DOKTOR KABOOM!

***Applause Series* CURRICULUM GUIDE**
CIVIC CENTER OF GREATER DES MOINES

November 3, 2011

Dear Teachers,

Thank you for joining us for the Applause Series presentation of *Doktor Kaboom!*. The creation of actor David Epley, *Doktor Kaboom!* strives to remind audiences of all ages that the foundations of scientific discovery can be joyful tools for a lifetime. We are confident that the zany and spectacular experiments that your students will witness during the show will reinvigorate their excitement for science and make lasting memories about the scientific method.

We thank you for sharing this very special experience with your students and hope that this study guide helps you connect the performance to your in-classroom curriculum in ways that you find valuable. In the following pages, you will find contextual information about the performance and related subjects, as well as a variety of discussion questions and activities. Some pages are appropriate to reproduce for your students; others are designed more specifically with you, their teacher, in mind. As such, we hope that you are able to "pick and choose" material and ideas from the study guide to meet your class's unique needs.

See you at the theater,

Civic Center Education Team

GUIDE CONTENTS

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This study guide was compiled and written by Karoline Myers; edited by Michelle McDonald and Eric Olmscheid.
Partially adapted from the "*Doktor Kaboom!* Educator's Resource Guide" and
the John F. Kennedy Center's "Doktor Kaboom! Cuesheet Performance Guide".

ABOUT THE CIVIC CENTER

The Civic Center of Greater Des Moines is a cultural landmark of central Iowa and is committed to engaging the Midwest in world-class entertainment, education, and cultural activities. The Civic Center has achieved a national reputation for excellence as a performing arts center and belongs to several national organizations, including The Broadway League, the Independent Presenters Network, International Performing Arts for Youth, and Theater for Young Audiences/USA.

Five performing arts series currently comprise the season— the Willis Broadway Series, Prairie Meadows Temple Theater Series, Wellmark Blue Cross and Blue Shield Family Series, the Dance Series, and the Applause Series. The Civic Center is also the performance home for the Des Moines Symphony and Stage West.

The Civic Center is a private, nonprofit organization and is an important part of central Iowa's cultural community. Through its education programs, the Civic Center strives to engage patrons in arts experiences that extend beyond the stage. Master classes bring professional and local artists together to share their art form and craft, while pre-performance lectures and post-performance Q&A sessions with company members offer ticket holders the opportunity to explore each show as a living, evolving piece of art.

Through the Applause Series— curriculum-connected performances for school audiences— students are encouraged to discover the rich, diverse world of performing arts. During the 2011-2012 season, the Civic Center will welcome more than 40,000 students and educators to 13 professional productions for young audiences.

Want an inside look? Request a tour.

Group tours can be arranged for performance and non-performance dates for groups grades 3 and above.

Call 515-246-2355 or visit CivicCenter.org/education to check on availability or book your visit.

DID YOU KNOW?

More than 250,000 patrons visit the Civic Center each year.

The Civic Center opened in 1979.

The Civic Center has three theater spaces:

- *Main Hall, 2744 seats*
- *Stoner Studio, 200 seats*
- *Temple Theater, 299 seats (located in the Temple for the Performing Arts)*

No seat is more than 155 feet from center stage in the Main Hall.

Nollen Plaza, situated just west of the Civic Center, is a park and amphitheater that is also part of the Civic Center complex. The space features the Brenton Waterfall and Reflection Pool and the Crusoe Umbrella sculpture.

The Applause Series started in 1996. You are joining us for our 16th season of school performances.

GOING TO THE THEATER . . .

YOUR ROLE AS AN AUDIENCE MEMBER

Attending a live performance is a unique and exciting opportunity. Unlike the passive experience of watching a movie, audience members play an important role in every live performance. As they act, sing, dance, or play instruments, the performers on stage are very aware of the audience's mood and level of engagement. Each performance calls for a different response from audience members. Lively bands, musicians, and dancers may desire the audience to focus silently on the stage and applaud only during natural breaks in the performance. Audience members can often take cues from performers on how to respond to the performance appropriately. For example, performers will often pause or bow for applause at a specific time.

