



Teacher's Guide for:
Jelly Jam Jar Jets

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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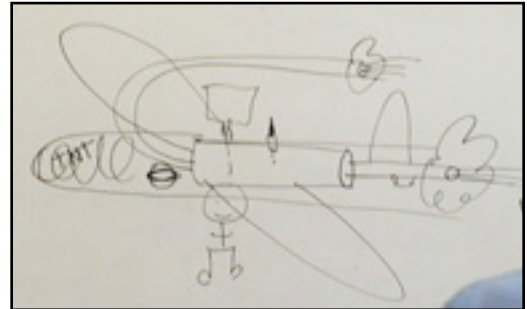
Jelly Jam Jar Jets
A Rock-it Science Lesson
Filmed July, 2009

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Intro Quick Recap:

- In World War II, one group of countries ran out of oil, which they needed for their tanks, planes, trucks, etc.
- They needed to come up with a way to make things run and fly without using oil.
- They came up with an ordinary tube hooked up to a spark plug, with a tail on one end and a little pipe on the other. This was an engine.
- This engine could power an airplane, hardly uses any fuel, and you could burn anything in it.
- In order to get it to work right, they had to get it to the right temperature.
- They put these engines in airplanes and filled the nose with TNT. There was no pilot; they were guided with a gyroscope.
- If you could hear one of these planes coming, you were okay. But if you heard the sound suddenly stop, that meant it was about to land on you and explode.
- The version we're going to use today is made from a glass jelly jar. But putting fire inside a glass jar makes the top part get hot while the bottom stays cool. This can make the glass crack along the bottom edge.



Airplane guided by a gyroscope.

Experiment Quick Recap:

- Instructor squirts some “gas treatment” (a mixture containing methyl alcohol) into a jelly jar with a small hole drilled in the lid, places the jar inside a large clear plastic tub, and lights it with a barbecue lighter.
- If the mixture contains too much fuel or too much oxygen, nothing will happen.
- Warn students not to have their face directly over the jar when lighting it, but instead look from the side, through the wall of the plastic tub.
- Students work in groups of four. Each group gets a large clear plastic tub and a jelly jar with a small hole drilled in the lid. Students wait until everyone is ready before attempting to light their jar.
- Instructor squirts “gas treatment” into each jar through the hole. Overhead lights are turned off in order to see the flames better, and turned back on after each round of lighting.
- Instructors remove used jars and replace them with new ones.
- For the second round, Instructor squirts isopropyl alcohol into the jars. If it doesn't light, students cup their hands around the jar and swirl it around to make it warmer.
- For the third round, Instructor squirts methyl alcohol into the jars. If it doesn't light, Instructor uses a balloon pump to force air into the jar.



Fuel igniting.

Equipment List: "Jelly Jam Jar Jets"

Items needed for Instructor:

- Tub, large clear plastic, about 12" square
- Jelly jar with 1/2" hole punched in center of lid.
- Barbeque lighter
- Pipette, about 12" long
- Balloon Pump
- Gas Treatment containing methyl alcohol
- Isopropyl Alcohol
- Methyl Alcohol
- Cup, plastic, 16-oz
- Water

Items needed for Students:

Consumables (per 4 students):

- Gas Treatment containing methyl alcohol, about 1 tsp
- Isopropyl Alcohol, about 1 tsp
- Methyl Alcohol, about 1 tsp
- Water, about 12 oz.

Other:

- Tub, large clear plastic, about 12" square
- Jelly jars with 1/2" hole punched in center of lid (3 jars per group)
- Barbeque lighter
- Cup, plastic, 16-oz

Prep Work:

- Punch 1/2-inch holes in center of jar lids.



Hole in Jar Lid.



Using pipette to squirt fuel into jar.

