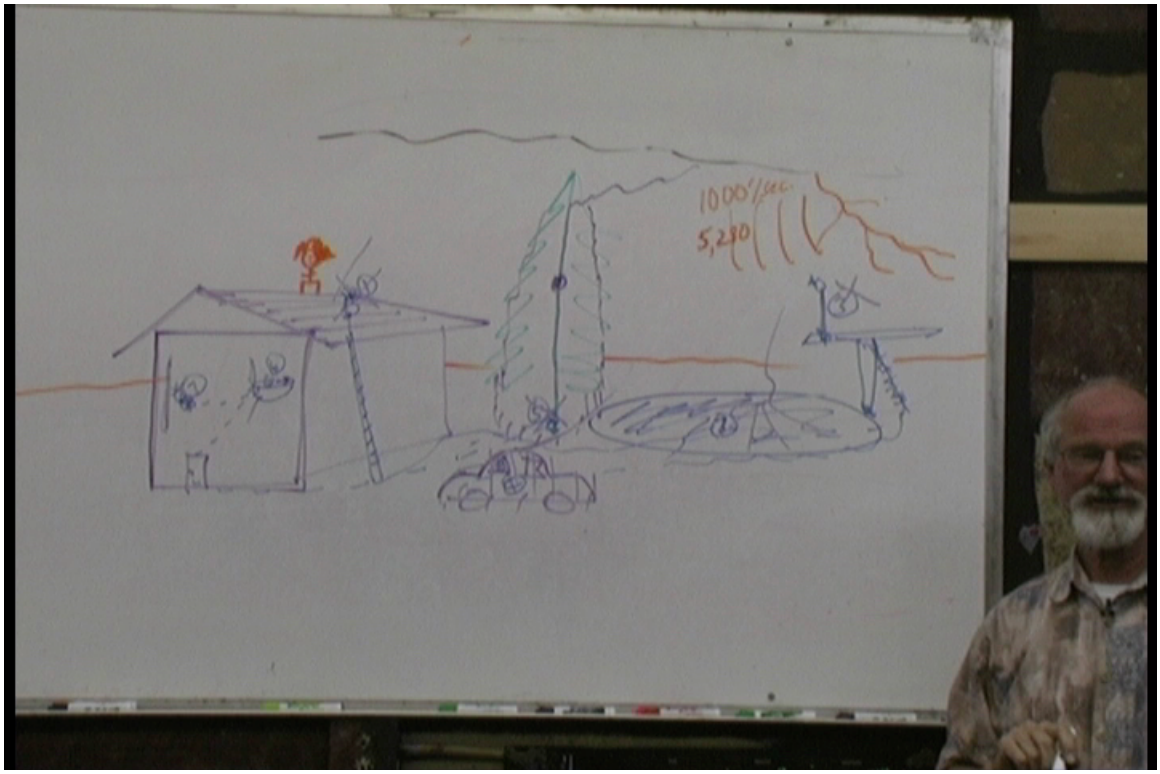
Lightning Bolts Summary

Intro – Safe & Unsafe Places



House with solar panels, car, tree, swimming pool & diving board.

Counting seconds to determine distance of lightning.

You want to take a picture of the lightning as it hits you, so you go up onto the roof. Your baby sister climbs up the ladder and warns you. You won't come down, so she slides down the ladder and tries to decide where to go to save herself.

She goes to the pool, the diving board, the car, hugs the tree, then goes into the house and sits in the bathtub. Then she gets out of the tub and talks on the phone.

Which is the most dangerous spot?

Lightning likes to go the tree. Some of it goes down the branches, and the rest goes down the trunk because it's wet. Turns it to steam, makes the trunk explode, lightning goes all the way into the ground. If you're hugging the trunk, you die.

The roof, pool, and diving board are unsafe. When lighting hits a body of water, the electrons spread out over the surface.

If it hits the house, it goes through the electrical wiring and the pipes. But if you're at the far end of the tub and it's not made of steel, you might survive, but you'd get shocked. Phone system has a lot of protection, so it's pretty safe.

Car is safest. Lightning goes all around the outside and jumps to the ground. Don't stick your head out the window. You can leave the car when the lightning stops.

If a fallen wire hits the car, stay inside until the power is turned off and the wire is removed.

