use baseball bats because their heads are hard as a rock. You can hit them all day long, and it won't hurt them if you hit them on the head.

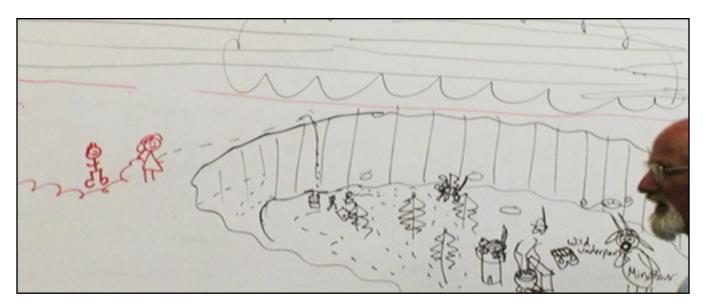
So Evil Mister Fred, he's hiding here in this cave. [Student: I thought he lives in a castle.] Well, his castle's inside the cave. And the minions are running around, they're not trying to stop



Weird Creatures, a Minion, and Evil Mister Fred hiding in a cave.

Jack and Jill. They're trying to sneak around and follow them because Evil Mister Fred doesn't know where the treasure is, and he knows Jack and Jill are going to find it. When they do, he's just going to have his minions bonk them on the head, steal all the treasure, take over the world, and things will be evil, just the way he likes them.

So Jack and Jill are in there, and a storm comes over, the moon is blocked out, it's a dark and stormy night, and a shot rang out. One of the minions lit a firecracker. And Jack and Jill have to find their way to find the X marks the spot. If you were Jack and Jill, and you were down there, how would you find the spot?



#### **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.)

And we're going to leave this "To be continued . . . "

## **Experiment/Demo:**

#### **Experiment Intro:**

There's a pan. I'm going to tilt mine up so you can see it. And you'll have a fire extinguisher, which is a cup full of water. And your pan is going to be laying flat, but I'm going to tilt this one up so you can see it. We're going to test some pieces of paper to see how they burn. Now, I'm going to use a match. And we're going to light the paper on fire at the top corners, like ears. So he's got ears, and you put the match in the water. And see how the paper burns, see how far it goes. Is it going to burn all the way or will it go out before it burns all the way?

While you're doing the experiment, don't blow on your piece of paper. Because if you blow on it, some people want to make the flame burn better or whatever, and they go [blows hard]. And the paper goes [pantomimes paper swirling through the air and landing on his head].



Lighting the Paper Towel

During the experiment, you don't get to add any other items to the burning paper. So if you have a gallon of gasoline in your back pocket, you don't get to put it on the burning paper. If you've got a hundred dollar bill that your parents gave you for your birthday, you don't get to put it on the burning paper.

That was a regular piece of paper. Here's a piece of tissue paper. [Student: Do we get to use the matches ourselves?] If you want to. And we're going to be putting some chemicals on paper to see if it burns faster or slower. One thing we're going to put on it is rubbing alcohol with a little bit of stuff in there called sodium nitrate. Another thing we're going to put on it is water with strontium nitrate. And another thing we're going to put on there is water with potassium nitrate. Now, you know water doesn't burn, usualy. So after we get the pieces of paper in this and give you a piece of paper, we're going to need to dry them out with a hair dryer. [To assistant: Let's see, three hair dryers.] And you're going to be working in groups of three. You get to pick your own groups. You'll have the tub to burn things in, and we want to see how they're going to burn. [To assistant: So, now we can give them tubs, because we know where the groups are.]

First, we're going to burn something really slowly. [Passes out pieces of paper towel.] And you're going to be taking turns lighting each sample. One person will light one, and then the next, and the next. We'll just work our way around. So you get a choice. Oh, you need your fire extinguishers. [Assistant passes out cups of water to each group.]