As you experience the performance, consider the following questions:

* What kind of live performance is this (a play, a dance, a concert, etc.)?
* What is the mood of the performance? Is the subject matter serious or lighthearted?
* What is the mood of the performers? Are they happy and smiling or somber and reserved?
* Are the performers encouraging the audience to clap to the music or move to the beat?
* Are there natural breaks in the performance where applause seems appropriate?

THEATER ETIQUETTE

Here is a checklist of general guidelines to follow when you visit the Civic Center:

* Leave all food, drinks, and chewing gum at school or on the bus.
* Cameras, recording devices, and personal listening devices are not permitted in the theater.
* Turn off cell phones, pagers, and all other electronic devices before the performance begins.
* When the house lights dim, the performance is about to begin. Please stop talking at this time.
* **Talk before and after the performance only.** Remember, the theater is designed to amplify sound, so the other audience members and the performers on stage can hear your voice!
* 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. Enjoy yourself!

GOING TO THE THEATER information is adapted from the Ordway Center for the Performing Arts study guide materials.

CIVIC CENTER FIELD TRIP INFORMATION FOR TEACHERS

Thank you for choosing the Applause Series at the Civic Center of Greater Des Moines.
Below are tips for organizing a safe and successful field trip to the Civic Center.

ORGANIZING YOUR FIELD TRIP

* Please include all students, teachers, and chaperones in your ticket request.
* After you submit your ticket request, you will receive a confirmation e-mail within five business days. Your **invoice will be attached to the confirmation e-mail.**
* Payment policies and options are located at the top of the invoice. **Payment (or a purchase order) for your reservation is due four weeks** prior to the date of the performance.
* The Civic Center reserves the right to cancel unpaid reservations after the payment due date.
* Tickets are not printed for Applause Series shows. Your invoice will serve as the reservation confirmation for your group order.
* Schedule buses to arrive in downtown Des Moines at least 30 minutes prior to the start of the performance. This will allow time to park, walk to the Civic Center, and be seated in the theater.
* Performances are approximately 60 minutes unless otherwise noted on the website and printed materials.
* All school groups with reservations to the show will receive an e-mail notification when the study guide is posted. Please note that study guides are only printed and mailed upon request.

DIRECTIONS AND PARKING

* Directions: From I-235, take Exit 8A (Downtown Exits) and the ramp toward 3rd Street and 2nd Avenue. Turn onto 3rd Street and head south.
* Police officers are stationed at the corner of 3rd and Locust Streets and will direct buses to parking areas with hooded meters near the Civic Center. Groups traveling in personal vehicles are responsible for locating their own parking in ramps or metered (non-hooded) spots downtown.
* Buses will remain parked for the duration of the show. At the conclusion, bus drivers must be available to move their bus if necessary, even if their students are staying at the Civic Center to eat lunch or take a tour.
* Buses are not generally permitted to drop off or pick up students near the Civic Center. If a bus must return to school during the performance, prior arrangements must be made with the Civic Center Education staff.

ARRIVAL TO THE CIVIC CENTER

* When arriving at the Civic Center, please have an **adult lead your group** for identification and check-in purposes. You may enter the building though the East or West lobbies; a Civic Center staff member may be stationed outside the building to direct you.
* Civic Center staff will usher groups into the building as quickly as possible. Once inside, you will be directed to the check-in area.
* Applause seating is not ticketed. Ushers will escort groups to their seats; various seating factors including group size, grade levels, arrival time, and special needs seating requests may be used to assign a group's specific location in the hall.
* We request that an **adult lead the group into the theater and other adults position themselves throughout the group**; we request this arrangement for supervision purposes, especially in the event that a group must be seated in multiple rows.
* Please allow ushers to seat your entire group before rearranging seat locations and taking groups to the restroom.
* As a reminder, children under the age of three are not permitted in the theater for Applause performances.