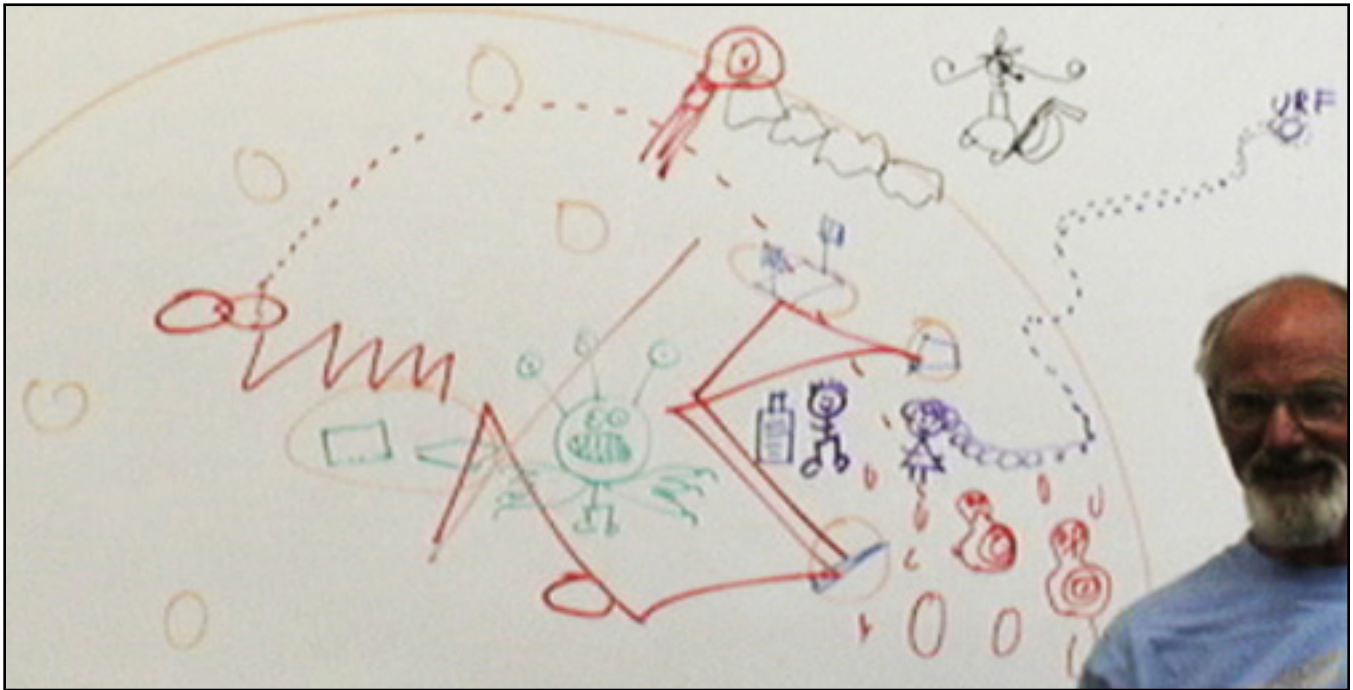
Story Recap: "Jack & Jill and the Moon People"



Part 1:

- Jack and Jill went to the Moon with their Kick-Mes.
- The Moon was made of swiss cheese, and aliens lived underground in the holes in the cheese.
- The aliens had big screen TVs, tennis courts, bowling alleys, swimming pools, etc., all hidden underground so no one would know they were there and wouldn't steal them.
- The Kick-Mes liked being on the Moon because they could get kicked farther in the low gravity. They also could bounce around a lot more in the underground holes.
- Evil Mister Fred noticed a trail of Jill hair leading from the Earth to the Moon, so he followed it on his vacuum cleaner.
- When he tasted the cheese, he decided to sell it on earth. So he started sucking up chunks of it with his vacuum cleaner.
- Everybody on Earth liked the cheese, so Evil Mister Fred kept coming back and taking more and more cheese.
- The aliens knew he'd eventually find their homes, and they suggested giving him their elixir.
- Jack and Jill tried the elixir, which made them really drunk.
- When Evil Mister Fred came back, he broke through into a chamber where there was a bunch of elixir, and he drank it and got totally drunk.
- While he was sucking up cheese, he found some of the alien people's riches, but he was so drunk he couldn't be sure what he was seeing. When he got back to Earth, he discovered he had sucked up a swimming pool.
- Jack and Jill knew he'd be back to take all the rest of the riches.

Story Recap (cont.)

