



# 2016-17 HOT SEASON *for* YOUNG PEOPLE

Teacher Guidebook



*Doktor Kaboom!*  
**LIVE WIRE!**  
THE ELECTRICITY TOUR

Sponsored by  **REGIONS**

# From our Season Sponsor



For over 130 years Regions has been proud to be a part of the Middle Tennessee community, growing and thriving as our area has. From the opening of our doors on September 1, 1883, we have committed to this community and our customers.

One area that we are strongly committed to is the education of our students. We are proud to support TPAC's Humanities Outreach in Tennessee Program. What an important sponsorship this is – reaching over 25,000 students and teachers – some students would never see a performing arts production without this program. Regions continues to reinforce its commitment to the communities it serves and in addition to supporting programs such as HOT, we have close to 200 associates teaching financial literacy in classrooms this year.

**Thank you, teachers,** for giving your students this wonderful opportunity. They will certainly enjoy the experience. You are creating memories of a lifetime, and Regions is proud to be able to help make this opportunity possible.

**Jim Schmitz**  
Executive Vice President, Area Executive  
Middle Tennessee Area

## WELCOME !N *to the* ARTS



**2016-2017  
HOT Season  
for Young People**

# Welcome to the Wacky World of Doktor Kaboom!

*Doktor Kaboom* offers your students a riotous romp through the varied regions of science. Actor David Epley has created a fun and engaging character, but don't be fooled by the spiky hair, goofy goggles, and extravagant German accent. Science is the real star of this show.

Rare indeed is the student that is not totally pumped up and energized about science after this hour long, one-man, scientific extravaganza. Utilizing catapult flung bananas, overflowing five foot high test tubes, eye-spinning optical illusions, and a smoke-ring blowing air cannon, Dr. Kaboom grabs students by their t-shirts boldly exclaiming, "Mein Gott! Science is fun!"

Your students will be so caught up in the fun and jokes, they might not even realize that they are learning along the way. There is real science going on under the surface of the show. *Doktor Kaboom* introduces concepts in physics, optics, and chemistry. Epley, in the guise of the crazy character he has created, promotes science safety and self-esteem. Above all, he encourages students to dive head first into their scientific studies.

## TPAC Education Study Guide *Doktor Kaboom: Live Wire The Electricity Tour!*

With thanks to Teaching Artist Neil Spencer  
and Dr. Kaboom

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Photo by Martin Albert



# **LIVE WIRE!**

## **The Electricity Tour**

*commissioned by the Kennedy Center*

This show explores the nature of electricity. What is it? What does it do for us? Where does it come from? With Tesla Coils, Van de Graaf Generators, and a ping pong shooting robot, Doktor Kaboom explains everything from voltage and current, to charges, conservation of energy, and plasma.



### **Doktor Kaboom is the creation of Actor/Comedian David Epley**

David grew up expecting to be a research physicist. Then a biomedical engineer. Then a mathematician, an astrophysicist, a chemical engineer, a marine biologist. So, of course, he became an actor.

For almost 30 years David has written, directed, and performed original comedy shows throughout the US, and around the world. Outdoor festivals and street performance were his primary venues of choice, with an occasional stage show thrown in for good measure. In 2006 David decided to bring science, his first passion, back into his life. Blending science and theatre has been a dream come true, opened multiple doors, and led to the most fulfilling work of his life.

Teaching, inspiring, and empowering the minds of our youth, and reminding their parents to be an active part of the equation. How could someone's work be any more rewarding?

**[www.doktorkaboom.com](http://www.doktorkaboom.com)**

# Doktor Kaboom Vocabulary

**Atoms:** The building blocks of matter.

**Current:** electric charge in motion, flowing

**Chemical:** A substance with a distinct molecular composition that is produced by or used in a chemical process

**Chemical Reaction:** occurs when two different elements or compounds come together and at least one of them changes its composition or identity.

**Electron:** one of the basic parts of an atom, it has a negative charge

**Proton:** one of the basic parts of an atom, it is located in the nucleus and has a positive charge

**Neutron:** one of the basic parts of an atom, it is located in the nucleus and has no charge

**Energy:** the capacity to do work

**Exothermic:** chemical reactions that produce (or give off) heat.

**Experiment:** a scientific procedure undertaken to make a discovery or to test a hypothesis

Photo by Martin Albert

**Voltage:** the pressure pushing electrons along an electrical current

**Theory:** a supposition or a system of ideas intended to explain something

**Static electricity** is made from extra charges stored some place so that they can't move. Normally charges don't like to collect in one place. They like to find opposite charges as partners and run away from particles with the same charge. (<http://wonders.physics.wisc.edu/van-de-graaff.htm>)

**Van de Graaf Generator:** A Van de Graaff generator is a device for making lots of static electricity.



# Doktor Kaboom: LIVE WIRE!

*Ideas from the show and the guidebook to explore before and after the performance*

## What do you WONDER?

How does electricity travel?