IN THE THEATER

* In case of a medical emergency, please notify the nearest usher. A medical assistant is on duty for all Main Hall performances.
* We ask that adults handle any disruptive behavior in their groups. If the behavior persists, an usher may request your group to exit the theater.
* Following the performance groups may exit the theater and proceed to the their bus(es).
* If an item is lost at the Civic Center, please see an usher or contact us after the performance at 515.246.2355.

QUESTIONS?
Please contact the Education department at 515.246.2355 or education@civiccenter.org.
Thank you!

ABOUT THE PERFORMANCE: EXPERIMENTS

Doktor Kaboom, whose real name is David Epley, is a comedian with a love of science. When he performs, he plays the role of a scientist from Germany. To show that you agree with Doktor Kaboom, remember to say "ja" (pronounced "yah"), which is German for "yes."

David performs "improvisational comedy," which means that he "improvises" (changes) his jokes depending on what happens during his show. To add to the fun, the audience never knows what he'll say next.

Doktor Kaboom will perform several daring experiments and demonstrations during the show. Some will even include volunteers from the audience. Be sure to raise your hand if you wish to volunteer.

Read about three of the experiments Doktor Kaboom will perform before coming to the performance (right), as well as the big science ideas that Doktor Kaboom will talk about during the show, such as safe science and scientific fact (page 7).

1 - A Chemical Reaction

Doktor Kaboom has a special mission: to create a fizzy liquid mixture in a gigantic plastic tube. He and his audience volunteer have to be careful to make sure the mixture turns out just right. Will the experiment work as planned? As Doktor Kaboom says, "It's science – what could possibly go wrong?"

Watch for…

* the order of the ingredients
* the moment when the mixture fizzes

2 – The Catapult "Schmatapult"

What does a scientist do when he wants to give a banana to someone across the room? Build a catapult for bananas, of course!

Watch for…

* the different parts of the catapult
* the way Doktor Kaboom uses a lever to shoot the banana
* how much force Doktor Kaboom needs to send the banana across the stage

3 – The Air Cannon

Now it's time to learn about the power of air. You've probably blown bubbles using air, dish soap, and wands. Doktor Kaboom, on the other hand, blows fog machine rings with *cannons*. If you think his first cannon looks big, just wait for his huge surprise at the end of the show.

Watch how…

* Doktor Kaboom can "show" air
* he sends one fog ring flying through another

ABOUT THE PERFORMANCE: SCIENCE BIG IDEAS

BIG IDEA #1: SAFE SCIENCE

As Doktor Kaboom says, "Science can hurt you, especially if I'm the one doing the science." He has to watch out for splashes of chemicals, or very hot or cold liquids. Even an expert experimenter can face unexpected dangers, so Doktor Kaboom suits up even if there's only the tiniest chance it will be necessary.

Goggles: Much as they do for swimmers, goggles protect scientists' eyes.

Lab Coat: Long sleeves cover Doktor Kaboom's clothing and his skin.

Gloves: Gloves protect Doktor Kaboom's hands.

What do you think?

* Why should we always practice safe science?

* If you are going to do an experiment or demonstration, and you already know you won't need safety glasses, why should you wear them?

BIG IDEA #2: SCIENTIFIC FACT

One of the things that Doktor Kaboom always likes to say is that "There is no such thing as a scientific fact."

We call gravity a scientific fact, when in reality, it is no such thing. We assume gravity will work as we expect, simply because it always has. Gravity has worked so far. There is always a possibility that some time in the future, it will behave differently. We must remember to keep an open mind. Sometimes a 'scientific fact' is falsified by newer and better science. That's how science works.

What do you think?

* Do you agree with Doktor Kaboom that there is no such thing as scientific fact?

