



What is electricity?

Note to Teachers:

Behind the Lesson: Why is it important to understand the basics of electricity before learning about electrical safety? The world around us relies more and more on electricity. The more students know about which things rely on electricity, the more aware of the potential dangers they'll become and the more likely they'll be to use it to safely prevent fires and shock/electrocution from happening.

How to Use the Teaching Points and Activities: Start with the activity, then the teaching point. For example, start with Activity #1 (Sticky Hair) and create discussion among the students. As they get to the question of "stickiness," i.e. what caused the balloon to stick when you rubbed it, introduce the idea of electrons, the movement of electrons, and how that produced a kind of electricity. That's Teaching Point #1. It's the same kind of electricity found in lightning (though obviously lightning is much more powerful). Ask the students what their ideas of electricity are, why we need it. Guide them to the idea that it powers things like light, ipods, computers, tvs, etc. Then move onto Activity #2. Guide the students to second section of Teaching Point #2, where the ultimate key is that when electrons move in a closed circle (circuit) we get power. Grades 3-5 move onto the indicated sections of Activity #2, which leads to Teaching Point #3.

Supporting Visuals:

- 1) Step-by-step diagram of how the Human Circle/Circuit works.
- 2) Diagrams of how a plug and switch connect to electricity in real-life situations.
- 3) Printout for follow-up activity for Grades 3-5: Drawing of interior room with a light fixture in the middle of a ceiling, a light switch on the wall, a socket, and an electrical appliance.



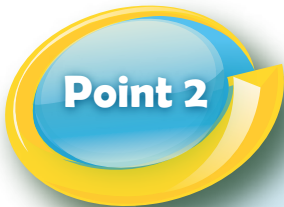
What is Electricity?



Point 1

What is electricity?

Everything in this world is made up of tiny atoms, and those atoms are made up of even tinier particles called protons, neutrons and **electrons**. When **electrons** move from one object to another, they create **electricity**. For example, think of lightning. When electrons from storm clouds move from the clouds to the ground we get a great flash of light.



Point 2

How Does Electricity Create Power?

Think again about lightning. It creates a lot of electricity, but we can't use it. That's because the electrons have stopped moving. In order to use electricity, we need electrons to keep going and going. Electrons that move through a circle (grades 3-5: circuit) of metal are the source of the electricity everywhere, from the wall behind the light switch to the outlet we use to plug in our appliances.



Point 3

How Do We Use Electricity? (Grades 3-5 only)

Plugs are the metal prongs found at the end of a wire (wires are wrapped inside a cord). They connect to the electrical circuit inside the socket. When the metal from the plug touches the electricity in the socket, the electricity passes through the metal plug to the wire inside the cord and powers your microwave, refrigerator, lights, computers, ipods, games, televisions, and cell phones.

Switches are actually part of the electrical circuit. They have metal pieces located on the other side of the wall. When the light switch is "up," that metal piece connects the circuit together, creating a path for electricity to flow and create light. When the switch is "down," the metal piece disconnects from the circuit, the circuit is broken, no electricity can flow, and the light goes out.



What is Electricity?



Sticky Hair

Object: To visually explain teaching point #1, and understand that electrons that move create something (in this case, electricity. *note: it's not that important to emphasize that it's static electricity but that it's actual electricity that they're seeing and creating*).

What you need: regular rubber balloons, (grades 3-5 will also need stop watches)

Instructions:

All Grades: Give each student a blown-up balloon. (alternative: divide class into smaller groups of two or three). Ask them what will happen if they put the balloon on their heads, would it stay or fall down? Have them try it. Then ask them what would happen if you rubbed the balloon on their hair first. Would it stay or fall down? Have them try it. Ask them what made the balloon "stick" to their hair. Give them a chance to come up with responses. Then explain that tiny particles called **electrons** went from the hair to the balloon. And that movement of electrons created electricity.

