



Teacher's Guide for: **Calcium Carbide**

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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Calcium Carbide
A Rock-it Science Lesson
Filmed July, 2009

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Intro Quick Recap:

Lesson Intro: Fizzy Smelly Rocks

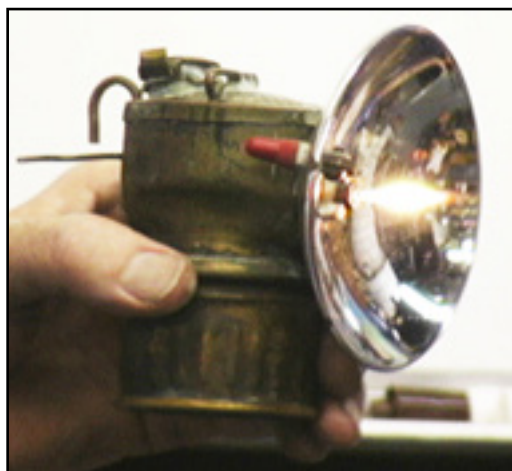
- There are fizzy rocks that smell like garlic.
- When seashells are burned in a hot, hot furnace with not enough oxygen, they form calcium carbide.



Demo/Experiment Quick Recap:

Demo: Miner's Lamp

- The fizzy rocks create acetylene gas.
- Fizzy rocks were used for miner's lamps.
- Instructor puts calcium carbide powder in the bottom chamber of a miner's lamp and adds water to the top chamber.
- The drip rate can be adjusted with a lever on the side.
- Instructor lights the lamp with a lighter, igniting the acetylene gas.
- Turn out the overhead lights to show students how bright the miner's lamp is.



Experiment: Exploding Fizzy Rocks

- Each student gets a small plastic souffle cup with lid.
- The lid has a small hole in it.
- Instructor puts a different amount of calcium carbide in each student's cup and puts the lid on.
- Instructor squirts a few drops of water through the hole in the lid and swishes it around, making the rocks fizz.
- Student puts either a lighter or a match over the hole, igniting the acetylene gas.
- Explosions differ depending on the amount of calcium carbide in the cup.



Equipment List: "Calcium Carbide"

Items needed for Instructor:

- Calcium Carbide, in chunks and powdered
- Miner's Lamp
- Water
- Pipette, plastic
- Tweezers
- Small phial or jar to hold powdered rock
- Small spatula to measure out powdered rock (you could also use the flat blade of a screw-driver for this)
- Butane Lighter
- Matches, wooden safety

Items needed for Students:

Consumables (per student):

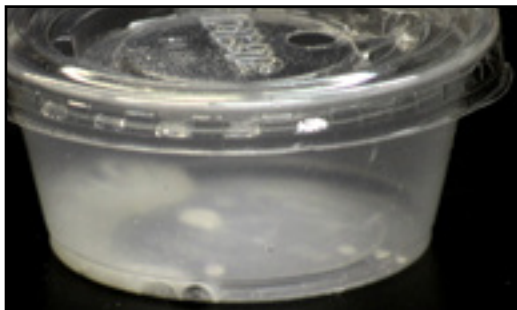
- 2-oz Plastic Souffle Cup.
- Lid for 2-oz plastic souffle cup, with 1/4" hole in center

Other:

- Goggles
- Earmuffs

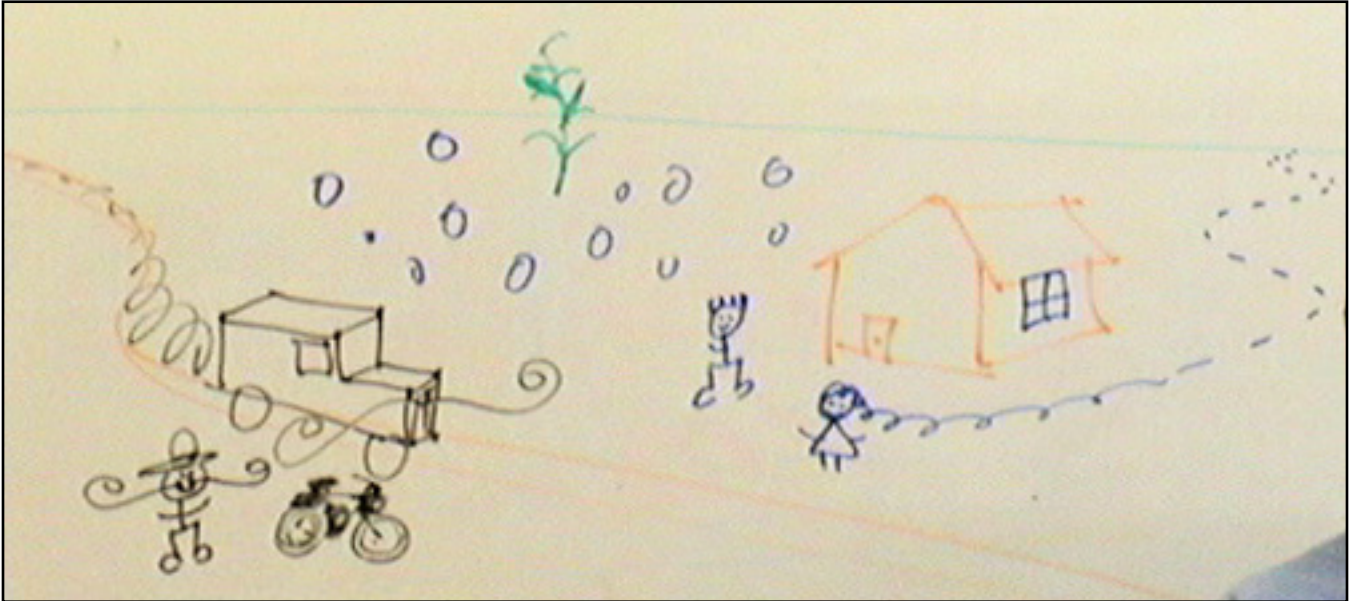
Prep Work:

- Burn 1/4" hole in souffle lids with a soldering iron, or punch them out with a paper punch
- Crush some of the calcium carbide into powder



Souffle cup with hole in lid.

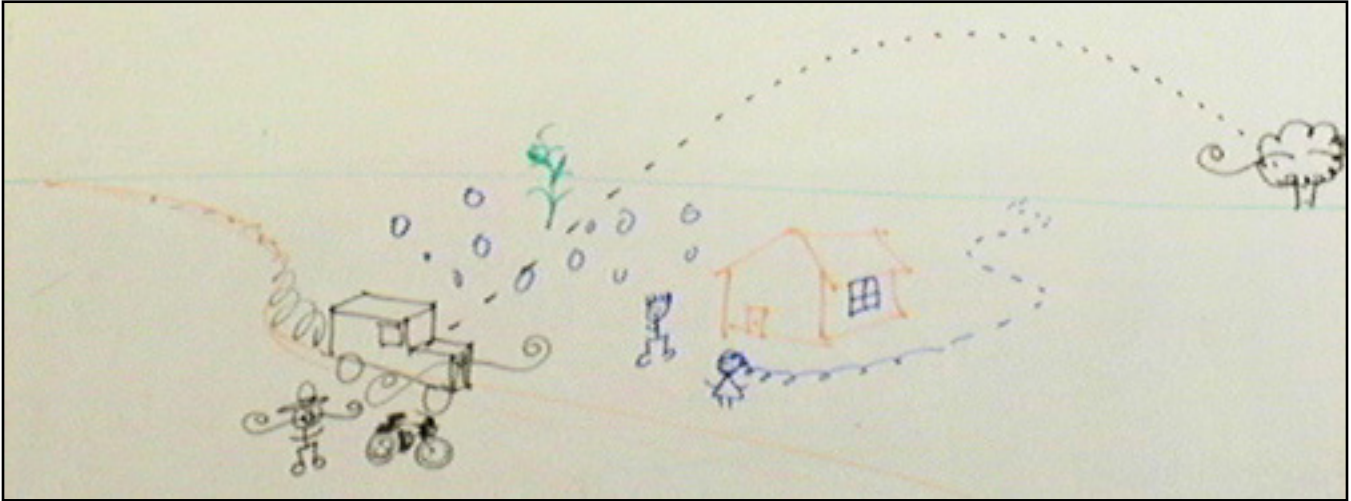
Story Recap: "Evil Mister Fred's Water-Powered Motorcycle"