* Can you think of examples of scientific theories that people once believed were true that have been proven false with newer and better science?

BIG IDEA #3: BEING RIGHT

When we have an idea in science, we call it a theory. We test our theory with experiments.

What do you think?

* Does it matter in science whether we are right or wrong?

BIG IDEA #4: APPLYING SCIENCE TO EVERYDAY LIFE

We often forget to apply what we know of science to our everyday lives. Doktor Kaboom will demonstrate this with his catapult. He will share how you can use your new knowledge of levers and fulcrums to win the Test of Strength at the state fair.

What do you think?

* Can you think of ways that you can apply your knowledge of science to something you do in your everyday life?

ABOUT THE ARTIST, DAVID EPLEY

Doktor Kaboom! is the creation of Actor/Comedian David Epley. During the show, David plays the role of the German scientist Doktor Kaboom. Learn more about David before seeing the performance.

TWO PASSIONS

David has been fortunate enough to discover two passions in his life. Science, his first, led him to study at the North Carolina School of Science and Mathematics. His second, performing, became his career. For 20 years, David has made his living by writing, performing, and directing original interactive comedy across the United States and Canada.

With *Doktor Kaboom!*, David brings his passions together for an exciting solo show – a science comedy extravaganza with an explosive style that refuses to allow audiences the time to catch a breath.

PERFORMANCES

David performs for many different types of audiences in many different types of settings. In addition to performances for schools, David performs for families, at outdoor festivals, and for company gatherings. *Doktor Kaboom!*'s material is guaranteed to thrill audience members of all ages and to create many laughs along the way. David's experience in improvisational comedy means that no two shows will ever be exactly the same.

PERSONAL LIFE

When he is not traveling and performing, David lives in Yellow Springs, Ohio. He is the proud papa of his 5-year-old daughter, Jindalee.

He believes strongly in service, is a veteran of the United States Army, and volunteers as an EMT and firefighter with his local Fire/ Rescue department.

"Fantastic show today, absolutely fantastic...Doktor Kaboom's familiarity with the audience, ability to improvise and engage the crowd sets the show apart from all other science shows that I've seen"
-Philip Wilson,
New World Stages,
New York, NY

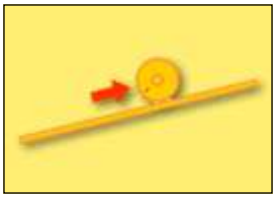
SIMPLE MACHINES GLOSSARY

During the performance, Doktor Kaboom will use a catapult, which is a lever. A lever is a type of simple machine. A simple machine is a machine with few or no moving parts that makes work easier. Simple machines surround us in our daily life. Learn more about the different simple machines and familiar examples of each.

INCLINED PLANE

A sloping surface, such as a ramp. An inclined plane can be used to alter the effort and distance involved in doing work, such as lifting loads. The trade-off is that an object must be moved a longer distance than if it was lifted straight up, but less force is needed.

Examples:
∗Staircase
∗Ramp



WEDGE

Two inclined planes joined back to back. Wedges are used to split things.

Examples:
∗Axe
∗Zipper
∗Knife

SCREW

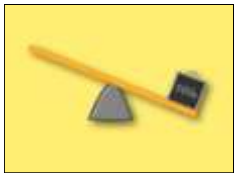
An inclined plane wrapped around a shaft or cylinder. This inclined plane allows the screw to move itself or to move an object or material surrounding it when rotated.

Examples:
∗Bolt
∗Spiral staircase
∗Top of a jar

LEVER

A straight rod or board that pivots on a point known as a fulcrum. The fulcrum can be moved depending on the weight of the object to be lifted or the force you wish to exert. Pushing down on one end of a lever results in the upward motion of the opposite end of the fulcrum.

Examples:
∗Door on hinges
∗Seesaw
∗Hammer
∗Bottle opener



PULLEY

A wheel that usually has a groove around the outside edge. This groove is for a rope or belt to move around the pulley. Pulling down on the rope can lift an object attached to the rope. Work is made easier because pulling down on the rope is made easier due to gravity.