Grades 3-5: Before doing this activity, divide the class into smaller groups. Have each group devise a chart (e.g. how long they rub equals how long will the balloon stay on the head). Have each student from each group time it out and then chart it out. The lesson is that as a rule, the more they rub the balloon, the more electrons will move, and longer it will stay on their heads. For additional exploration, they could also rub the balloon on their heads and try to stick the balloon onto walls, chairs, coats, etc.

What is Electricity?



Activity 2

Human Circle/Circuit (Part 1 of 4)

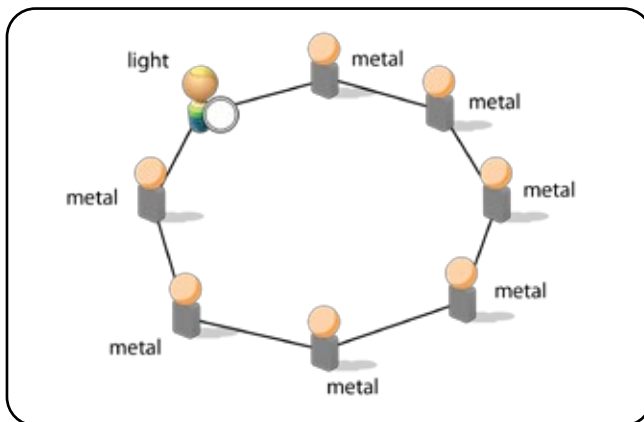
Object: To understand that electricity must flow in a closed circuit (via metal/water) in order for it to be used, and that electricity in a closed circle/circuit means powerful energy.

What you need: 1 red scarf, 1 ball, Mr. Plug cutouts (1 per student). Teachers can refer to activity #2 diagram attached in your kit for visual instruction.

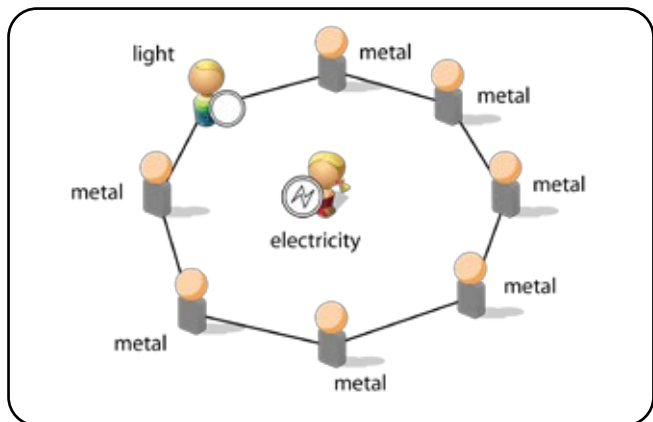
Instructions:

All Grades: Give one student the scarf (tell the students that the scarf is the **electricity** trying to move). Give another student a ball (tell the students the ball is the **light** that will be "turned on"). The rest of the students are pieces of **metal**. Give each of the **metal** "pieces" a Mr. Plug cutout to tape to the front of their shirts. Have the **metal** "pieces" and ball holder form a circle facing inward and holding hands (ball holder should hold the ball with both hands, the **metal** on either side should place their hands on the ball holder's shoulders to connect). Place the scarf holder in the center.

Step 1



Step 2



What is Electricity?