Part 1:

- Jack & Jill live on a farm where they grow corn.
- The other farmers in the area have had a bad time because there was no rain and their crops died.
- When the farmers couldn't pay the bankers, the bankers sold their farms, homes, and possessions, and the farmers were left with nothing.
- But Jack and Jill were doing well, because they had been growing Pet Rocks in between their corn, and it made them rich.
- Evil Mister Fred came by in his truck and asked for a drink of water.
- He took a sip and poured the rest in his gas tank.
- He told Jack and Jill that his car's engine ran on water.
- He also showed them a motorcycle that ran on water.
- He said he needed investors so he could manufacture more of these vehicles, but no one would invest with him.
- He let Jack and Jill borrow his motorcycle for a week so they could test it and decide whether to invest.
- Evil Mister Fred went off to write a contract that would guarantee that he could keep Jack and Jill's money no matter what.
- All week, the motorcycle worked great on water. Jack & Jill even took it apart, and it looked just like a regular motorcycle.
- They were seriously considering investing with Evil Mister Fred.

Story Recap (cont.)



Ending:

- On the last day, they took examined the gas tank, which was welded together, and saw little rocks inside. They realized Evil Mister Fred was running his engines on calcium carbide.
- When Evil Mister Fred came back, Jack and Jill told him they wanted to do one last test. They would put the motorcycle in the back of his truck, start it up, then zoom it out to see how much power it had.
- They told Evil Mister Fred to sit in the driver's seat just in case, and they put the motorcycle in the back.
- Jack and Jill poured a lot of water into the gas tank, lit a candle, and tiptoed out of the truck and closed the doors.
- After awhile, the acetylene gas built up until the candle flame ignited it.
- Evil Mister Fred was blasted over the horizon, and a mushroom cloud formed where he landed.

Transcript: Introduction

Have you ever seen fizzy dirt before? Well, there's something that looks like dirt that fizzes. And it stinks when it fizzes. It smells kind of like garlic. If you take seashells, and you take a whole bunch of seashells and you put them in a hot, hot fire, and you don't give them enough oxygen, the seashells burn, burn, burn, burn, burn, and they combine with the ashes and form calcium carbide. It looks like a rock. But if you get it wet, it starts to fizz.

Here's a rock of calcium carbide. Seashells burned in a hot, hot oven with not enough oxygen. And it smells like something. To me, it smells kind of like garlic. *[Allows children to smell it.]* Now, they spent enough time making this that it ought to be good for something. It turns out it is good for something. But you won't find out until after we do the experiments. Fizzy rocks.



Rocks made of Calcium Carbide

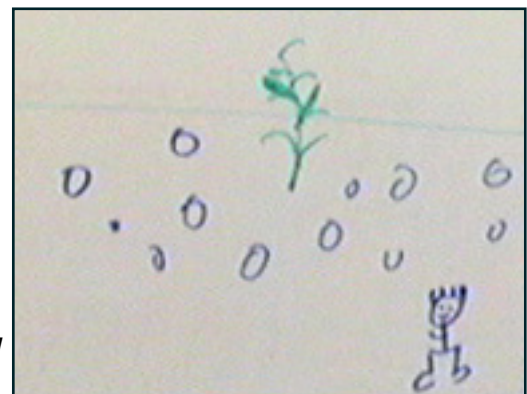
Story: "Evil Mister Fred's Water-Powered Motorcycle"

Once upon a time, in the midwest, people grew corn. There's some corn. The corn has ears. And living out there are two farmers, Jack and Jill. And Jack and Jill were doing pretty good. They got to keep their farm. Other people had planted their crops and it didn't rain. And the crops all withered and died. And the guy from the bank came and said, "Hey, you owe money. You've got to pay it back. The people said, "Sorry, there was no rain. We don't have any money." And the guy said, "Oh, that's okay. We'll just sell everything you have, and your children, and your dog, and your car, and everything you have left. And you can go away." They said, "What? You can't do that!" And the guy at the bank said, "Sure I can. And we'll do it tomorrow." And so they'd have an auction and sell off all these other farms.