Examples:
∗Flag pole
∗Crane
∗Mini-blinds

WHEEL AND AXLE

A wheel and axle has a larger wheel (or wheels) connected by a smaller cylinder (axle) and is fastened to the wheel so that they turn together. When the axle is turned, the wheel moves a greater distance than the axle, but less force is needed to move it. The axle moves a shorter distance, but it takes greater force to move it.

Examples:
∗Door knob
∗Wagon
∗Toy car

GEARS

Two toothed wheels fit together either directly or through a chain or belt so one wheel will turn the other. Some gears may have a screw or a toothed shaft in place of one of the wheels. A gear may also be a combination of toothed wheels that produces a certain speed (such as a bicycle's top gear which makes the bike go fast, and the low gear for slow speed.)

Examples:
∗Clock
∗Automobile
∗Drill

Simple Machines Glossary information adapted from and images courtesy of edheads.org/activities/simple-machines.

VOCABULARY

amplify: to cause to become more marked or intense.

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

Doktor Kaboom creates a chemical reaction during a demonstration.

chemical reaction: occurs when two different elements or compounds, come together and at least one of them changes its composition or identity. With the help of a volunteer, Doktor Kaboom will demonstrate how to create a fizzy mixture through a chemical reaction during his show.

demonstration: showing the existence or truth of something by giving proof or evidence. Doktor Kaboom will perform several demonstrations during the show.

exothermic: chemical reactions that produce (or give off) heat. Fire is one example of an exothermic reaction.

experiment: a scientific procedure undertaken to make a discovery or to test a hypothesis.

force: anything that acts on a body to change its rate of acceleration or alter its momentum.

fulcrum: the point on which a lever rests or is supported and on which it pivots.

lever: a rigid bar resting on a pivot, used to help move a heavy or firmly fixed load with one end when pressure is applied to the other.

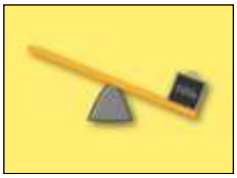


Diagram of a lever. Can you spot the fulcrum?
Image courtesy of edheads.org

simple machine: a device that has only one function and a minimum of moving parts. Seven simple machines make work easier for us: inclined plane, wedge, screw, lever, pulley, wheel and axle, and gears.

theory: a supposition or a system of ideas intended to explain something.

transmit: to pass on from one place or person to another.

vacuum: a space where there is no matter.

Ocean whirlpool.
Image courtesy of uvs-model.com.

vortex: a mass of whirling fluid or air, esp. a whirlpool or whirlwind. Doktor Kaboom creates an air vortex with the use of an air cannon.

ACTIVITIES AND DISCUSSION, pg. 1 of 4

IMPROVISATION GAME: WHAT ARE YOU DOING?

When: Before or after the show

Goal: David Epley, the creator of Doktor Kaboom, is both a scientist and an improvisational comedian. To improvise, one must be creative and able to think quickly on one's feet. Students will practice these skills by playing the game 'What Are You Doing?,' a game where you say one thing but do another.

Activity:
1. Have students stand in a circle.
2. To play, the first person pretends to do an action like brushing their teeth or planting a garden.
3. The person next to them then asks, "What are you doing?"
4. The person who is pretending to do an action must respond by saying an action that is different than what they are showing. For example, they might say "I'm playing the trombone."
5. Then the person who asked must pretend to do the action that was just said (playing the trombone).
6. The next person then asks what that person is doing and he or she will reply with another action.
7. The game continues around the circle.
8. Once everyone has grasped the game, you may implement the rule that once you make a mistake you are out. To keep everyone thinking quickly, no actions can be repeated. Keep it going as fast as you can!

Follow-up questions:
1. Did you find this challenge easy or hard? Why?
2. What was the most difficult part?