Can we create electricity? Where do we get it?

What are other sources of energy?

What makes static electricity?

How does Dr. Kaboom make science so entertaining?

## What do you KNOW?

We use electricity every day, from home to school, day and night. Share examples.

What happens when there is a “power outage”?  
What alternatives do we use?

What do scientists do? (Observe. Ask Questions.  
Test Theories.)

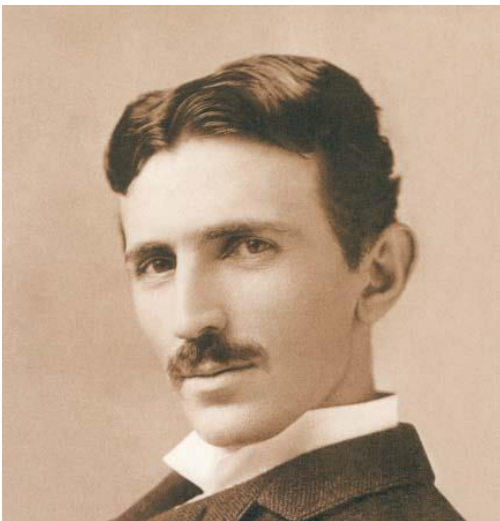
How does creativity and curiosity help you learn?

After the show: What inspired your students? What would they like to know more about?

## Famous Scientists



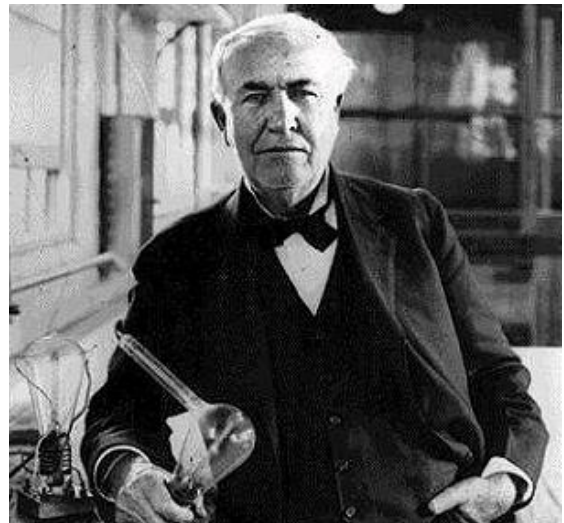
In *LIVE WIRE! The Electricity Tour* Dr. Kaboom introduces Nikola Tesla and Thomas Edison, scientists known for their work with electricity. ***Who are some other famous scientists and what is their contribution to how we live today?***



**Nikola Tesla 1856-1943**

Inventor Nikola Tesla contributed to the development of the alternating-current electrical system that's widely used today and discovered the rotating magnetic field (the basis of most AC machinery).

Source: Biography.com



**Thomas Edison 1847-1931**

Inventor Thomas Edison created such great innovations as the electric light bulb and the phonograph. A savvy businessman, he held more than a 1,000 patents for his inventions.

Source: Biography.com

# Experiment and Explain Static Electricity with Balloons

Explanations from [sciencenetlinks.com](http://sciencenetlinks.com)

## Balloon On the Wall Demonstration

Blow up a balloon and hold it against a wall – does it stick?

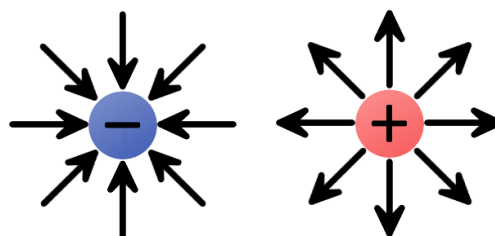
Now rub the balloon with a piece of wool (such as a sweater, sock, scarf, rug) and hold the balloon against the wall again. What happened? Why?

**Explanation:** When you rub the balloon with wool, negatively charged particles called electrons are transferred from the wool to the balloon, giving the balloon an overall negative charge. When the charged balloon is brought near the wall, it repels some of the negatively charged electrons in that part of the wall (negative charges repel other negative charges, and positive charges repel other positive charges). Therefore, that part of the wall is left repelled. Then, the negatively charged balloon and the positively charged section of the wall are attracted to each other, and the balloon sticks. The charged balloon may be made to stick to a wide variety of objects (even a person) because of the charge it receives after being rubbed.