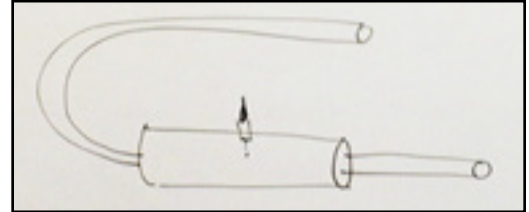


Ending:

- The Kick-Mes got into the elixir and filled themselves with alcohol.
- Jack and Jill knew that Evil Mister Fred was coming back, so they turned off the lights in order to help the aliens hide from him.
- Evil Mister Fred was hovering above the surface on his vacuum cleaner.
- One of the Kick-Mes lit a candle to see what was going on, and it got too close to his mouth.
- The candle ignited the alcohol, and there was a jet-powered Kick-Me bouncing all around inside the caves.
- The Kick-Me hit a weak spot and shot through.
- The rest of the Kick-Mes also lit themselves up, because this was fun, so they all started bouncing all over the place and flaming as they went.
- Evil Mister Fred saw the Kick-Mes fly by, and he sucked up five or six of them in his vacuum cleaner before he realized these were rocket-powered Kick-Mes.
- As the Kick-Mes bounced around inside the vacuum cleaner bag, the bag got bigger and bigger, until it exploded and blew Evil Mister Fred all the way to Pluto.

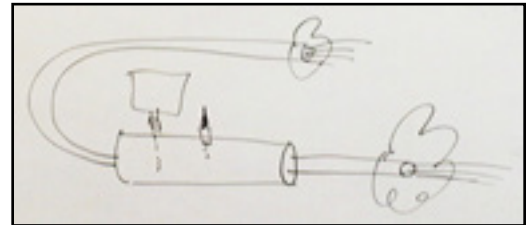
Transcript: Introduction

In the old days, there was a war that went on. They called it World War II. And part of the countries were on one side and the other countries were on the other side. One group ran out of oil. What to do? You need oil to make gasoline to run your tanks and your trucks and your cars and your airplanes. And you need diesel fuel. They had to figure out some way to make things run on the ground and fly through the air without using a lot of expensive oil. And they figured out something that was really weird. If you take an ordinary tube with nothing in it, just an ordinary tube, and you hook onto it something like a spark plug -- a spark plug is like a tesla coil that makes sparks inside -- and you put a tail on it coming out this way, and you put a little pipe coming out this way. They said, "There you go! That's an engine." And people looked at that and said, "No, it's not. It's a tube with a bent tail." And they said, "Yeah, but it's going to go!" They could power an airplane with it, and it hardly uses any fuel, and you can burn anything you want. You could put cooking oil in there and burn it up. And they said, "Oookayyyy, let's see what it does."



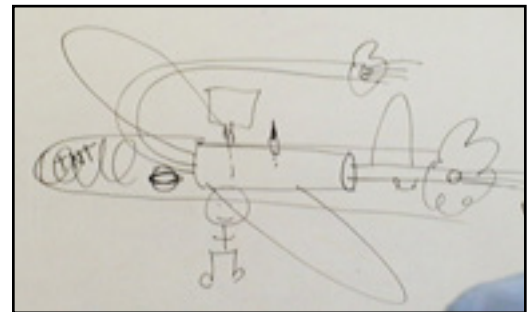
A simple Engine.

There was a tank here with some fuel in it, pouring into it. So they let some fuel go in, and sparked the spark plug, and it went ka-boom! Some flames shot out here, and some flames shot out here. And it stopped. And he says, "Gotta warm her up!" So he put in a little more fuel and it went ka-boom again. Put in a little more fuel and it went ka-boom again. And when he finally got it to the right temperature, it started going ba-ta-ta-ta-ta-ta-ta-ta-ta-ta, and flames shot out both places, most of it coming out that way. And the flame was pushing really hard against the frame that it was sitting on. Like, if you made a hat out of this thing, it would probably tip you over.



Flames shooting out.

And they put these in airplanes. They put wings on them, like that. They put a tail on them. They put a nose, like that. And they filled the whole nose full of something like TNT. And they flew them off of an airport. There was no guy inside, nobody to steer it. They came off of a wooden ramp. They just flew them off with nobody in there. They had a gyroscope inside. Know what a gyroscope is? It's a spinning wheel. Spins really fast. And it kept the thing straight and flat. And they just aimed it at the enemy -- vooooommm.



Airplane guided by a gyroscope.