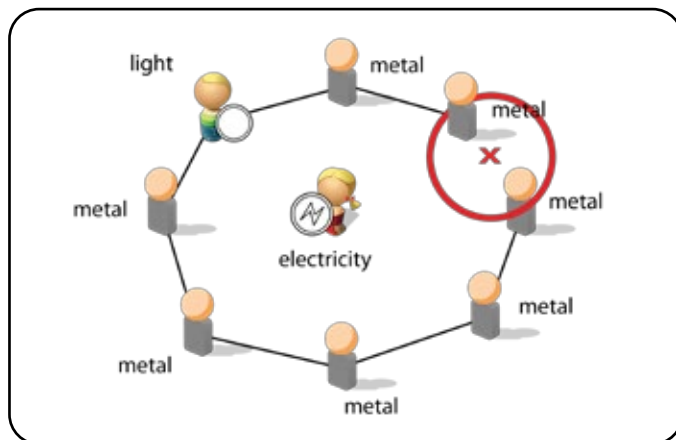


Activity 2

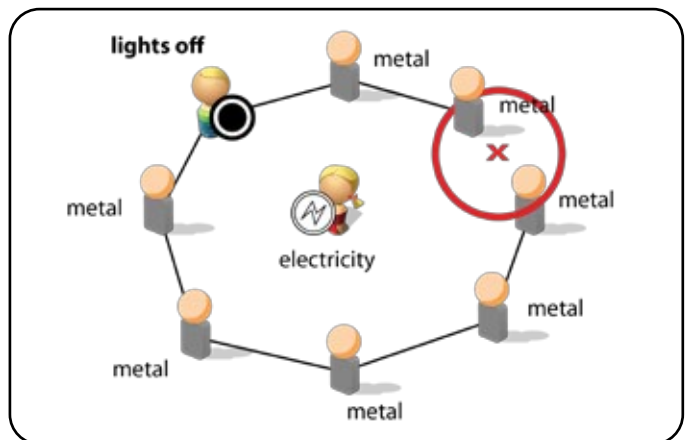
Human Circle/Circuit (Part 2 of 4)

Tell the scarf holder to go around the circle and touch everyone with the scarf (**electricity**). The scarf must keep moving so long as the circle is connected. When the scarf (**electricity**) passes the ball holder, the ball holder says "lights on," raises the ball (**light**) in the air, and keeps it up. As the scarf keeps going around, point out that the light is on because the circle/circuit is closed. While the scarf (electricity) is still going, have two metal "pieces" let go of each other. Once the circle/**circuit** is broken, the scarf (**electricity**) must stop at the **break**. the ball holder says "lights off" and lowers the ball. Show that the light is off because circle is broken. Have students take turns being the **light** and **electricity**.

Step 3



Step 4



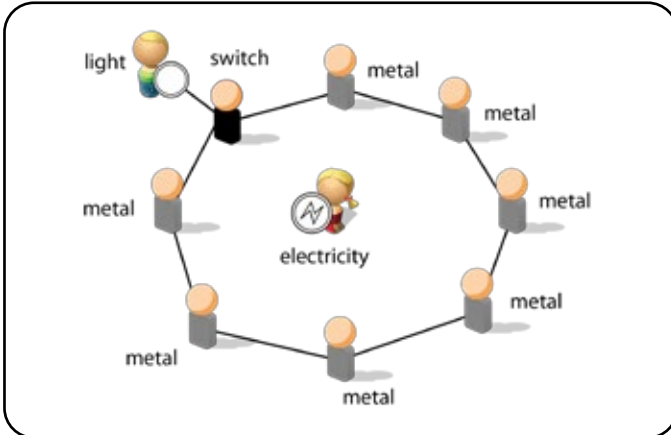
What is Electricity?

Activity 2

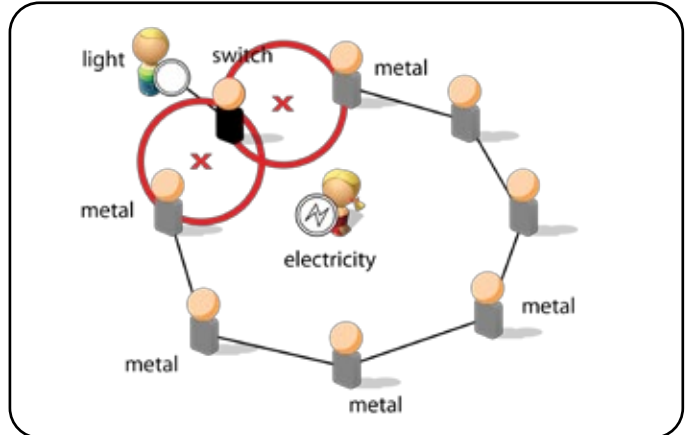
Human Circle/Circuit (Part 3 of 4)

