Doktor Kaboom!

School Show Study Guide

Luther Burbank Center for the Arts
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Special thanks for the Ordway Center for their permission to use this study guide

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Coming to the Performance

Your Role as an Audience Member

Audience members play a special and important role in the performance. The performers are very aware of the audience while they perform and each performance calls for different audience responses.

Lively bands, musicians, and dancers may desire audience members to clap and move to the beat. Other performers require silent focus on the stage and will want an audience to applaud only when they have completed a portion of their performance.

As you enjoy the show, think about being a part of the performance.

- What are the differences between attending a live performance and going to a movie or watching television?
- What are some different types of live performances? Name a few as a class.
- What kind of responses might an audience give in each circumstance?
- What are the different cues that a performer will give you so that you know how to respond? For example, might they bow or pause for applause?

Also, remember that a hall is designed to magnify sound, and even the smallest whispers or paper rustling can be heard throughout. When you come to the Ordway, you are part of a community of audience members and you all work together to create your performance experience.

Audience Member Checklist for Review at School

- ☐ Leave your food, drinks, and chewing gum at school.
- ☐ Remember to turn off all cell phones before the performance begins.
- ☐ When the house lights dim, the performance is about to begin. Please turn your attention toward the stage.
- ☐ Cameras and other recording devices are not allowed in the theater.
- ☐ Talk before and after the performance only. Remember that not only can those around you hear you, the performers can too.
- ☐ Appropriate responses such as laughing and applauding are appreciated. Pay attention to the artists on stage; they will let you know what is appropriate.
- ☐ Open your eyes, ears, mind, and heart to the entire experience!
- ☐ After the performance, you will be dismissed when your school is called from the stage. Remember to check around your seat for everything that you brought into the theater.

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About the Performance: Doktor Kaboom

Photo courtesy Shaw Entertainment

Who is the creator of Doktor Kaboom?

Doktor Kaboom was created by actor and comedian David Epley. David was initially interested in a variety of science subjects, such as physics, biomedical engineering, mathematics, astrophysics, chemical engineering, and marine biology. He even studied science subjects at the North Carolina School of Science and Mathematics. However, he eventually decided to become an actor.

David has written, directed, and performed original comedy shows around the United States and the world. It was in 2006 that David decided to combine his earlier interests in science with theatre.

In addition to performing, David worked as a firefighter and EMT. He is also a veteran of the U.S. Army, and a father to two daughters.

Who is Doktor Kaboom?

The character of Doktor Kaboom is an eccentric German physicist, who greatly enjoys the world of science. Doktor Kaboom's costume includes chrome goggles, an orange lab coat, motorcycle boots, and spiked hair.

David utilizes his improvisational skills to ensure every show is different as he takes the audience through the wheel of science!

The Mission

Doktor Kaboom strives to empower, excite, educate, and entertain the people of Earth.

Through interactive, character-driven science comedy, he improves society's understanding and retention of basic scientific principles, builds upon those basics, demonstrates that all science is for everyone, and removes the cultural stigma that scientific awareness is something to fear.

Core values:

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

Discussion Question:

Doktor Kaboom is David's alter ego. If you were to create an alter ego, who would it be? What would your mission be as that character? What would be your costume?

