# Interactive Notes-"Electricity"

**Materials (per group of 4 students):**

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| Demo 1 | 1-balloon- already blown up<br>1-ping pong ball |
| Demo 2 | 1-fluorescent light bulb |
| Demo 3 | 1-set of Density Blocks (item #WW46065M00 at sciencekit.com)<br>1-bowl or beaker- to put ice cubes in<br>1-towel |
| Demo 4 | 3-gator clip wires (item #WW47889M00 at sciencekit.com)<br>1- 9-volt battery<br>1-mini light bulb- cut from strand of Christmas lights (see demo #4)<br>1-250 mL beaker half full of distilled water (distilled preferred, but tap water will also work)<br>1-50 mL beaker with about 10 mL of table salt<br>1-plastic spoon/stirring rod |
| …and | 4-note sheets (see last page) |

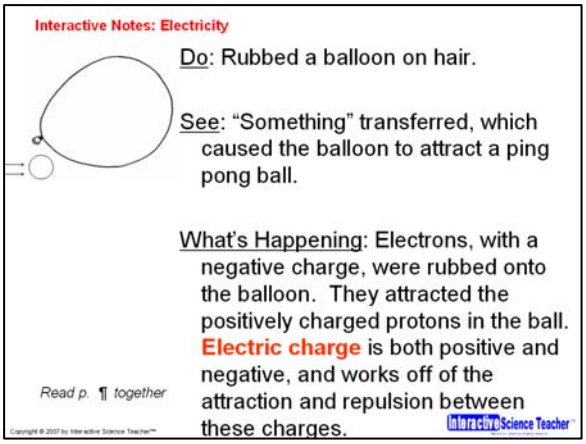
**Additional Materials for Teacher:**

PowerPoint- see last page
1-cooler of ice
1-box or can of table salt
All-purpose spray cleaner (something with ammonia) - to clean balloons in between classes where it was rubbed on hair

**Beforehand:**

- At least a week before this, ask students to bring in Christmas lights that don't work any more. Cut and strip the lights as described in demo #4. These are the same kind of lights used in the "Circuit Board" lesson.
- Ask the custodian in your building to borrow the fluorescent light tubes needed for demo #2.
- Fill a cooler with ice.
- Close all blinds and cover windows with plastic (if you have it) in preparation for demo #2. The darker the better.
- Masking tape the fluorescent light tubes to tabletops to keep them from rolling off.
- Set out all materials *the day before*. Leave yourself time to realize you're missing something, and to practice a new demonstration, research something or even make a change. In the morning read through the slides and notes one last time. Relax and have fun along with your students.
- Insert page and paragraph numbers from relevant pages in your textbook at the bottom of slides 1 and 2 if you choose to have the class read from it together. This is a good way to connect with your textbook as well as transition into the next demo. You can also delete these page inserts, or Copy and Paste them onto later slides if needed.
- Print extra copies of the notes pages on paper for yourself, students that are slow writers or can't see well, and for absentees. Click "File" → "Print" → then where it says "Print what:" select "Handouts" → and then "OK".
- As with any other demonstration, try these out ahead of time for yourself so you know how they work best and so you know what to expect. Practicing will also help you decide what to say and how to say it.

1.




Ask student #1 (of the 4) if they're having a good hair day so far today. Tell them to put the balloon next to the ping pong ball sitting on the table and observe what happens (nothing). Now have them rub the balloon on their hair and then bring that charged spot up close to a ping pong ball, and observe the ball move towards the balloon! Then see if they can spin the ball.

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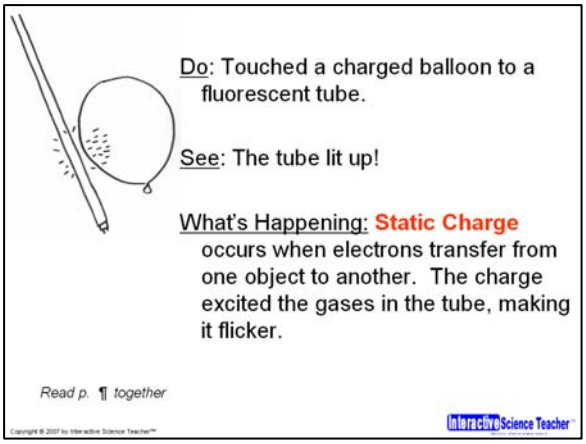
Use a marker to put a black dot on each balloon so students know where to charge the balloons, and to help them keep track of where those electrons are.

A "charged-up" balloon will move around many things- pepper, salt, styrofoam, puffed rice cereal, paper, and even bubbles. Pings pong balls are used here because they're the most surprising and amusing to watch. And the least messy (I thought you'd appreciate that).

An alternative to rubbing balloon on head is rubbing on arm hair.

The notes were carefully worded to not suggest that the ping pong ball had an overall positive charge. When you rub the balloon on your hair, electrons transfer to the balloon. That gives that little spot on the balloon an overall negative charge (and your hair, having just lost electrons, now has a positive charge, which is why the balloon and your hair attract). When the balloon is put next to the ping pong ball, the negative charge repels away the electrons in the ball, but attracts the protons, and so it rolls. Cool, huh?