Grades 3-5: While the **metal** "pieces" are still holding hands in a **circuit**, pull the ball holder out of the circuit and rejoin hands to "close the circuit." Have the ball holder touch the shoulder of someone in the circle—that person is the "**switch**." As the scarf (**electricity**) goes around touching people in the circle, make sure the scarf holder keeps moving so long as the circle is complete. When you say "lights off," the "switch" lets go of her hands and ducks down.

Step 5

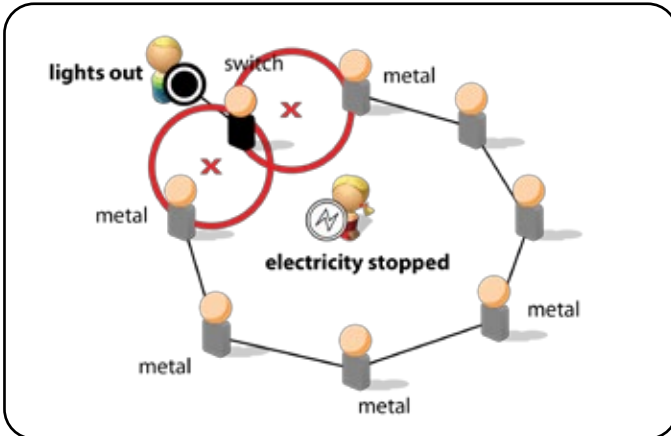


Step 6

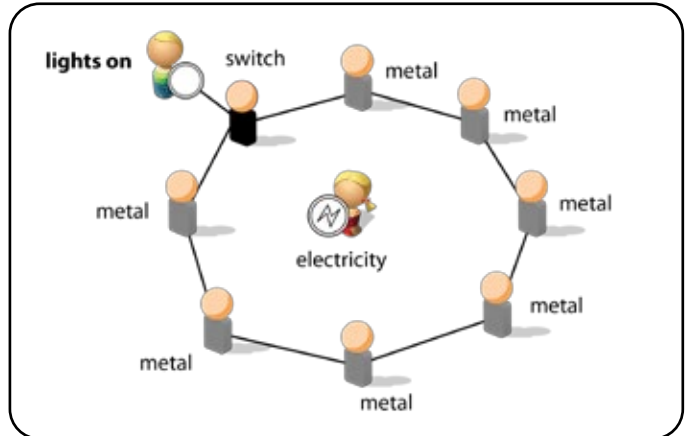


The scarf has to obey the same rules as before and stop at the **switch** which has now **broken / opened** the **circuit**. The scarf (**electricity**) can't get to the ball (light), and the ball is lowered down. When you say "lights on," the "switch" rejoins the circuit (ball holder still holding on), and the ball holder now connected to the circuit raises up the ball. Have students take turns being the **switch**, **light**, and **electricity**.

Step 7



Step 8



What is Electricity?