IMPROVISATION GAME: PASS THE BALL

When: Before or after the show

Goal: David Epley, the creator of Doktor Kaboom, is both a scientist and an improvisational comedian. To improvise, one must be creative and able to think quickly on one's feet. Students will practice these skills by playing the game 'Pass the Ball,' a game where participants pantomime throwing a ball.

Activity:
1. Have students stand in a circle.
2. Ask the players to pass a mimed ball to others (one ball at a time). To show who you are 'passing' the ball to, students should make eye contact with one another.
3. While the ball is passed between two students, the other students should be sure to watch it.
4. As students become comfortable, give suggestions about the nature of the ball. For example, it becomes heavier and heavier until it weighs a ton, or extremely light, extremely big, or extremely small.
5. The actors must convey the ball's characteristics in the way it gets passed.

Follow-up questions:
1. What sort of teamwork was needed to play this game?
2. How did you show that the ball was _____?
3. Do you think actor David Epley uses his body and the way he moves to portray the character of Doktor Kaboom in a certain way? Do all actors use their bodies? Why?

ACTIVITIES AND DISCUSSION, pg. 2 of 4

SIMPLE MACHINE SCAVENGER HUNT

When: Before or after the show

Goal: To identify simple machines that students encounter in their daily lives.

Activity:
1. Review the 'Simple Machines Glossary' (found on page 9) as a class.
2. Remind students that they encounter simple machines in their daily lives.
3. Ask students to go on a scavenger hunt to find simple machines in their environment. You may choose to look for simple machines in the classroom, on the playground, or to invite students to look in their homes.
4. Ask students to find at least one example of each of the following simple machines: inclined plane, wedge, screw, lever, wheel and axle, and pulley.
5. Have students draw a picture of each of the simple machines they identified and to write a short sentence or two to describe what kind of work the machine helps us do.
6. Compile students' answers and post them in your classroom. See how many different examples you can find of each.

Follow-up Questions:
1. How do simple machines help us?
2. What types of simple machines were most common? Which ones were harder to find? Why do you think that is?

MARSHMALLOW CATAPULTS

When: After the show

Goal: To create a marshmallow catapult, drawing on knowledge of levers and fulcrums

Materials:
* Small blocks of wood
* Plastic spoons
* Masking or duct tape
* Large marshmallows

Activity:
1. Ask students to recall Doktor Kaboom's catapult demonstration.
2. Tell students that they are going to design their own marshmallow catapults.
3. Provide each student with a plastic spoon, a block of wood, and some tape.
4. Invite them to create a catapult using their new knowledge of levers and fulcrums. Their goal will be to launch their marshmallow as far as possible.
5. When the catapults are constructed, have an informal contest to see who can launch a marshmallow the farthest.
6. Invite students to make alterations to their catapults as they so desire to improve their performance.

Follow-up questions:
1. How did your catapult act as a lever? Where was the fulcrum?
2. Were there features of certain catapults that improved their performance? What were they?

ACTIVITIES AND DISCUSSION, pg. 3 of 4

OBSERVING A CHEMICAL REACTION

When: After the performance

Goal: Doktor Kaboom demonstrates a chemical reaction whose product is very easy to see, but some chemical reactions create a product that we cannot see. Students will explore this concept by trapping gas created by a chemical reaction in a balloon.

Materials:

* Clean, empty 4 oz. plastic bottle
* Water
* Effervescent antacid tablet
* Paper towel
* Latex balloon
  Hint: Blow up the balloon and let the air out a few times before using it in the activity. This will allow the balloon to more easily expand.
* Clock or timer

Activity:

1. Fill the plastic bottle half way with water.
2. Break one effervescent antacid tablet into several pieces over a paper towel. Carefully place the pieces of the tablet in the water.
3. Hold the bottle steady. An adult should quickly pull the opening of the balloon over the mouth of the bottle.
4. Have students carefully observe the balloon.
5. Use the clock or timer to see what happens in one minute's time.
6. After one minute has passed, remove the balloon from the bottle by pinching the neck of the balloon and gently pulling it off the mouth of the bottle. Slowly release the air from the balloon.
   Note: If at any time, you notice the balloon has gotten too big, remove it from the bottle.
7. Have students draw a picture of the balloon just after you put it on the bottle and a picture of what the balloon looked like after a minute had passed.
8. Pour the liquids down the drain and throw away the balloon and other materials. Thoroughly wash the work area and wash your hands.