Okay, you guys, suppose you're the enemy, and you're sitting around having dinner. And you're talking about war and everything that's going on. And you hear this sound up in the air -- vwoooooo. You say, "Uh oh! It's one of those things!" And then the sound stops, and you go, "Oh, no." And it would glide down and ka-boom! The people that were having dinner and stuff didn't worry as long as they could hear the sound because as long as it was going vrmmmmm, it would go overhead and would go beyond them. But if it was just starting to come towards them and stop, they'd say, "Okay, everybody in

the cellar.” And they’d leave their dinner on the table and run down the stairs, down in the basement really fast, and this thing would go crash! And blow up their whole kitchen. It was very, very efficient and used almost no fuel.

And some guys on the internet said, “We can do that. We can make one of those. And they did it with a jelly jar. So we’re going to try that today. If you look on the internet about these things, they’re called a jelly jam jar jet. And there are videotapes of guys trying to make their jelly jam jar jets work. But most of the time they don’t work. And they try and it goes pffft! And they try again and it goes pffft! And they try again and again and again. Finally, I found a site where the guy figured it all out, so I copied his ideas. And we can make our jelly jam jar jets work.

Now, there’s another problem with jelly jam jar jets. They’re made out of glass. If you put fire inside of a glass container, well, that’s not so bad. It’s good quality glass. But when the top part of it gets hot, and the bottom part is cool, then it cracks right around the bottom edge. And it just goes pshhht! And you look at it and go, “Oh, man, my jelly jam jar jet just died.” And we’ll see how many we can get to run before we break all the jars that we have today. We’ll try and keep some jars for the second class, but you never know. But first we need a crazy story.

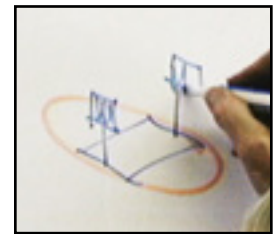
Story: "Jack & Jill and the Moon People"

Once upon a time, Jack and Jill were -- let's see, they were on the Moon. And they took along their Kick-Mes. The Moon is made out of swiss cheese. Yeah, it's got all those holes in it, it's got to be swiss cheese. And Jack and Jill had always wondered how all those holes got there on the Moon, so they decided to go there and look. And they discovered that there were aliens there. There were aliens that look like that. And the aliens lived in the holes in the swiss cheese. They had these big diggy hands so they could dig the swiss cheese out and eat it all up. And there are all kinds of houses and things down inside.



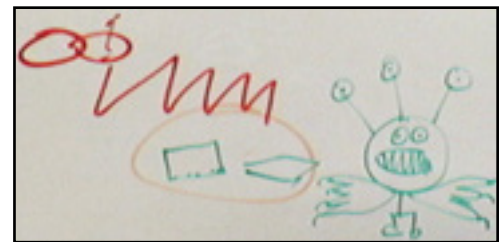
Alien living in the swiss cheese holes.

So if you're an alien living on the Moon, they live pretty nice. They had big screen TVs in their homes, they had tennis courts, bowling alleys, baseball diamonds, basketball courts, theatres, everything you can imagine, swimming pools, it was all there. And Jack and Jill couldn't believe it, because the outside of the Moon was just all this cheesy stuff. And they asked the aliens, "Why don't you put your stuff on the surface where you can play with it more easily? You've got to eat away at all this thing to make those holes." They said, "Ah, if we put it on the outside, any alien that flew by would see that we were all rich and happy, and they'd come and steal it from us. So we just hide under the ground and nobody bothers us. Jack and Jill said, "Whoa, that's great."



Basketball Court.

Let's put Jack and Jill in there. And Jack and Jill had brought all their Kick-Mes with them. And the Kick-Mes really liked it on the Moon because the Moon had one-sixth the gravity of Earth. So when you kick a Kick-Me, instead of going ten yards, you go sixty yards. And so they would kick a Kick-Me -- choooooo -- he'd fly a long, long ways, and maybe he'd land in a hole and bounce around in side -- doonk, doonk, doonk, doonk, doonk, doonk, doonk. He could bounce a lot farther, too. And there were Kick-Mes all over the place. And for quite awhile, Jack and Jill had a great time with their Kick-Mes playing there.



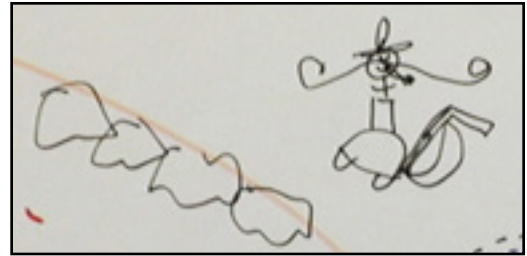
Kick-Mes bounced all over.