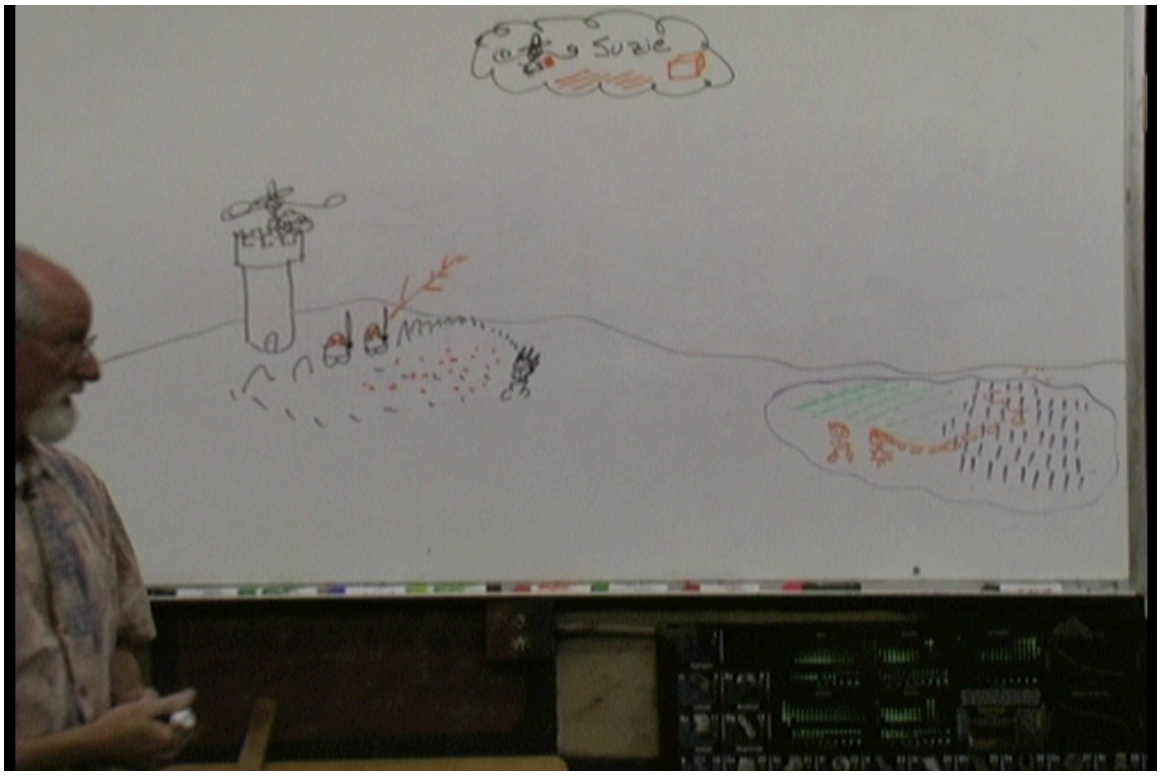
You can make lightning with van de graaf generators, which produce one pulse of current per spark, similar to lightning. You can also use a tesla coil, and hit stuff that's on the platform.

MythBusters did this with a measured amount of gunpowder to see if it would ignite. If it did, that would be enough to kill a person. We're going to use flash paper.

It's not the voltage that kills you; it's the amperage. Voltage is how far electricity can jump; amperage is how many electrons are going by. A squirt gun can shoot far but not hurt you. A firehose doesn't shoot far, but it can take your skin off if you're close to it.

So you want to work with things that don't generate a lot of current. Van de graaf's biggest spark generates about 1 milliamp. Tesla coil's biggest spark generates about 20 milliamps. Takes about 400 to kill you.

Story



EMF's cousin Suzie ("Zeus" backwards) lives on a cloud. She's always angry, but she smiles to trick people.

She has an app on her iphone to make lightning bolts, which she stores on the cloud. She drifts around and can throw them down on the earth. She doesn't like EMF.

EMF wants to motivate his minions, using a large bag of M&Ms. He tells them if they march forward and hit a dummy, he'll give them M&Ms. They all start running at different speeds instead of staying in line, and instead of hitting the dummy they end up hitting each other.

EMF throws down some M&Ms, hoping the minions will knock each other nuts in order to get the M&Ms. But you can't knock a minion nuts because their heads are too hard.

Suzie's watching this and thinks it's laughable. She throws a lightning bolt and hits the minions. They absorb the energy, and their eyes start to glow. Their bats sound like light sabers, and they shoot out little lightning bolts. They start hitting each other with these, and whoever gets hit the most, his bat shoots the biggest lightning bolts. Eventually one minion can shoot 10-foot bolts.

EMF thinks this is great. He says, “Thanks, Suzie!” She throws a bolt at him and knocks him off the tower.