You have a choice. You can either light yours with the matches, or you can light them with the lighter. Sometimes, when you're lighting with a match, the end breaks off because the wood isn't very strong. Mostly because kids hold it from the very tip, they try to keep their fingers as far away from the end as they can. And they go to strike it, and the match breaks. And the flaming end flies through the air and lands in somebody's lap. So while we're working with fire, you want to be standing up and not ever sit-



Hold the Match sideways

ting down. If you don't want to use a match, you can use this guy [holds up butane lighter] to light yours.

If you're going to use a match, you hold it about halfway, strike it, and now you've got time. You can count to a hundred if you want, and it will slowly burn as long as you hold it sideways. If you turn it this way, it'll burn your fingers. If you hold it that way, it might keep burning or it might go out. Sometimes the burning end might fall down on your hands. So the best way to hold it is sideways. When you're done lighting whatever you're going to light, then you take the match and psssssh -- put it in water. Stand up and move the chairs away from the table.

#### **Experiment:** Burning Chemically Treated Papers

[Instructor works with each student in turn, assisting them if necessary in lighting the match or lighter. Student then lights two corners of the paper towel piece and watches to see how it burns. It burns slowly and completely, leaving a small clump of ash.]

Here's sodium nitrate in alcohol. We're going to see if it burns any different than before. I'm going to coat them first. [Brushes solution onto tissue paper with a cotton swab. Then students and/or instructors use the hair dryer to blow it dry. Then the Instructor works with each student in turn, as before.]



Student Lights Paper Towel



Applying Sodium Nitrate solution to Tissue Paper with cotton swab.



Using Hair Dryer

Next one is going to be magician's flash paper. Magician's flash paper is paper that's been soaked in potassium perchlorate and sat there for awhile. And they add a little sodium to it to make it burn really cool. To do this, the third person who hasn't lit anything is going to light one of these. I'm going to be hold-



Burning tissue paper soaked in Sodium Nitrate solution.

ing it in the pincers like this. You're going to be using the [butane lighter] this time. We're going to turn the lights off. And then, [to first student] you go ahead and light the flame. Here goes. [Student holds the lighter still and the Instructor brings the flash paper to the flame. It burns very brightly and quickly. Other students light the lighter in turn as before, while the Instructor holds the flash paper.] Move your chairs back to the table.



Hold Flash Paper with Pincers

Flash Paper Ignites

### **Demo:** Burning Powders

Here's a stomp rocket stomper, and I'm going to be stomping it. Suppose you made a big mistake and caught something in your house on fire. And you don't have any water, and the water company has turned off your water, and you can't spit enough spit to put it out. Now, we're going to give you a choice of things to pour on the fire to see if you can put it out. One of them is coffee creamer. Another one is flour, like what you might use to make bread. One of them is baking soda. And the last one is aluminum powder.

We're going to start off with coffee creamer. Here's your fire [lights tiki torch]. We have a stomp rocket down here. So if we put some powder, some coffee creamer in the cup by the flame -- there, now it's got coffee creamer in there -- and turn off the lights. I'm going to stomp the stomp rocket, and you watch the flame. See if it does anything. Okay, five, four, three, two, one -- [stomps. Flame sparks slightly.] Oh, that didn't spark enough. We'll tilt it down so the flame is more close to it. Okay, five, four, three, two one -- [stomps.] Oh, it went out. Maybe I'm stomping too hard. I'll try softer stomps. I think it matters how hard you stomp on it. [Refills cup with creamer.] Okay, I'm going try this one with a slow stomp and see if we can get it better. [Stomps again, and flame bursts into a bright



Tiki Torch with Cup for Powders



Coffee Creamer Ignites

*flare.*] So if you throw coffee creamer on a fire, chances are the fire will get bigger.

Let's try ordinary baking flour like you use to make bread. Okay, I'll do a slow stomp too, like I did the last time. [Lights off.] Lights, camera, action -- [stomps, and flame flares up again.] So, chances are, pouring flour on a fire is a bad idea.

Let's try baking powder. I'm going to pump it exactly the same way I did last time. Okay, five, four, three, two, one -- [stomps, and flame goes out.] Turns out, baking powder puts out fires really well. So if you want to put out a fire in your house, you don't use flour, you don't use coffee creamer. Baking soda or baking powder is good. Better, yet, a real fire extinguisher you should have in your kitchen.