The trail of Jill hair from Earth to the Moon.

And Evil Mister Fred had been flying around the Earth, dropping things on people, and he noticed a trail of Jill hair leading towards the Moon. He said, "Hmm, gotta follow that!" So he followed along on his vacuum cleaner. *[Student: But he can't breathe.]* Sure he can. Evil Mister Fred breathes through an anchovy fish. It provides all the air he needs. There's the anchovy sticking out of his mouth. He's breathing anchovy fish air. And when Evil Mister Fred got to the Moon, all he saw was cheese. And he landed his craft down there, and he looked at it and sure enough, it felt like cheese, looked like cheese. He grabbed a piece of it -- tasted like cheese. He said, "Wow, swiss cheese costs four dollars

for eight ounces. There's a lot of cheese here. I'm just going to take a bunch of this Moon and sell it on Earth to all the grocery stores. I'll corner the cheese market." So Evil Mister Fred flew his vacuum cleaner over, and he started sucking up big chunks of cheese into his vacuum cleaner. And then he flew back home and sold the swiss cheese. And they discovered this was the best swiss cheese they had ever tasted. And Evil Mister Fred created a swiss cheese empire, selling cheese from the Moon.



Evil Mister Fred sucking up chunks of cheese.

Well, the aliens and Jack and Jill and everybody were hiding underneath, and they're saying, "Uh-oh, this is bad. Sooner or later he's going to hit one of our chambers and discover all the good things we've got here. Then we're in trouble." And one of the aliens said, "Well, maybe we could feed him some of our famous elixir." Jack and Jill said, "What's elixir?" And they said, "Well, come try it and you'll see." Jack and Jill got a bottle of this stuff. It said "Fermented Swiss Cheese" on it. And they said, "Well, can't be all that bad. It's cheese -- it's natural." So they took a couple of swigs of the stuff, and Jack went, "Whooooaaaahhhh!" And Jill said, "Whoa, what's up with that?" And Jack said, "Try it." And then Jack went *[staggers around drunkenly]* "Whooooaaa, I'll just sing songs." And Jill drank some, and she says, "Ohhhhhh, this is like alcohol! This is like really powerful alcohol." And the aliens said, "Really? We just drink it like water. Doesn't do anything to us." Jack and Jill said, "Well, to us, it makes us weird!" And they said, "Are you going to give some of that to Evil Mister Fred? This could be bad."



Jack and Elixir

Well, about that time, Evil Mister Fred came down, and he broke through into one of the chambers where there was a whole bunch of the elixir. And Evil Mister Fred said, "Mmmm!" So he drank the whole bottle -- glug, glug, glug, glug, glug, glug, glug, glug! And he got totally drunk. And now he's going, *[staggers]* "Awhhhhhh!" He's flying all around, going chung, chung, chung, taking pieces of swiss cheese here and there. He found some of their riches, and he says, "Wow, I wonder if that's real or not." He couldn't trust his eyes, he was so drunk. And then he eventually flew back with what he had, and he sucked up some of their good stuff. When he got back and opened his vacuum cleaner, it wasn't just swiss cheese. There was a swimming pool in there. And he said, "Whoa, how'd that get there? I didn't put that there. I don't remember a thing about that." Of course, he's going to come back. And he's going to find out about all the riches they've got. He's going to ruin everything. If you were Jack and Jill and wanted to stop him, what would you do?

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: "Jelly Jam Jar Jets"

For our experiment, you're going to work in groups of four, and there might be one group of five. The only thing you'll need is eye protection. You don't need hand protection. So get some goggles for your eyes. *[Students put on goggles, and each group is given a clear plastic tub, about one foot square.]* Everybody move your chairs away from the table.

[Instructor takes a jelly jar, the kind with a lid that comes in two pieces, and takes out the center part of the lid.] Here's a lid that I poked a hole in *[reassembles the lid and screws it onto the jar]*, and you can just leave the lid on. The jar sits in the container. *[Places jar in plastic tub.]* The container is there in case the jar explodes. Never had one explode, but you never know. And we're going to put some fuel in there.