But Jack and Jill were doing well. They were growing rocks in between the corn. And there was a good market for rocks. And they would paint the rocks with funny little faces on them and sell them in boxes with instructions on how to feed your rock and when you should walk your rock . . . *[Student: A Pet Rock!]* Yeah! And so Jack and Jill had a whole bunch of money. And everybody else was just kind of going, "Ohhh, man, I better go to California."



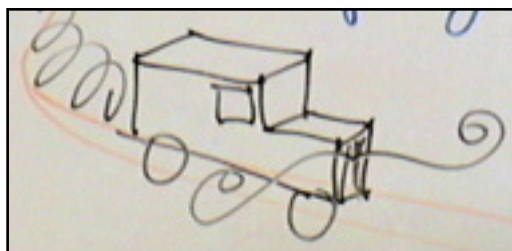
Jack & Jill's Farm



Jack & Jill's Rocks

There was a dirt road in front of their house. And one day along came an old truck down the road leaving a trail of dust. And the truck had a mustache. *[Students: Evil Mister Fred!]* Yep. And Evil Mister

Fred stopped his truck in front of Jack and Jill's place and went to the door. And he says, "Ah, it's a really hot day. Could you spare a drink of water?" And Jack and Jill said, "Sure, we'll give you some water." So Evil Mister Fred got the water, he took a little sip, and he says, "Oh, my truck's running a little low on fuel." And then he went outside, opened the gas cap, and poured the water in the gas tank and closed it up. And Jack and Jill said, "Evil Mister Fred, you're going to wreck your engine. You just poured water in the gas tank." He says, "Oh, no, no, no, this truck doesn't use gas. It runs on water." Jack and Jill said, "Uh, I don't think so." He said, "Oh, yeah, I make all my machines run on water. In fact, I've got lawn mowers, motorcycles, all sorts of things that run on water." And Jack and Jill said, "Huh?" And Evil Mister Fred said, "Sure, I'll show you one."



Evil Mister Fred's Truck

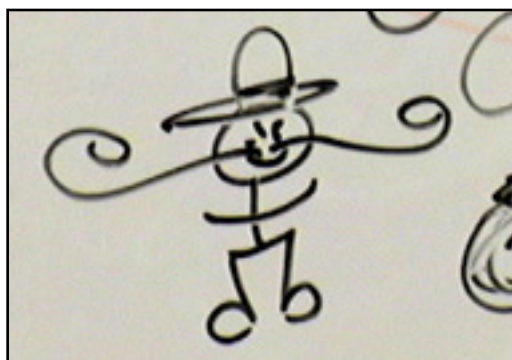
And he pulled out of the back of his truck a motorcycle. He says, "There you go! There's a motorcycle." Here's a motorcycle. It has a motor in it, and a gas tank, and some lights -- we have to add tires. And he said, "I'll show you how it works." He tipped over the motorcycle and he poured out everything that was in the gas tank, tipped it back up, and he poured more water in there, closed it off, and went brrrooommm! And rode it around.



Evil Mister Fred's Motorcycle

And Jack and Jill said, "Wow! That's really good." And Evil Mister said, "Yeah, it's a good idea, but nobody will give me money to produce these. They all think I'm trying to cheat them." And Jack and Jill said, "Well, that's because you're a cheater and a liar and a thief, you're mean, and you're rotten." And Evil Mister Fred said, "Well, thank you, but even so, they still won't give me their money." And Jack and Jill said, "Doh!!" And he said, "If somebody would invest just a few thousand dollars, I could produce more of them, sell those, and make even more, and sell those. They'll run forever, on water."

And Jill said, "I'll tell you what. Let us have it for a week, and if it still works at the end of the week, we'll invest in your company." And Jack looked at Jill, and he said, "Jill, are you nuts?" And Jill said, "No, not at all. We want to see." So he said, "Okay." And Evil Mister Fred said, "Well, this is the only one. If you wreck it, you've got to pay." Jack and Jill said, "We'll be careful." So Evil Mister Fred agreed. Then he went away down the road.



Evil Mister Fred needs Investors

And Jack and Jill took the motorcycle out and drove it all over the place. Over the hills, out into the fields, used it for everything, and whenever it stopped they just added water and brrrooommm -- away it would go. And then they said, "Hm!" Next night, they took the motorcycle into their house, and they got their toolbox out, and they took it all apart. Every little piece. And they looked at all the pieces, and it looked like a regular motorcycle. They put it all back together -- brrrooommm -- and it started again.