Explanation:

Effervescent antacid tablets contain an acid, similar to vinegar or lemon juice, and a base, similar to baking soda. When the acid and base are dry like they are in the tablet, they do not react. When they dissolve in the water, they react to produce carbon dioxide gas. You cannot see the gas, but you can show that it is there by collecting it in the balloon.

Follow-Up Questions:

1. What substances were combined to make the chemical reaction?
2. What did the chemical reaction produce? How do you know?
3. What do you think would happen if we used more or less water? (Try it!)
4. What do you think would happen if warm water is used versus room temperature or cold water? (Try it!)

Activity adapted from "It's a Gas!" lesson from the American Chemical Society, acs.org/kids.

ACTIVITIES AND DISCUSSION, pg. 4 of 4

MATH PATTERNS (grades 5 and up)

When: Before or after the show

Overview: It is unfortunate that many people grow up deciding they hate mathematics. It is more likely that they simply dislike numbers. Math, however, is not about numbers. Numbers are simply the alphabet of mathematics. Math is about patterns. We use numbers to describe and explore these patterns. Use the following examples to explore how math is about patterns.

Pattern Example 1:
Counting is a pattern: 1, 2, 3, 4, 5… The next number in the pattern is, of course, 6. The pattern continues on and on.

Can you spot any patterns with multiples of 9?

1 x 9 = 09	10 x 9 = 90	09, 90
2 x 9 = 18	9 x 9 = 81	18, 81
3 x 9 = 27	8 x 9 = 72	27, 72
4 x 9 = 36	7 x 9 = 63	36, 63
5 x 9 = 45	6 x 9 = 54	45, 54

Pattern Example 2:
Using this pattern, you can multiply 11 by any two-digit number faster than someone else can do it with a calculator. (Try it!)

To multiply any two-digit number by 11 use the following steps: (For this example we will use the number 26.)

1. Separate the two digits in your mind. (2_6)
2. Notice the hole between them!
3. Add the two digits together. (2 + 6 = 8)
4. Put the sum of the two numbers in the hole. (286.)
5. That's it! 26 x 11 = 286

The only tricky thing to remember is that if the result of the addition is greater than 9, you only put the "ones" digit in the hole. You then carry the "tens" digit from the sum. For example, 49 x 11.

1. Separate the two digits in your mind. (4_9)
2. Add the two digits together. (4 + 9 = 13)
3. Put the "ones" digit in the hole. (3)
4. Add the "tens" digit (1) to the first number (4).
   (1 + 4 = 5)
5. This gets you the result 539. 49 x 11 = 539

Activity adapted from "*Doktor Kaboom! Educator's Resource Guide.*"

CLASSROOM DEMONSTRATIONS, pg. 1 of 3

AIR PRESSURE DEMONSTRATION

Overview:
Doktor Kaboom will conduct a demonstration of air pressure using an egg and a bottle. After the performance, you may replicate the demonstration in your classroom. For safety reasons, this demonstration should be led by an adult.

Materials:
* Boiled eggs, peeled
* Narrow necked bottle or flask
* Matches
* Paper

Procedure:
1. Place a peeled, boiled egg on top of the bottle.
2. Ask students if they can think of a way of getting the egg into the bottle without causing it to break.
3. Remove the egg from the top of the bottle, momentarily.
4. Light the match and start burning a small piece of paper.
5. Drop the burning paper into the bottle and place the egg on top of the bottle, narrow end down.
6. Observe the flame go out shortly thereafter, the egg beginning to be "sucked" into the bottle, and the entire egg go in the bottle with minimal damage.