Let's try some of this stuff, called "gas treatment." It's supposed to be methyl alcohol, but it's kind of a mixture. *[Draws out some of the liquid with a pipette and squirts it into the jar through the hole in the lid.]* And we put some fuel inside. And the jar sits in there. Do you remember when we did the exploding film cans? If you get too much fumes in



Gas Treatment

there and not enough oxygen, it doesn't do anything. If you get too much oxygen in there and not enough fumes, it doesn't do anything. But if you happen to get the right amount, then it should do something.

[Lights a butane barbecue lighter.] I'm going to put a flame by the opening. Now, when you're putting a flame over an opening, it's usually not a good idea to put your face directly over it and try to light it, because if it goes boom! it'll burn your eyebrows off like it did on MythBusters. So the way to do it is, you kind of look through the side of the thing and you do it like this. *[Brings flame down to hole in jar lid. There is a bright flash, and then the fuel starts to burn noisily, like an engine. Instructor turns overhead light off so students can see it better.]* There, that's called a jelly jam jar jet.

After it does that, the jar now is really hot. If you reached in there to look at the jar, you would pick it up a little ways, and then your nerves would say to your wrist, "It's hot." And your wrist would say to your elbow, "It's really hot." And your elbow would say to your shoulder, "It's really, really hot!" And your shoulder would tell your brain, "Let go!!" And you go, "Aaaaaa!!" And the jar would fly through the air and crash somewhere. So it's better to leave the jar there after it's hot.



Squirt fuel into jar with pipette.



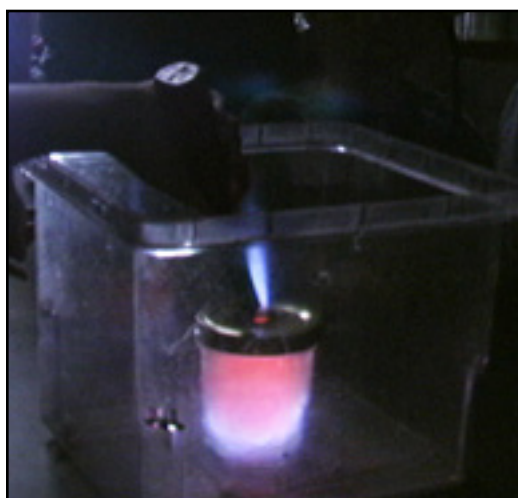
Keep your head off to the side when you light the fuel so it doesn't burn your face.

This stuff is called methyl alcohol. This doesn't usually work as well as it did today, maybe because it's warmer today. We're going to try methyl alcohol, and we're going to try isopropyl alcohol. This stuff is called rubbing alcohol. They put it on people to cool them off. And this one is pure methyl alcohol. It doesn't have all the junk that's in the first one we tried. We're going to see which ones work. You get to take turns. *[Student: Can we light it with a match?]* No, because your hand would be right there. And did you hear it go pfoof? It would burn all the hair off your fingers. You have a group with a fair number of people. Decide among yourselves who wants to light it.



Fuel burning in jar.

So when your jar is hot, wait to take it out. And the next person can use a cool jar. Have you ever poured water on a hot jar? It usually breaks, because if you cool off glass too fast, it cracks. So we're going to let them cool really slow. Then we'll get new jars.



Igniting the fuel.

[Student: Can we make it fly?] It's hard to make it fly, because the jet is pointed upwards, so it's going to be pushing downwards. It's probably not a really good idea to have flaming flying glass things. We're going to try this stuff until it runs out *[indicates gas treatment]*. There's maybe two more jars' worth in there. *[Instructor squirts some gas treatment in the first group's jar.]* We need someone with a water container, because wherever there's fire there has to be water. Before we start, let's put some cups with water out.

[Student: Can we wear earmuffs?] Well, we don't want you to have earmuffs, because you won't hear a thing, and if we say something, you won't hear us either. But the noise level is a lot lower than anything that could ever hurt your ears.

[Instructor squirts some fuel in each group's jar before allowing anyone to start. An Instructor stands by as each group lights their fuel. Overhead lights are turned off. After each group has burned their fuel, jars are allowed to cool, then Instructors remove them and replace them with cool jars.]

Okay, now we're going to use isopropyl alcohol. *[Instructor squirts the liquid into all of the jars, then students light them. Some of them don't light.]* If it gets hot enough, it might work. What you can do is have someone in your group that has warm hands do this *[cups his hands around the jar and swirls it around]* and you might get it to work. Do you have warm hands? Just hold the jar to warm up the jar a little. This alcohol requires more heat to work. If it doesn't light right away, it won't light.