J&J are in Goodville teaching aikido and tai chi (non-violent martial arts). The people are outside practicing.

EMF thinks they look funny. Send minions over with their lightning bats. People ignore them and accidentally hit a bunch of them while doing their martial arts. Eventually, minions manage to zap a few people. They all run inside their houses and lock the doors.

Minions hit a bunch of other things with their bats, and they knock out all power except water and sewage. The people are isolated from the world and being tormented by minions with lightning bats.

Experiment

Use electric guitar to demonstrate a resonance feedback loop that keeps growing.

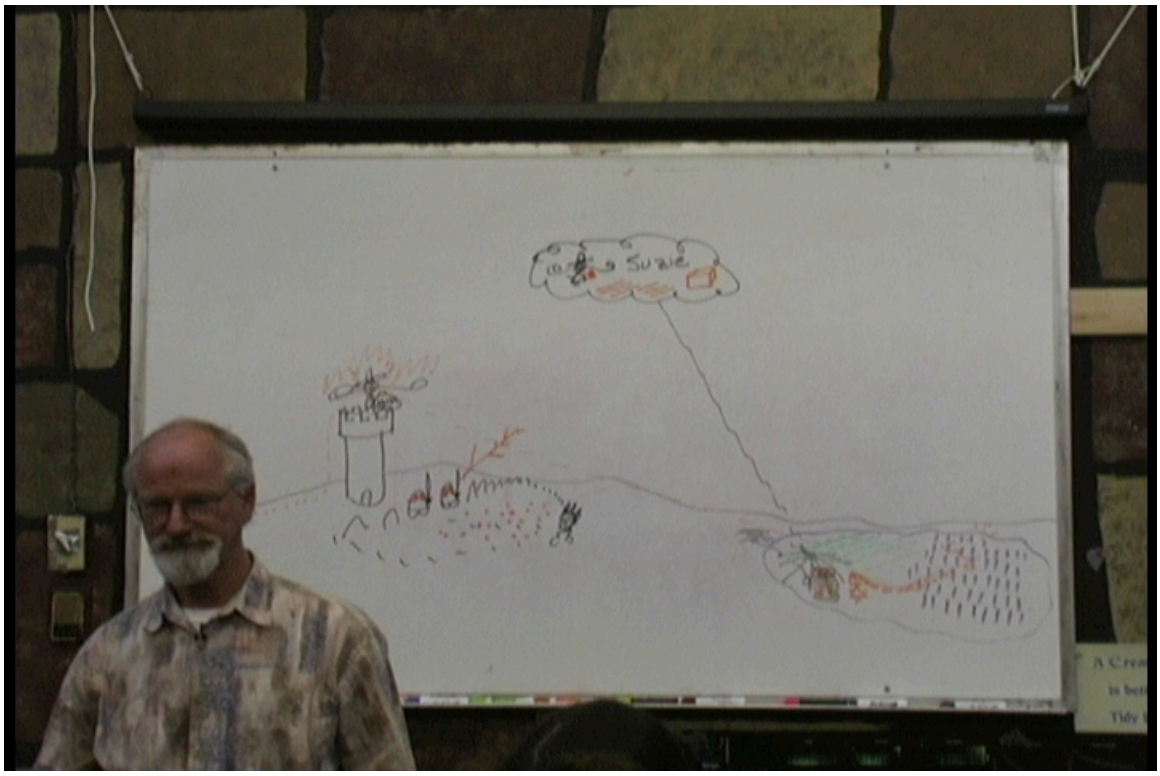
Explain how tesla coil works. Demonstrate sparks coming off the copper wire on top, first with it still, then rotating.

Students will make a “city” on the board made of various materials to see what happens when the lightning bolt hits them. Materials include marshmallows, wooden sticks, pipe cleaner wire, fuzz balls, gummy bears and other candy, foam slices, etc., and glue guns.

First, they make a person and glue a small piece of ping pong flash paper onto it. Glue washers on the bottom if needed for weight.

Put them on the board and turn on the tesla with rotating coil to see if the “people” catch fire. Also try making buildings.

Story End



Jill wraps Jack in aluminum foil, and he runs out to try to get the minions to fight each other. He has a bag of M&Ms and throws them away from the city. The minions run in that direction. EMF yells at them, but they ignore him.

Suzie throws a lightning bolt toward Jack, but the minions jump in the way, trying to get it into their bats. They crowd around Jack, shielding him from Suzie. The lightning hits their bats, but they're already charged, so the lightning is deflected sideways and hits EMF. His hat ignites like flash paper.