Source: *Doktor Kaboom: Science Comedy*, http://www.doktorkaboom.com

About the Performance: The Wheel of Science

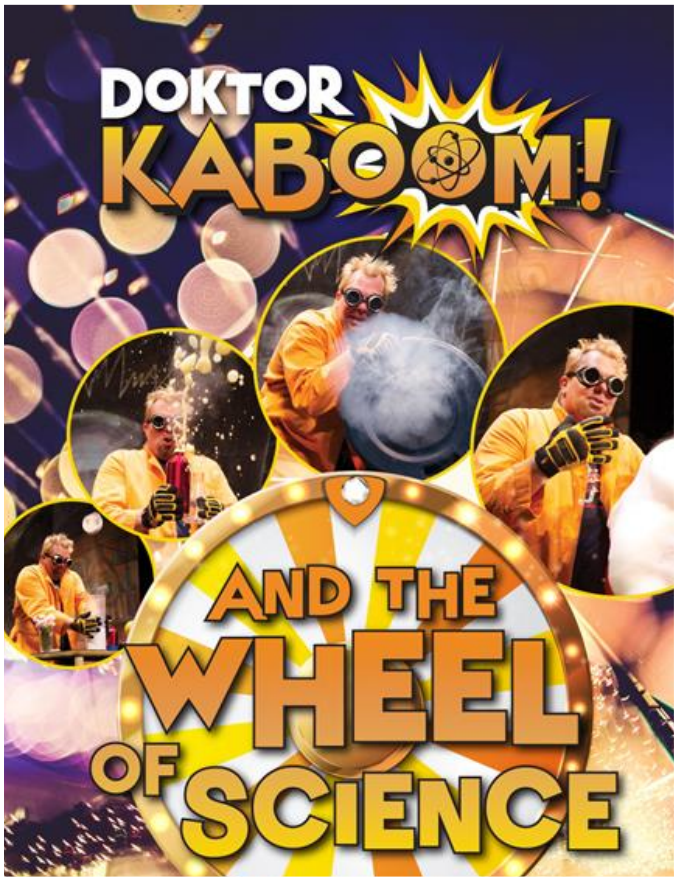


Photo courtesy Shaw Entertainment

Discussion Questions

1. What kind of science demonstrations do you hope to see in the performance?
2. What are some of your favorite topics in science? Why?
3. Doktor Kaboom uses a spinning wheel to help him in his decision-making. How do you make tough decisions? What are some special techniques or tools you use in decision making?

Doktor Kaboom and the Wheel of Science

Due to Doktor Kaboom's intense love of science, he is unable to pick his favorite science demonstrations. He lets fate take a hand in his decision-making by using The Wheel of Science! Doktor Kaboom built a great wheel that has on it all of his favorite science demonstrations: from optical illusions to chemical reactions to a homemade hovercraft, and more! Every performance is unique.

Photo courtesy Shaw Entertainment

About the Performance: Scientific Method

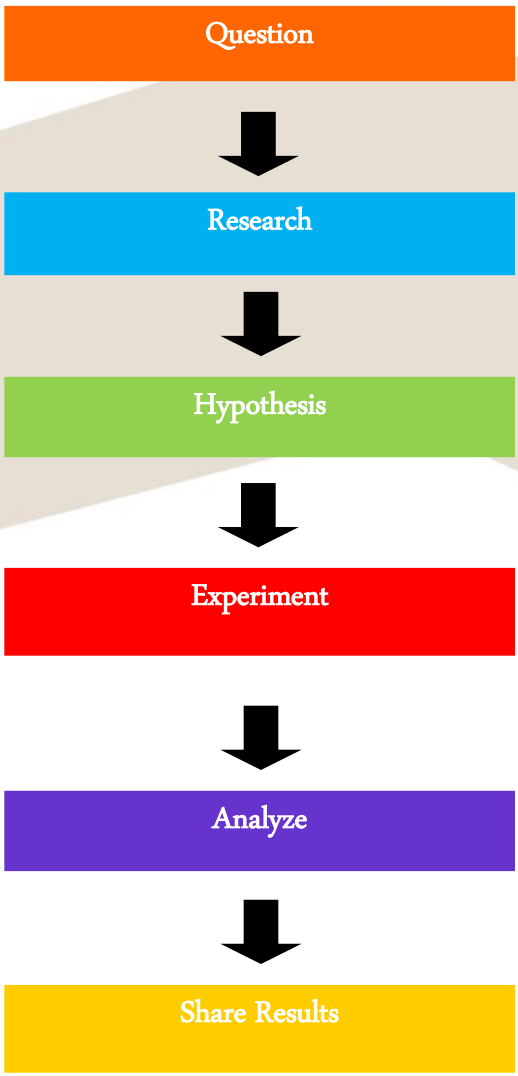
What is the Scientific Method?

The scientific method is a way of researching in which a problem or question is identified, information is gathered, a hypothesis is formed, and the hypothesis is tested.

The main goal of the scientific method is, "...to discover cause and effect relationships by asking questions, carefully gathering and examining the evidence, and seeing if all the available information can be combined to a logical answer."[2]

What are the steps in the Scientific Method?