By the end of the week they were impressed. And Evil Mister Fred came back. And he said, "Well, what do you think?" And Jack and Jill said, "Well, Evil Mister Fred, you're evil, you're rotten, you're no good. But this thing seems to work. We can't figure out how you're doing it." And Evil Mister Fred said, "There is no trick. I've turned over a new leaf. I'm a good guy now. I'm a CEO." And Jack and Jill said, "All right. We'll invest a hundred thousand dollars in your company." And Evil Mister Fred said, "Yeah!" If you were Jack and Jill, would you invest a hundred thousand dollars in this venture?

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 . . ."

Demo/Experiment:

Demo: Miner's Lamp

In the old days, if you went into a mine, it was dark in there, and they needed light. So they made lamps for the miners to use, and the miners' lamps used those rocks to make them work. Yeah, the smelly rocks you can use to make light in a mine. In order to do it, you need a little bit of water. I'm going to pour some water in the top compartment of this, just like Evil Mister Fred put it in his gas tank. There's some water. And there's a lever on it that controls the water a little bit. There's a lever on the side, and if you push the lever on way, it goes drip, drip, drip, drip, drip, drip. You can make it go slower -- drip . . . drip . . . drip . . . So we can drip water into this lower chamber, and in the lower chamber, we can put one of our fizzy rocks that smells like garlic. I might have to smack it with a hammer to make it smaller. They're pretty hard rocks. Oh, I know, let's crush it in the vice and see if it will break. The vice is this metal thing over here. *[Students gather around as Instructor attempts to crush a rock in the vice. It works.]* Okay, go sit down where you were.

We'll put a little piece in our miner's lamp, and we'll put the lid on. Let's set it so it just drips a little bit. We'll try it at that drip level. And it's going to fizz. We can make it fast or slow. Right now it's not doing anything yet, so we'll make the drip rate faster. *[Assistant lights the lamp.]* There it is. The rock is producing something.

Turn off the lights, and we'll see if this is seeable. Now, I'll shine it on your face and you tell me if it's bright or not. *[Students: It's bright.]* So if you're a miner, and you're in a dark



Add water to the Top Half



Miner's Lamp lit with Calcium Carbide

cave, this is the kind of thing you'd use. Here's a dark cave [*points the lamp into the castle in the corner of the class-room*], and you could look around in there and go dig out the gold nuggets that are in your cave. We'll just let it run. It's not going to run very long because I've got it on a kind of high speed. Okay, switch the lights back on.



The Miner's Light is Very Bright

Experiment: Make Fizzy Rocks Explode

Now, the gas that it's making in there is called acetylene gas. They use it in acetylene torches to cut through steel. But we're not going to put it in torches. We're going to put it in a plastic cup.

We have plastic cup, and we have a lid. And I have a little jar of the crystals from a broken rock. We're going to put a tiny chunk of rock in the cup. Let's see, there's some tiny rocks. You see the little pile of tiny rocks? We're going to try to put some of those in here. It's always hard to tell how much to put

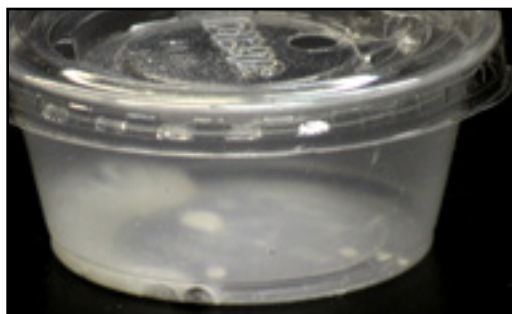
in. Then we put the lid on. There's a hole in the lid. Ooh, that's nice and tight. We're going to set that right there, and here's a pipette. We're going squeezey, squeezey, squeezey, and put some water inside.

[Squirts a few drops of water through the hole in the lid and swirls it around.]

And the water makes the rocks fizz. See it fizz? So it's making acetylene gas, right?

[Lights butane lighter.] And then we'll put this over it. *[Lid blows off cup with a loud bang.]* And I thought I heard a tiny little sound. Did you hear something like a mosquito sneeze? Yes? See if you can find any pieces of that. Anybody find the lid? Oh, look at the lid! It was stuck on the handle.