## Balloons Repel Demonstration

Blow up 2 balloons and tie a long thread onto each. Rub each balloon with wool, (or your hair). Hold each balloon by the end of the thread and try to bring the balloons close to each other. What happens? Why?

**Explanation:** When we rub the balloons with the wool, each of the balloons acquires a negative charge. Negatively charged particles called electrons are transferred from the wool to the balloons, giving the balloons an overall negative charge. Because the two balloons have the same kind of charge, they repel each other.





# Short Activities

## Experiment with Acting

### ❖ Observing Theatrical Techniques

Like many comedians and actors, David Epley uses exaggeration in his voice, gestures and movement in his performance as Dr. Kaboom. Visit Doktor Kaboom's website to explore the actor (David Epley), and his character. Ask students to describe the character just from the photos. Next watch one of Dr. Kaboom's videos and discuss how he uses his voice. What does that add to his character? What other theatrical devices does he use for his performances? (Suspense, comedy, costuming, storytelling) **Discuss:** After attending the performance, ask students to notice the difference in their engagement in the live performance and watching the video. What did they notice on stage? Which experience is best for them? What would they recommend to a younger grade classroom who is considering seeing the performance?

### ❖ Show Your Character

-Have students stand in a circle. Call out various character types, such as an old woman, a sports guy, an evil villain, a shy girl, a superhero. Ask students to show what they think this character might look like using only their faces, no voices or body movement.

-Next, call out a character type and add the following situations, or any other additions you wish to add: Tasting a lemon; A bee lands on the character's nose; Trying not to sneeze; Saying goodbye to a friend who will be gone for a long time. Ask students to notice each other's interpretations.

-Now, have the students pick ONE of the characters they have practiced. This time ask students to show their character using their entire body, including their face. Call out one of the situations and give them a slow count of three to change their body and face. Take few minutes to walk around the room as that character, and return to their place in the circle.

-**Discuss:** Compare using only your face to show emotion with using your whole body. Which was easier to do? Which gave more information about the character? What did you have to think about as you were creating your characters? What did the students notice about their classmates' characters?

### ❖ Science Vocabulary Performance

Hand out flashcards with vocabulary words and definitions on each. (Dr. Kaboom's vocabulary is on page 3). Tell students that they are going to share their vocabulary word in the voice or style of a made-up character. Encourage them to think about how they use posture, exaggeration, voice (volume, speed, pitch, accent). Give them a short time to read the card to themselves and prepare. Ask for volunteers or go around the circle. It's OK if more than one student has the same word, if they are performing as different characters, their delivery of the definition will be different!



# Core Values

Doktor Kaboom is a lot of fun and he is serious about kids and science. During the show he will ask the audience to demonstrate confidence, respect, and curiosity. On his website, Doktor Kaboom gives his three core values.

**Discuss** with students: what does it mean to have a core value? What are the core values of your school, your classroom, your family? As a writing activity, have students develop and write their own core values and give examples.

## Doktor Kaboom's Core Values

1. Science is for everyone, not just the guy in the labcoat, or the girl who wins the science fair every year.
2. Science is not hard, but it does take effort. That's not hard, that's just work, and that's just life.
3. Every child is intelligent, creative, valuable, and should know that about themselves.



# You Can Perform Science!

Doktor Kaboom is a character created by actor/comedian David Epley. In his shows, David combines his love of science with his performing abilities to create shows that educate and entertain on a grand scale. Encourage students to create their own science demonstrations with a dose of Dr. Kaboom's style - keeping in mind **respect, safety and confidence**.

## Brainstorm

Discuss with students: What are some techniques David Epley uses to make science so much fun?

**Humor \* A Strong Character \* Audience Participation \* Good Storytelling \* Demonstrations  
Respect \* Safety \* Confidence**

## Select and practice a demonstration

There are many simple scientific demonstrations\* available online and in this guidebook. Guide students to select a demonstration, or assign your choice of options. As a project, give students the opportunity to develop their own mini show featuring a real science demonstration. They can work individually or in teams to take their presentation to the next level. The demonstration "Roll a Soda Can with Static Electricity" is used as an example for the suggestions below.