1. *Observation and Question*—all experiments start with an observation and question you want to answer.[1] It begins when you ask a question of something you observed.
2. *Background Research*— research is needed to ensure you are looking for your answer in a well-informed way. Search for information in books and reliable internet sources to ensure you are correctly pursuing your answer and that you are not repeating mistakes other scientists have made.
3. *Hypothesis*—you will need to create a hypothesis, which is an educated guess about the experiment's results. Its goal is "..to answer your question with an explanation that can be tested." [2] A good hypothesis follows an if, then statement. For example: "If I do this, then this will happen."[2]
4. *Experiment*—now you conduct the experiment to test your hypothesis. The experiment is to show whether or not your prediction is correct, which would then support your hypothesis. It's important to observe and record data throughout the experiment. It's also important to record how you did your experiment so other scientists can repeat it.
5. *Analyze the Data and Conclusion*—now that the experiment is done, it is time to look at the results and measurements to see if your hypothesis was correct or not. If your hypothesis is not correct, use the data from your experiment to make a new hypothesis.
6. *Communicate the Results*—in order to share the information with other scientists and the public, the results of the experiment are put into a report or public display. This way other scientists can check your work and try to repeat your experiment themselves.



Sources: [1] *What is the Scientific Method? Science Book for Kids*, Speedy Publishing LLC, 2017.
[2] *Steps of the Scientific Method*, Science Buddies.
https://www.sciencebuddies.org/science-fair-projects/science-fair/steps-of-the-scientific-method

Vocabulary

abstract: a non-representational object or subject of artwork

actor: a person who is in the profession of acting on stage, in movies, or on television

alter: change in a small way

alter ego: a person's second or different personality or identity

astrophysics: the application of laws and theories of physics to nature of stars, planets, etc.

biomedical: science of biology and medicine

engineering: science that involves design, building, and use of structures

chemical: a substance that has been prepared

chromatography: a way that you separate mixtures into separate parts

comedian: an entertainer who makes people laugh

components: a part or element of a whole

dissolves: when a substance become a liquid

eccentric: unconventional and slightly strange

experiment: to test a hypothesis in the real world

friction: the resistance between two objects when rubbed against one another

gravity: the force that keeps a body and objects toward the center of the earth

hypothesis: an educated guess based on information you already know, can be tested with an experiment

illusion: something that can trick the senses

improvisational: a spontaneous performance

marine biology: a study of science of organisms that live in salt water

mathematics: the science of number, quantity, and space

minimizes: reduce or make smaller

observation: gathering information using the senses and recording the information

optical: using sight

physicist: an expert in the study of physics

physics: science that looks at nature as well as nature and matter properties

scientific method: the method of knowledge acquisition which includes the formulation of a question, testing a hypothesis, and analyzing the results

Photo courtesy Shaw Entertainment

My Review!

Name:

You are a reporter for your school's newspaper!

Write and illustrate a review article to inform others about the performance you just saw.
Name your article, illustrate a moment, and write about the performance!

Title:

I saw _____

I heard _____

The show made me feel _____

The performance reminded me of _____

My favorite part was _____

I wish I had seen more _____

Description: Students will understand mixtures further by creating chromatography art.

Duration: 20-30 mins

Objectives:

- Students will see mixtures in action.
- Students will be introduced to the concepts of cohesion and adhesion.
- Students will practice chromatography.

Supplies:

- Whiteboard
- Black Marker
- Colored Markers
- Cups of water
- Straws (one for each student)
- Coffee filters (one for a demonstration and one for each student)

Directions:

Part 1:

1. Ask the students if any of them know what a mixture is and to explain their answer.
2. Explain to the students that a mixture is a substance that is made by mixing other materials together.
3. Explain that there are a lot of mixtures in the world. Ask the students to think of examples of mixtures. (examples could be cereal and milk, soap, etc.)
4. Explain to the students that scientists use a special technique when they want to separate the individual things/substances that make up a mixture.

   How they do this is through a process called chromatography. Chromatography is a way in which to separate mixtures.
5. Demonstrate the process of chromatography for the students through the following steps:

- Explain that a black marker is a mixture. It is made up of many color inks mixed together to create the black ink in the marker. Ask the students what colors they think are in a black marker and record the students' responses on the whiteboard.
- Explain that you are now going to test their predictions.
- First, cut a coffee filter into strips about one inch wide.
- Then draw a squiggly line across a strip of coffee filter with your black marker, about an inch up from the bottom.
- Hold the strip over a bowl of water. The water should touch the very end of the coffee filter, but not the ink.
- Tape the coffee filter in place and wait to see what happens. The water should creep up the coffee filter strips and separate each ink mark into a cool dye pattern.
- Explain that this is called chromatography. Notice how the dyes within the black ink are separating.
- Explain to the students that when the coffee filter is dipped in water, some of the water sticks to the coffee filter and gets it wet. That's because there is a force between the water molecules and the molecules in the coffee filter. This force is adhesion. The water molecules also stick to themselves, which is cohesion. Both adhesion and cohesion are what draws the water up the paper towel, moving against gravity. When the water reaches the ink, it dissolves some of the dyes in the ink, and then causes the dyes to travel up the paper towel with the water. This is what allows us to see the different colors or components within the black ink mixture.
- Ask the students what colors do you see separate from the black ink? Were the color predictions we recorded earlier correct?