Now, that happened to be just the right amount of rock. If you put too much rock, it just goes pfft. If you put too little rock, it goes pfft. So what we're going to do is, we're going to do a test. We're going to try to find out what a different amount of rocks does in different cups. We're going to put different amounts of rocks in all of your cup, and then you'll get a chance to use this *[lighter]* or a match. And you'll hold it over the hole and then see what it does. Everybody go get some earmuffs, and get some goggles. And some gloves, and some bullet-proof vests.



Rocks Fizzing inside Plastic Cup



Bring the Lighter to the Hole in the Lid, and Bang!

[Instructor holds a box of safety matches.] [Some kids want to] make sure that they strike it, so they strike so hard that they break the match. It lights, but it's broken. And the flaming piece goes bouncing across the table and lands on somebody else's lap. And they do the "ooh-ahh ooh-ahh" dance. So when I give it to you, just slide it across the side of the box. And if it doesn't light, do it again. And if you hold it sideways, you can say "A,B,C,D, E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U,V,W,X,Y and Z." You could say that five or six times before your fingers start to even feel hot. So being sideways is the best way to hold it. When you're done, you dip it in the cup. And if you listen, it'll go "sssss." If you light it and hold it upright *[match goes out]*. Oh, poor match. Sideways is always the best for matches.



Hold the Match Sideways

You have a choice of lighting it with a match, or trying to light it with our adult-proof cigarette lighter. So I'm going to go by and put the crystals in the cups, and then *[an assistant]* will go by and ask whether you want to light it with one of these *[lighter]*, or one of these *[matches]*, or have one of us light it, and see if it blows up. And I'll be putting different amounts in the cups. Do not put any water in until we come by to light it. If you put the water in too early it just goes fizz and there's nothing there. *[Instructor goes around the table, giving each child a different amount of rocks in their cup, closes it, squirts some water in, swishes it around, and lets the student light it to see what kind of explosion happens.]*



Use a Match ...



... or a Lighter



Size of Explosion depends on how much Calcium Carbide is in the cup.



End of Story

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



So Evil Mister Fred said, "Yeah! A hundred thousand dollars! This is great. I'm going to be rich." And he went off to write a contract. And he wanted to make a contract that said, "No matter what happens, I get to keep your money." And while he was off getting this all written up, Jack said, "You know, there's got to be something fishy about this." Jill said, "Yeah. Let's take another look." They took the gas tank off of the motorcycle, and they looked at it, and they shook it, and it was all welded together. And they said, "There's something rattling in this gas tank. I wonder what that could be." And they shone a flashlight down inside, and they found a bunch of brown rocks. They poured some water in there and it fizzed. They said, "Oh, ho!" And they got some tweezers and pulled out one of the rocks. And it went fizzy, fizzy, fizzy. And they said, "Ooh, that Evil Mister Fred has put rocks in the gas tank. He's running his engine on calcium carbide. Arrrgh! What are we going to do about that guy? He's trying to trick us."

So when Evil Mister Fred came back with the contract Jack and Jill said, "You know, Evil Mister Fred, there's one more test we'd like to try." And Evil Mister Fred said, "Anything. You just name it. You can try whatever you like." Jack and Jill said, "Oh, we want to do a neat trick. We'll put the motorcycle in your truck. I want to start it up and zoom out of your truck with the motorcycle. I want to see how much power it has." Evil Mister Fred said, "Sure! Go for it!" And Jack and Jill said, "Now, if you'll just sit in the driver's seat there in case anything goes bad, we'll do this." So they put the motorcycle in the back of the truck. And then they opened the gas tank. And they poured in a whole bunch of water. And Jack and Jill tiptoed out of the back of the truck. And they left a candle burning in the truck. And all of the gas from the gas tank of the motorcycle started to fill the back of the truck, just like it filled your plastic cup. And when the gas got to be just the right amount, the flame lit it on fire. What do you suppose happened to Evil Mister Fred? [Student: He blew up and went waaaaahhhhh!] Yep, it blew up, and Evil Mister Fred got to do the bird-flapping thing all the way over the horizon. And there was a mushroom cloud where he landed, with a mustache. 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.