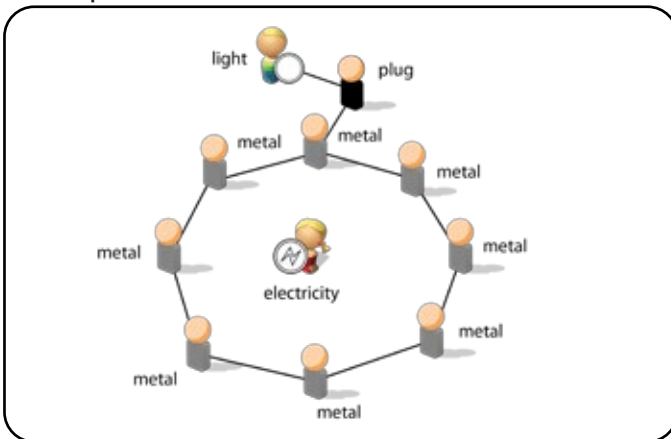


Activity 2

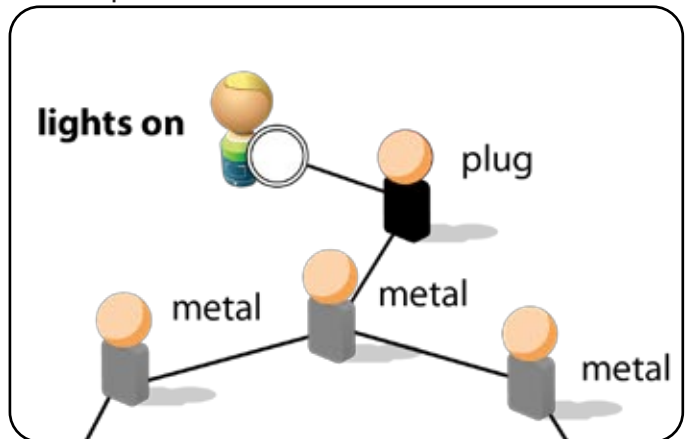
Human Circle/Circuit (Part 4 of 4)

Grades 3-5: Turn the switch into a **plug**. The plug and ball holder (touching the plug's shoulder) are on the outside of the closed metal **circuit**. The **circuit** remains closed the whole time, so the scarf (**electricity**) always keeps flowing. Since the ball holder touches only the plug, it only "turns on" if the plug touches the circuit. When you say "lights on," the plug must touch someone in the circuit, and the ball holder raises the ball. When you say "lights off," the plug pulls away from the closed circuit and the ball is lowered again. The circuit remains closed so make sure the scarf keeps moving. Have the students take turns being the **plug**, plugging in and out of different parts of the circuit. Point out that no matter where the plug "plugs in," the "light" is on because the circuit is **closed**.

Step 9



Step 10





What is Electricity?



Activity 2

Follow-Up Group Discussion to Human Circle/Circuit

- 1) When did the light turn on? When did the light turn off? Write down key words like "electricity," "close" and "open," and "circle" or "circuit." For ages 3-5: Additionally, write down key words like "switch" and "plug."
- 2) What would happen if the ball was 1) an "ipod," 2) a "computer," 3) a "space heater?"
- 3) What would happen if none of the metal pieces were connected? (Answer: nothing, electricity must flow in a complete circle/circuit) What if some of the metal pieces were connected? (Answer: nothing).
- 4) K-2 (should be done right after the game): Draw for the class the different ways the scarf tried to get to the tennis ball. Draw a diagram showing the circle they made and the path the electricity took.
- 5) Grades 3-5 (can be in groups of two/three or for homework):
 - a) Have them come up with other shapes that still would allow electricity to flow (oval, wavy circle, etc.) Have them present to the class why their shape works.
 - b) Using the printout "What is electricity?" students must connect the light to the switch via electrical power, and the electrical object to the electrical power via the socket. The drawing is only correct if a circuit is drawn in each instance. Discuss the different ways people did it. Reinforce the point that it's not important how the circuit is drawn, but that a circuit is drawn at all.

Other activities:

- 1) List all the things in your life that need electricity.
- 2) Grades 4-5 only: Bring in a battery-operated device. Open up the part where the batteries go. Show students the metal that the batteries must touch. Play with the battery—pull it out a bit, or turn it upside down and try turning the toy on. Press it all the way in or turn it right side up. Batteries are "portable electricity." Electricity is put inside the battery, and the battery gives electricity to ipods, cell phones, games, etc. At some point, all batteries run out of electricity and we either throw them away or recharge them by plugging them into an electrical outlet.