Part 2:

1. Explain to the students that they are now going to get creative and create their own chromatography art by using any marker colors they want on their own coffee filter. They are then to use the straw to drops bit of water on their colored filter paper, which will cause the colors to separate creating interesting designs.
2. Give the students time to create their chromatography artwork.

Source: "Paper Chromatography," *Flash Bang Science.* http://www.flashbangscience.co.uk/funstuff/experiments/chromatography.html

Photo courtesy Shaw Entertainment

Discussion:
Before the Show

1. Were your predictions of the colors in the black ink correct?
2. Were you surprised at what colors were found in the black ink mixture?
3. How did you decide what colors to use for your chromatography art design?
4. What was it like using the water to alter the colors in your coffee filter?
5. Did you use the scientific method during this experiment? Explain.

After the Show

1. What science demonstrations happened during the performance?
2. Did any of the demonstrations look like the chromatography experiment you practiced?
3. What moments stood out to you in the performance?
4. Did anything surprise you in the performance? Explain.
5. ~~If you were to tell a friend about this performance, what would you tell them?~~

Source: "Paper Chromatography," *Flash Bang Science.* http://www.flashbangscience.co.uk/funstuff/experiments/chromatography.htm

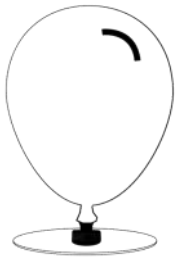
Description: Students will gain an understanding on how hovercrafts operate by practicing with their very own hovercraft.

Duration: 30 minutes to 1 hour

Objectives:

- Students will gain an understanding of hovercrafts ability to hover.
- Students will gain an understanding on the concept of friction.

Materials:



- CD/DVD discs
- Push up water bottle tops
- Hot glue gun
- Scotch Tape
- Masking Tape
- Balloons
- A cleared space, such as table or floor
- Tablet or computer

Prep:

Make the Hovercraft Base (make enough for every two students to have one).

- Place scotch tape over the center hole of the CD and poke about six holes in the tape with a push pin.
- Using a hot glue gun, glue a push up water bottle cap to the center of the CD/DVD disc. You'll want to be sure you create a good seal to keep air from escaping.

Directions:

1. Ask the students if they have ever seen a hovercraft in person or on TV before?
2. After the students have responded, explain that a hovercraft, also known as an air cushion vehicle or ACV, is a craft that is able to travel over land, water, mud, ice, and other surfaces both at speed and when stationary, or not moving. Hovercrafts are kind of like airplanes—they require a pilot to drive them. This is because they float in the air.
3. Explain to the student that there are different types of hovercrafts. Show them examples of this with the following clips:

- Ferry: https://youtu.be/h-_6qXNh7cw?t=44

- *Mythbusters*: https://www.youtube.com/watch?v=kAimDLp5TmA

4. Ask the students how they think hovercrafts float.
5. Break the class into groups or pairs and explain that they are going to be working with their very own hovercraft to try and find the answer to that question.
6. Give each pair their own hovercraft.
7. Demonstrate how to run the hovercraft by completing the following steps:

- Close the top of the water bottle cap and put the CD flat-side-down on a tabletop. Blow up the balloon and pinch the neck shut so no air gets out. Carefully stretch the neck of the balloon around the closed water bottle top so the part you drink out of is totally covered. There's your CD hovercraft!
- Now put the hovercraft on a flat surface, like a table, and give it a little push to see how far it goes.
- Holding the hovercraft down, pull open the water bottle cap with the balloon still on it. Do this carefully—make sure the cap doesn't come unglued!
- Now give the hovercraft another little shove and watch it go! What just happened?

8. Ask the students:

- How did the hovercraft move when I pushed it the first time?
- Why do you think it didn't move as well that first time?
- How about the second time I pushed the hovercraft, how did it move then?
- Why do you think it floated that second time?