## Choosing a Character

As a class, practice "getting into" different character types.... old man, young girl, body builder, business person, cowboy, minion, etc. With students standing in a circle, call out a character type. Students respond by moving in ways that show: What is this character's posture? How does he/she walk? How would this character brush teeth? Toss a ball? Eat an ice cream cone? Walk on a hot beach? Add more attributes to your characters: very enthusiastic like a sports fan, impatient, absent minded, distracted by cell phone, very strict, etc. Practice as a group and then individually until students really know and understand their character.

## Problem Solved

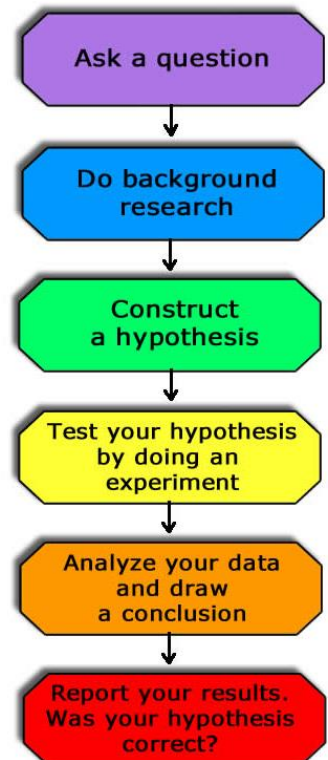
In most plays and stories, there is a problem that characters have to solve. Your science demonstration can be made more interesting for the audience if there is *a problem* that can be solved through your demonstration. The problem can be real or wacky, as long as the storytelling convinces the audience that it is important! (For example: On planet Dirigible, the balloons have an annual contest to prove their power! Watch as our hero, Mr. Red Balloon, attempts to move a soda can without even touching it! Oh no – his competition is spoiling the contest by putting drops of water in the can! Who will win!?)

## The Scientific Method

Plan your presentation using the scientific method and test variables (which one will be best!?). For example, in the "Roll a Soda Can" demonstration, there is an opportunity for audience participation, or for a team of students with different hair lengths to get involved investigating "does the length of the person's hair effect the power of the static electricity?"

\*See: [sciencebob.com/category/science-fair-ideas](http://sciencebob.com/category/science-fair-ideas)

## The Scientific Method



# Roll a Soda Can with Static Electricity

## You will need

- \* An empty soda can
- \* A blown-up balloon
- \* A head of hair

## What to do

1. Place the can on its side on a flat smooth surface like a table or a smooth floor.
2. Rub the blown up balloon back and forth through your hair really fast.
3. Hold the balloon close to the can without actually touching the can. The can will start to roll towards the balloon without you even touching it!

Try This Too: While you've got the balloon out, tear up part of a tissue into tiny pieces about 1/4 inch (.5 cm) big. Rub the balloon in your hair again and bring it close to the tissue pieces. They will be attracted to the balloon and then jump away.

## How does it work?

When you rub the balloon through your hair, invisible electrons (with a negative charge) build up on the surface of the balloon. This is called static electricity, which means "non-moving electricity." The electrons have the power to pull very light objects (with a positive charge) toward them – like the soda can.

## Make It An Experiment

The project above is a DEMONSTRATION. To make it a true experiment, you can try to answer these questions by charting the variables:

1. Does the size of the balloon change the power of the pull?
2. Does the length of the person's hair effect the power of the static electricity?
3. How much water can you put in the can until the balloon can't pull it anymore?



**Find this demonstration and more like it at: [sciencebob.com](http://sciencebob.com)**

# Curious About Electricity?



## Electricity Everyday

When scientists and engineers talk about **energy** in its simplest form, they mean “the ability to do work.” Types of energy are stored in different ways. For example, the energy stored in the food you eat allows you to run and jump.

How do we get the electrical energy used in our homes and work? From refrigerators, to computers, to street lights, to power that keeps factories working each day, the electrical power is generated by the Tennessee Valley Authority (TVA).

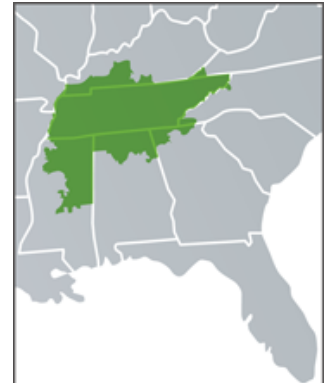
TVA produces electricity for millions of people in Tennessee. The electricity is generated in four main ways:

- Fossil plants—TVA burns fossil fuel (fuel formed over time in the earth from plants that died long ago) in these plants to make electricity. Coal is the fossil fuel TVA uses most.
- Nuclear plants—In these plants TVA uses heat given off when uranium atoms are split to make electricity.
- Hydroelectric plants—These plants use river water to turn generators and make electricity.
- Combustion turbines—These plants use gases given off when oil or natural gas is burned to turn turbines that run electric generators.