You're in Charge Outdoors



Goals:

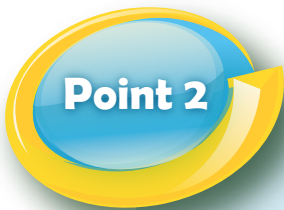
- 1) To put the students in charge of their own electrical safety when they're outside.
 - 2) To show students there's a lot they can do to help prevent electrical shock and electrocution.
-



Teaching Point #1: WHY is electricity dangerous?

Wherever there's electricity, there's power. And wherever there's power there's danger.

A single bolt of lightning is hotter than the surface of the sun, and has enough power to light an entire home for a month! Outside, power lines and substations are the main sources of electricity for houses and communities. So if sockets can give you shocks, think how powerful a shock would be from a power line or substation. The good news is that you students have just learned all about electricity, so preventing electrical dangers will soon become second nature.



Teaching Point #2 WHAT are the outdoor electrical dangers?

Electrical shock or electrocution from...

1. Power lines that run through trees, or power lines that have fallen down due to storms.
2. Being in water during a storm (lightning).
3. Being in water near electrical devices.
4. Being outside during when there's lightning.
5. Substations around the house/neighborhood/school.



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Teaching Point #3: HOW can you stop the dangers?

1. **Leave Lines Alone.** Power lines create a huge electrical circuit around communities, bringing electricity to homes, schools, and buildings.
 - a. Keep away from power lines that have fallen down.
 - b. Avoid playing in or around trees where power lines run through them.
2. **Water and Electricity Don't Mix.** Electricity travels through water just as easily as it does through metal. And humans are made up mostly of water. So even if we're not swimming in water while being struck by lightning (i.e. another source electricity), if we touch either electricity directly or water that's touching electricity then we will get shocked or electrocuted. This goes for all liquids, not just water.
 - a. Stay away from swimming during a storm.
 - b. Keep any electrical devices away from water.
3. **Substations are Shocking.** Much like power lines, substations provide houses and communities with electricity. They look like giant harmless boxes, but what's inside is very dangerous.
 - a. Stay away from substations.
4. **Call 9-1-1**
 - a. Call 9-1-1 if someone gets hurt, or there is a fire. Firefighters will come right away!



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Have a local firefighter/lifeguard visit the school and go through the potential outdoor dangers.

- a. Grades 3-5: invite a lightning strike survivor/research a survival story and send questions.



Make an Outdoor Electrical Safety Checklist

- a. K-2: Make a checklist with a picture for each item for them to color/take home to their families:
 - i. Leave Lines Alone
 1. Image: a downed power line in front of a sidewalk.
 - ii. Water and Electricity Don't Mix
 1. Image: lightning hitting a pool.
 - iii. Substations are Shocking
 1. Image: substation near a house.
 - iv. Get Help
 1. Image: cell phone's number pad with the numbers 9-1-1 highlighted in the screen.
- b. Grades 3-5: Have the students make their own checklists for outdoor areas. Include the option of drawing images to remind them what it means.
 - i. Leave Lines Alone
 - ii. Water and Electricity Don't Mix
 - iii. Substations are Shocking
 - iv. Get Help



You're in Charge Indoors



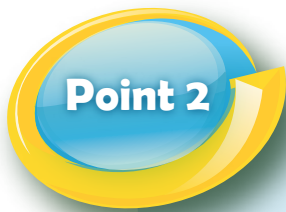
Goals:

- 1) To put the students in charge of their own electrical safety when they're indoors.
 - 2) To show students there's a lot they can do to help prevent electrical fires and shock/electrocution.
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Teaching Point #1: WHY is electricity dangerous?

Wherever there's electricity, there's power. And wherever there's power there's danger. The good news is that you the students have just learned where electricity comes from and how it travels, so preventing related dangers will soon become second nature.



Teaching Point #2 WHAT are the indoor electrical dangers?