9. Explain to the students the following: The air from the balloon is flowing through the spout now; when the CD was on the table with no air flow, the friction between the two flat surfaces kept it from going far. With air flowing between them, there's a lot less contact between the surfaces and therefore a lot less friction—nothing to stop the hovercraft from really going! A real hovercraft will use blowers that push down on the surface, which creates a cushion of air that the hovercraft floats on. Typically the cushion is contained within a flexible "skirt," which allows the vehicle to travel over small obstructions without damage.
10. Give the students 5-10 minutes to practice using their own hovercrafts.
11. After the students have practiced with their hovercrafts, ask the students if they think the size of balloon will affect the disc's ability to hover.
12. After hearing their responses, ask the students to make the balloon a smaller size than was completed before to try and see how far the hovercraft will go.
13. Ask the student: How far do you think the hovercraft will go with the balloon a smaller size? Can you guess how many inches or feet it will go? Ask the students to write down their predictions.
14. Give the students time to practice using the smaller size of balloon with their hovercrafts. Ask the students to use a ruler or measuring tape to measure from where the hovercraft landed to its starting point. Ask the students to write down their results.
15. Ask the students to now make the balloon a slightly larger size than before to try and see how far the hovercraft will go. Ask the students to write down their predictions before testing it out. Ask them to follow the same steps they completed for the smaller balloon size.
16. Ask the students to compare their two measurements and answer the following as a group:

- What do our measurements tell us?
- Which balloon size ended up causing the hovercraft to go farther?
- Knowing what you know now about hovercrafts, why do you think the one balloon size made the hovercraft go farther?
- Did you notice a difference in height from the surface in each of the balloon sizes?

Source: "Build A Tabletop Hovercraft," Science Bob. https://sciencebob.com/build-a-tabletop-hovercraft-2/
Adapted from Lesson Activity by Brian McNeill, Extension Educator, UMN Extension 4-H Youth Development, 2014.

For fun: Hovercraft Race

1. Use two pieces of masking tape to create a start and finish line.
2. Ask the students to think about their balloon sizes and how it affected their hovercraft when competing in the friendly race.
3. Have each pair of students take turns racing each other with their own hovercraft.

Discussion:

Before the Show

1. What was it like running your own hovercraft?
2. What happened to your hovercraft when you used different balloon sizes?
3. What was it like working with your partner in running your hovercraft?
4. Did you use the scientific method during this experiment? Explain.

After the Show

1. What science demonstrations happened during the performance?
2. Did any of the demonstrations look like the hovercraft experiment you practiced?
3. What moments stood out to you in the performance?
4. Did anything surprise you in the performance? Explain.

Source: "Build A Tabletop Hovercraft," Science Bob. https://sciencebob.com/build-a-tabletop-hovercraft-2/
Adapted from Lesson Activity by Brian McNeill, Extension Educator, UMN Extension 4-H Youth Development, 2014.

Resources

Ordway's Local Resources

Bell Museum
www.bellmuseum.umn.edu

The Bell Museum brings together science, art, and the environment with a uniquely Minnesotan perspective. Features a digital planetarium, wildlife dioramas, outdoor learning spaces, and hands-on exhibits.

Minnesota Children's Museum
www.openeyetheatre.org

The Minnesota Children's Museum provides spaces for kids and families to explore interactive exhibits that provide opportunities for problem solving and skill-development in confidence, critical and creative thinking, communication, and more.

Science Museum of Minnesota
www.smm.org

The Science Museum of Minnesota offers interactive science exhibits for all ages to enjoy. Featuring dinosaurs, hands-on exhibits, and the Omnitheater.

Book Resources

- *What is the Scientific Method? Science Book for Kids,* Speedy Publishing LLC, 2017.
- *STEAM Kids: 50+ Science/Technology/Engineering/Art/Math Hands-On Projects for Kids,* Anne Carey, 2016.
- *Professor Astro Cat's Frontiers of Space*, Dr. Dominic Walliman, 2013.
- *National Geographic Kids Why?: Over 1,111 Answers to Everything*, Crispin Boyer, 2015.

Internet Resources

- Science Bob https://sciencebob.com/
- Flash Bang Science http://www.flashbangscience.co.uk/
- National Geographic Kids—Science https://www.natgeokids.com/uk/category/discover/science/
- Nova Labs https://www.pbs.org/wgbh/nova/labs/