Now, let's suppose you happen to live in a chemist's shop, and all you have is aluminum powder. They use aluminum powder in fireworks. Five, four, three, two, one -- [stomps, and flame blows out.] Oh, darn, too fast. [Some smoke is left behind.] We have to wait for that to settle. [To assistant: I'm going to use less and go slower.] Have you guys ever played with an Etch-A-Sketch? The powder that makes the silvery look on the Etch-A-Sketch is aluminum powder. I'll try it again. I'll have to stomp more slowwwly. Here we go, more slowly. Five, four, three, two, one -- [stomps, and flame produces a huge, very bright flash.] Okay, all I see is a dot. You guys see dots? Yeah.



Ordinary Baking Flour Ignites



Aluminum Powder makes a Blinding Flash

So, if you have a fire at home and you throw aluminum powder on it, probably not a good idea.

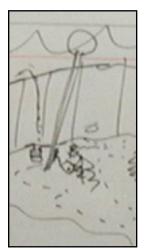
## **End of Story**

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

Now, we need to make an ending for our story. Let's put an X out here. So Jack says, "We're never going to find this thing. They're wandering around, and the minotaur -- he can sniff really good -- and he said, "Fee, fie, foe, fum, I smell the blood of an englishman. Arrrgggh!" And he's right behind Jack and Jill. Wild underpants is flying overhead, spying Jack and Jill with its infrared detectors. The toilet is running, banging off the trees everywhere because it has no head. It's just banging all over, ready to run into Jack and Jill. The skunk-castle is hopping like he's on a pogo stick, leaving holes in the ground where he lands. And the flying monkeys are just flying around playing games, because they lose their attention span really fast. Jack and Jill said, "We've got to find this quick." And Jack says, "You know, Jill, your hair grows infinitely fast, doesn't it?" She says, "Yeah." And Jack said, "Okay, let's just make a torch out of your hair." And Jill said, "Oh, good idea."

Well, they'd already been wandering all over the forest, and Evil Mister Fred was out there, following Jill's hair so he could catch her. So he's got hair in his hands. He's got a big bundle of it, because the minions are following behind him and the're collecting it all up. And they've got a huge wad of Jill hair. And Jack said, "Well, let's just cut it off and light it, and we'll make some light and we'll find the X, find the treasure, get out of here, and save the world." And Jill says, "All right. Okay, go ahead."

So Jack calls the Acme Store of Everything and orders a match. And they send him one, but they made



Giant Match

a slight mistake in the size of the match. And Jack says, "What am I going to do with a match this size?" And Jill says, "Well, you've got to strike it on something. Just strike it on the cliff." Jack says, "All right." So he goes fwizzzzhhhh -- and it burns like ten thousand suns -- aghhhh! And he's trying to put it on Jill's hair. And he lowers the match down and just happens to hit the wad of hair that the minions are holding in their arms. And it's like magician's flash paper. It goes KA-BOOOOMMMMM!!! Lights up the entire dark forest. All the animals cover their eyes and run for their lives. Meanwhile, Jill sees the X, runs over there and stands on the X. And Jack says, "Hey, that's it." And Jill says, "Okay." And she clicks her heels three times -- click, click, click -- and turns around and says, "I wish I was home, I wish I was home." And just when she hits it the third time, she puts her hand on Jack's head. And when she gets the third time around, there's a big flash, all the treasure, Jack, and Jill end up back in Kansas with a bunch of little chickens. And they all lived happily ever after except Evil Mister Fred.

## **Experiment Wrap-up**

So if you go to a magic shop and you buy flash paper, don't light it unless your parents are there, because flash paper goes fwoomm! And it doesn't take a match to set it off. You can set it off with a spark. And the older it is, the worse it gets. So stuff like that should be stored in a steel box and only be used when your parents are there.

End of Lesson -- If you have questions about this lesson, please ask them through the online <u>Teacher Support Forum</u> on our web site.