2.




Ask student #2 if they're having a good hair day. (Groans) Before you turn off the lights, ask them to hold the balloon in their hand. Make your room darker by turning off your computer monitor and black-screening your projector, if you're using one. Turn off all lights. Have student #2 charge the balloon up again with hair and then touch that charged spot to the fluorescent tube (anywhere on it, not just the ends) for an unexpected result- it lights up! You'll notice it resembles the flash of an aurora.

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Ask your friendly building custodian to borrow the fluorescent lights that you need.

This demo will work on any fluorescent light bulb, even the compact "curly q" shaped energy savers. (A cool at-home trick is to have students hold one of these bulbs in front of a television set as it's turned off in the dark.)

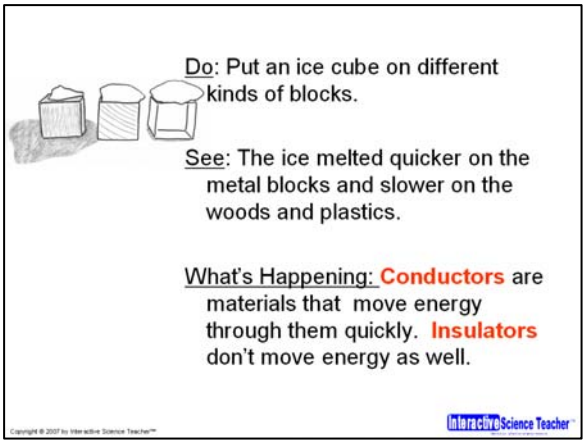
Total darkness is not essential for this demonstration, but it helps. For instructions on making window coverings so your room can be nearly pitch black, see the file "Making black plastic window coverings" included in this lesson's folder.

Instead of powering your projector off when you need the room black, your remote should have something like an "A/V Mute" button that blackens the video without shutting the projector off completely. That feature saves wear on your projector lamp. Powering on and off repeatedly is stressful to a projector lamp.

In a fluorescent light bulb, electricity excites the mercury vapor that is in either argon or neon gas. This causes plasma, which produces u.v. light, which then glows, or "fluoresces". Now you know where the name came from.

*Caution: always handle fluorescent lights carefully*. They will explode if dropped or hit (that's why they should be taped down).

3.




Ask student #3 if they're having a good hair day (just kidding). Have them bring the bowl/beaker up to you to get a handful of ice, and then line up the 9 density blocks in a row. Tell the class that they are about to put an ice cube on top of each block to see which melts fastest. Give them a second to decide and predict results. For some reason, some will think wood will melt the ice fastest, others plastic, and the rest will think metal. After you have some fun with that, let them put the ice on and watch.

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Be ready with the towels when the ice melts.

The density blocks used here cost about $20 per set. If you don't have any blocks but can afford a class set (1 set per 4 students), they're well worth it. They are also used in the activity "Counting Atoms". If you can't afford 8 or 9 sets, pick up 2 or 3 and give each group one metal, one plastic, and one wood block.

At the end of the day, give each block and their box one last dry off with a towel and then let them sit out overnight to finish drying. The iron one especially needs this so it won't rust.

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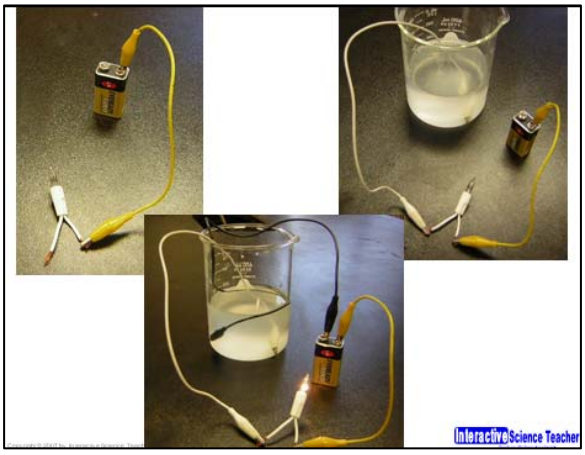
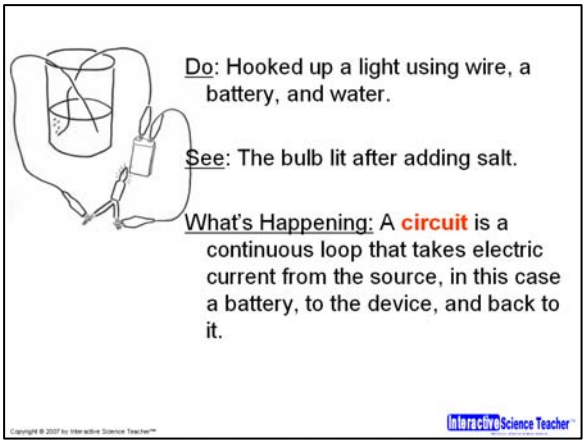



This 3-picture sequence is a lead-in that shows student #4 how to hook up their circuit.

4.