Cup hands around the jar to warm it up.



Using balloon pump to add air to the jar.

[After all groups have finished] Okay, now we're going to switch off this for the yellow stuff, which is methyl alcohol. Isopopyl alcohol doesn't work that well, but we didn't want you to think all fuels would work in this. [Instructors pass out new jars.] Last time it was isopropyl alcohol. This one is methyl alcohol. [Instructor squirts liquid into each jar before students start to light them. This time, the flame shoots straight up when it first lights, but not all of them work.]

[Instructor brings out a balloon pump.] You have to decide whether there's too much air or too much fuel in there. We'll test this one. We're going to push some air in [inserts nozzle of balloon pump into hole in jar lid and pumps it]. If there was too much fuel before, now there's going to be a lot less. Try that and see if it works. [Student lights it, and it works.] Ah, too much fuel before. Now that's the right amount. [The fuel burns for awhile, then there is a loud crack as the jar breaks.]

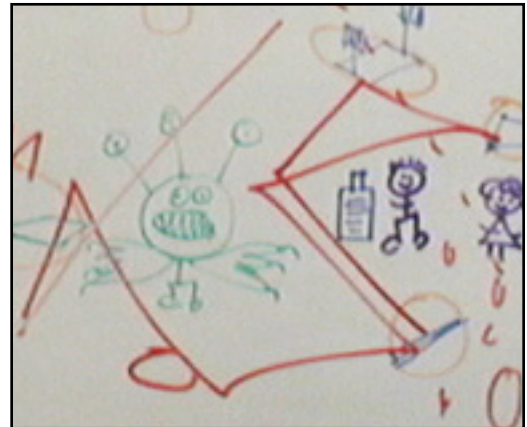
[After all students have finished burning their fuel, Instructors collect tubs and move chairs back into regular position.]

End of Story

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

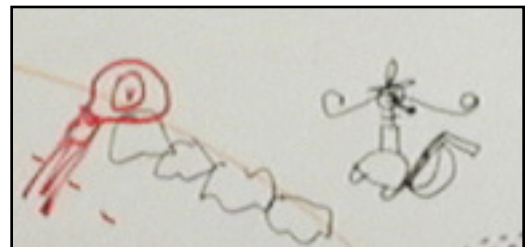
When Evil Mister Fred went to take some swiss cheese from the Moon, he discovered all the treasure hidden underneath. They didn't know that the Kick-Mes had gotten into the elixir that the aliens had produced. And the Kick-Mes had filled themselves up with alcohol. And Jack and Jill were thinking, "What are we going to do? What are we going to do?" And one of the aliens said, "Let's turn off all the lights, make it dark here so nobody can see what's going on. Maybe Evil Mister Fred won't find us." So they did. They turned off all the lights.

And the Kick-Mes were looking around, and they couldn't see anything because it was dark. Evil Mister Fred was hovering over the surface on his vacuum cleaner. One of the Kick-Mes lit a candle to see what was going on. And it accidentally got too close to his mouth. Next thing you know -- brrrrrrr -- we had a jet-powered Kick-Me. He was bouncing around inside the Moon, going boing, boing, boing, boing, boing, boing, boing, boing, inside these caves. And the Kick-Me hit a weak spot and shot through. And some of the other Kick-Mes lit candles, too, because they thought that was fun. And they held them by their mouths, and now you've got Kick-Mes going boing, boing, boing, boing, boing, boing, boing, boing all over the place. And they're kind of flaming as they're going, and they're going backwards because they don't know what's happening. And of course, they're laughing because they love being blown around like that.



The Kick-Mes were bouncing all over.

And Evil Mister Fred saw one of the Kick-Mes fly by. He says, "Oh boy! Treasure!" He went over and sucked it up in his vacuum cleaner. He went and sucked up five or six Kick-Mes in his vacuum cleaner before he realized these were rocket-powered Kick-Mes. And they bounced around inside the vacuum cleaner, and Evil Mister Fred said, "Oh, no!" as the bag got bigger, and bigger, and bigger. And then the bag exploded -- ka-boom!! -- and blew Evil Mister Fred all the way to Pluto. And everybody lived happily ever after, except Evil Mister Fred.



A Kick-Me flies by 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.