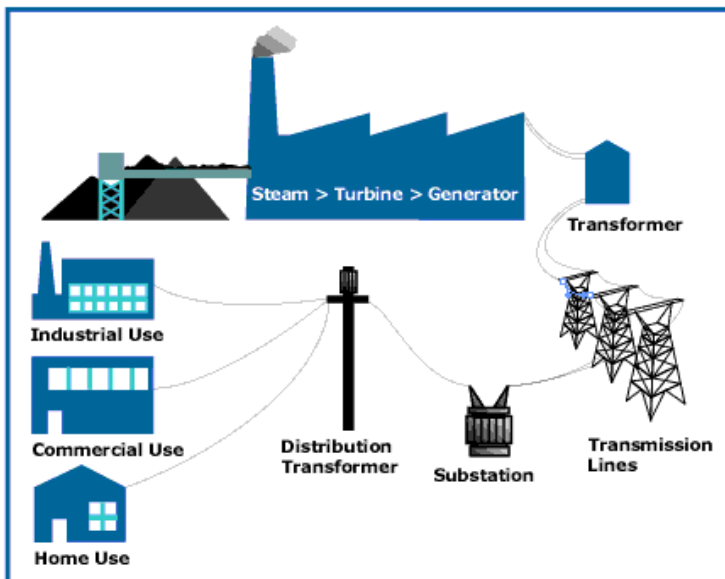
TVA operates three nuclear plants, 29 hydroelectric plants, 11 coal-fired plants, five combustion turbine plants, and one pumped storage hydroelectric plant.

### Tennessee Valley Authority TVA

TVA is the largest public power company in the United States. It's called “public” because it's owned by the U.S. government, unlike most companies that are owned by individual people or investors. Through its many plants that make electricity, TVA supplies power to about 8.8 million people in the southeastern United States.



Source: [www.tvakids.com/electricity/production.htm](http://www.tvakids.com/electricity/production.htm)



Electricity is produced at TVA generating plants and carried over high-voltage transmission lines to delivery points of local companies that distribute the power in the central south. The substations and transformers reduce voltage to levels that can be used by homes and businesses.





## The Amber Effect

The word ELECTRIC evolved from the Latin word *electrum* and Greek word *electron*, both meaning "amber."

Originally the word described a substance which, like amber, could attract other substances when rubbed. This was called the amber effect.

The property now called 'static electricity' was known to the philosophers of ancient Greece. Amber is a resinous mineral used to make jewelry. It is probable that small fibers of clothing clung to amber jewels and were quite difficult to remove. Trying to rub the fibers off made the situation worse, causing early philosophers to wonder why.

In 1600, the "amber effect" was mentioned by William Gilbert in his book *On Magnetism*. Gilbert is sometimes credited as "the father of electricity and magnetism," but his original observations turned out to be incorrect. He noticed that the attraction between 'electrics' was much weaker than magnetism and wrongly said that electrics never repelled. But his use of the word continued with future philosophers and scientists.

## Recommended Resources

### tvakids.com

Tennessee Valley Authority maintains an extensive website for educators and kids, with history, videos, games, and explanations of how energy is generated for the Tennessee region and about alternative energy sources and conservation.

### doktorkaboom.com

Dr. Kaboom's official website with videos and photos!

### sciencenetlinks.com

Science NetLinks is a premier K-12 science education resource produced by the American Association for the Advancement of Science. At Science NetLinks, you'll find teaching tools, interactives, podcasts, and hands-on activities, and all of it is free!

### sciencebob.com

Experiments, science fair ideas, and lots of helpful interactive information about science

## Live Wire! Cue Sheet for Students

Visit ArtsEdge, for more arts-related resources and Doktor Kaboom Live Wire!

<https://artsedge.kennedy-center.org/students/kc-connections/series/cuesheet/2014-2015/140930-tya-doktor-kaboom>





# SPECIAL THANKS

The Tennessee Performing Arts Center's nonprofit mission is to lead with excellence in the performing arts and arts education, creating meaningful and relevant experiences to enrich lives, strengthen communities, and support economic vitality. TPAC Education is funded solely by generous contributions, sponsorships, and in-kind gifts from our partners.



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## LIVE WIRE! THE ELECTRICITY TOUR

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This performance is presented through arrangements  
made by Shaw Entertainment.

Cover photo credit:  
Scott Suchman



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