Have student #4 hook up the wires, light, and 9-volt battery through the water as shown in the previous slide. DO NOT ATTEMPT TO RUN CURRENT DIRECTLY FROM AN OUTLET! After hooking it up, observe that the light is still not lit. Turn off the classroom lights (again) and ask them to pour in the salt and stir with the spoon. The light will slowly come on.

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Salt adds ions, which electricity needs in order to conduct through solutions.

If you'd rather not run the wires through the beaker of water, you don't have to. But doing so adds intrigue, and gives you the opportunity to talk about water and electrical safety. If you prefer to skip the water, just run wires directly from the battery to the light and back again.

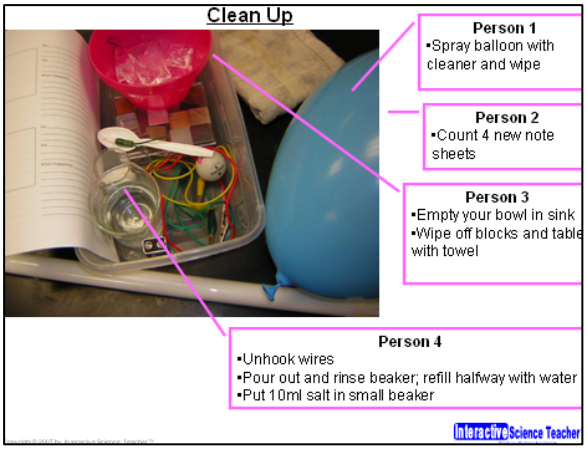
One thing your students must understand is that the water in the beginning of this experiment is distilled, or almost pure, $H_20$. But the water coming out of the faucets at home is NOT distilled and DOES conduct. Ask students what they see when they fill a glass with water at a home faucet and look at the bottom of it. Those little floaties and cruddies (lime) are what give water its ability to conduct. That's why electrical building code requires all outlets within 6 feet of water (in kitchens, baths, garages, and basements) to be equipped with the special GFI outlet equipped with the Test/Reset buttons. These save hundreds of lives every year in the United States.

Observant students will notice during the demo that one of the wires (coming from the hot, or negative, terminal of the battery) is bubbling. That's because the electricity there is dissembling the water (this is called "electrolysis"), converting $H_2O$ into $H_2$ and $O_2$, both gases.

The little bulbs used in this demonstration were salvaged from a strand of broken Christmas lights. A week before this lesson, have students bring in strands from home that no longer work. Then put student volunteers to work- use scissors to cut each light with about 2 inch tails on both sides remaining. Then use wire strippers to remove the insulation from the outer half inch to expose the bare copper wire. Test each bulb by briefly touching the copper tails to the terminals on top of a 9-volt battery.

Keep spare bulbs and gator clip wires handy. Some will go bad today.

At the end of the day, rinse and dry the wires to remove the salt before it corrodes. If they look rusty tomorrow, put a student to work knocking that off with sandpaper. A little bit of rust will keep an otherwise perfectly good wire from working.




Use this slide to direct students how to clean up and reset everything for the next class.

You'll need at least 5 minutes to reset everything for the next class.

Leave refills of everything in different parts of the back of your room so students don't all crowd one spot:

- Box/can of salt
- Note sheets
- Extra towels
- Distilled water
- Cleaner (ammonia-based) and towel-to clean the balloons for next hour.

If you don't want this slide to show, right-click on the slide and select "Hide Slide".

To help you with clean up, have your last science class take everything out of the boxes and put them in like piles in the back of your room.

# Student Handout

Topic: _____ Date: ___/___/____

Do: _____

See: _____

What's happening: _____

Do: _____

See: _____

What's happening: _____

# Special Doc-How To Make Your Room Completely Dark

## Black Plastic Window Covers

Having black plastic covers for your windows may seem like a luxury, but is cheaper than you may think ($25), easy to make, and will become a re-useable system you'll likely end up using several times a year.

The covering you see pictured to the right is 6-mil black plastic fastened to the window using industrial velcro. Both are available at your local hardware store. Make sure the velcro you buy has the adhesive side that sticks to things.

To make: measure your windows then cut the plastic to those measurements using a box cutter or utility knife along a straight edge (like a meter stick). Cut it a bit oversized-1 inch extra on each side, to help cover that loose area along the edge where light likes to seep in. If there's too much, you can always trim it down more.

Then cut and stick on the two matching pieces of velcro to the corners of the plastic and window where they meet. A one inch by one inch set of velcro squares is big enough to hold up the plastic, but not so much that it sticks too much and risks tearing the plastic when you pull it off.

As you finish each piece of plastic, stick a masking tape label to the inside top of the plastic (the side facing the window) reminding you which window it goes with. Keep track of which goes with which even if all your windows are the exact same size, since the velcro on each set of plastic/window will be slightly different.

If your coverings ever tear or puncture, patch with black electrical tape or black duct tape.

*Caution*-when hanging up and taking down your window coverings on windows higher than your reach, use a ladder or step stool so you keep your balance. Never stand on a chair, desk, or counter.

Expect great things every time the plastic goes up- not only cool demonstrations that everyone will enjoy more because of the total darkness, but also the curiosity from students (and staff) when they enter your room and wonder what's going on this time.