1. **Fire...** from frayed cords, fabrics and paper products placed too close to electrical heaters, lamps, and other hot surfaces.
2. **Shock/Electrocution...** from touching electrical sockets or frayed cords, trying to plug or unplug by using the cord itself, or touching water that is exposed to electricity.



You're in Charge Indoors



Teaching Point #3: *HOW* can you stop the dangers?

1. **Respect the Cord.** Electrical cords have wires inside them, running electricity from the socket to the TV, microwave, and other electrical products, so it's important to be careful around cords.
 - a. Ask an adult if you want something plugged or unplugged.
 - b. If you are allowed, only connect or disconnect a cord by the plug.
 - c. Tell an adult when a cord is bent, cracked, or frayed.

2. **Water and Electricity Don't Mix.** Electricity travels through **water** just as easily as it moves through metal. And humans are made up mostly of water. So even if we're not swimming in water while being struck by lightning (i.e. another source electricity), if we touch electricity directly or we touch water that's touching electricity then we will get shocked or electrocuted. This is true for all liquids, not just water.
 - a. Keep anything that uses electricity away from water.
 - b. Avoid showering/bathing during a storm. Electricity from lightning can travel through the water pipes.

3. **Stop the Shock.**
 - a. Stay away from electrical outlets, even when they're not in use.
 - b. Keep electrical objects away from water, and water away from electrical objects.
 - c. Keep away from cords when they're in use.
 - d. Tell an adult when too many things are plugged in at once.
 - e. Use only the plug part of a cord when plugging in or unplugging.
dangerous.

4. **Fight Fires Before They Start.**
 - a. Tell an adult when something is too near a lamp / heater/any plugged-in hot surface.
 - b. Keep water/drinks away from electrical outlets.
 - c. Tell an adult when a cord is frayed, broken, or smoking.

5. **Get Out, Get Help.**
 - a. Use your escape route to get out of your home, school, or building.



You're in Charge Indoors



Activity 1

All Grades: Map out and test the smoke/fire detectors at home and in the classroom. Discuss how many detectors are needed in a given space. Do you need one in your bedroom? Classroom? Where are good ideas to put them?

Activity 2

All Grades: Make a fire escape plan for your home. *Grades 3-5:* In the classroom, have them make a fire escape plan for their homes. When they get home, have them test out their escape plan and time it. When they come back to class, have them discuss if their plan worked, if they needed to make revisions, anything else that came to mind.

Activity 3

K-2: Have a local firefighter visit your class to help reinforce the importance of fire safety. Although this can be used for grades 3-5, it's selected for this age group, since firefighters are considered heroes and fire trucks are very appealing.

Activity 4

Grades 3-5: Have students make signs for **Get Out, Get Help**. Make a poster campaign in school during the month of May. Make a contest for slogans/YouTube PSAs, or commercials you can submit online to ESFI. Finalists will have their videos posted.



You're in Charge Indoors



Make a checklist of the rules to stop electrical dangers.

- a. *K-2*: With a picture for each item for them to color/take home to their families:
 - i. Respect the Cord
 1. image: frayed cords/hand about to pull on a cord to unplug something
 - ii. Water and Electricity Don't Mix
 1. image: kid in bath with plugged in laptop or handheld device
 - iii. Stop the Shock
 1. image: finger near a socket
 - iv. Fight Fires before They Start
 1. image: paper airplane on a lamp.
 - v. Get Out, Get Help
 1. Image: split image of kid in pajamas leaving front door of house on fire/ cell phone's number pad with the numbers 9-1-1 highlighted in the screen.
- b. *Grades 3-5*: Have the students make the checklist for the classroom or their homes. Include the option of drawing images to remind them what it means.
 - i. Respect the Cord
 - ii. Water and Electricity Don't Mix
 - iii. Stop the Shock
 - iv. Fight Fires before They Start
 - v. Get Out, Get Help