Follow-up Questions:
1. How are the burning piece of paper and the fact that the egg gets "sucked" into the bottle related?
2. Does the egg really get "sucked" into the bottle? (Explain the procedure in a more scientific fashion.)
3. Can you think of a method to get the egg out of the bottle, without causing damage to the egg?

Explanation:
The egg is not sucked into the bottle. In reality, it is pushed. The flame heated the air inside the bottle, causing the air to expand. It escapes the bottle, creating a pressure differential between the inside and the outside of the bottle. This results in air molecules outside the bottle hitting the egg with more force per area than the air molecules on the inside, resulting in the egg literally being pushed into the bottle.

Demonstration adapted from "*Doktor Kaboom! Educator's Resource Guide.*"

CLASSROOM DEMONSTRATIONS, pg. 2 of 3

ELEPHANT TOOTHPASTE

Overview: This demonstration of a chemical reaction shows the decomposition of hydrogen peroxide catalyzed by potassium iodide. The reaction is done in a tall graduated cylinder so that the foam product shoots out very quickly in a tall cylindrical shape; hence, the name elephant toothpaste. For safety, this demonstration should be led by an adult.

Materials:

- Tall graduated cylinder (at least 500 ml)
- Food coloring
- Dish detergent
- 30% hydrogen peroxide (H_20_2)
  Hint: use 6% H_20_2 for a safer demo. This is available at beauty supply stores.
- Saturated solution of potassium iodide (KI)
- Disposable gloves

Hazards:
1. Wear safety goggles. Also, wear disposable gloves when pouring 30% hydrogen peroxide, as it is a very strong oxidant.
2. Do not stand over the graduated cylinder because steam and oxygen will be produced quickly.

Procedure:
1. Place a garbage bag or other covering on the lab table and possibly on the floor.
2. Put on disposable gloves. Pour 80 ml of 30% hydrogen peroxide into a graduated cylinder.
3. Add about 20 ml of dish detergent to the hydrogen peroxide.
4. Tilt the graduated cylinder and drip red and/or blue food coloring down the sides of the graduated cylinder to make your toothpaste striped.
5. Quickly add the saturated solution of KI solution and stand back. Move your hand away from the top of the graduated cylinder quickly or the hot foam will get on your hand and arm.

Follow-up Questions:
1. What is a chemical reaction?
2. What did you observe during this demonstration that makes you believe this is a chemical reaction?
3. Can you think of other examples of chemical reactions in your everyday life?

Explanation:
The rapid catalyzed decomposition of hydrogen peroxide produces O_2 gas, which forms foam with the liquid detergent.

$$2H_2O_2\,(aq) \rightarrow 2H_2O + O_2\,(g)$$

The I-1 ion is a catalyst for the reaction. The brown color of the foam is evidence of iodine in the reaction. Note: It will stain clothes, skin, and carpet.

Disposal:
Leave the gloves on while cleaning up. The foam and solution left in the graduated cylinder may be rinsed down the drain with excess water.

Demonstration adapted from "*Doktor Kaboom! Educator's Resource Guide.*"

CLASSROOM DEMONSTRATIONS, pg. 3 of 3

AIR CANNON

Overview: Doktor Kaboom will conduct a demonstration by using an air cannon. You too can create a vortex by constructing your own air cannon. For safety reasons, an adult should construct the air cannon and handle fog or other materials used to show air movement.

Materials:
- 1 large trash can
- 1 heavy duty shower curtain or garbage can
- Duct tape
- Fog machine and fluid

Procedure:
1. Carefully measure, mark, and cut a hole in the bottom of the trash can. Be sure the hole is no more than 50% of the diameter of the can.
2. Trim and tape the shower curtain over the open end of the can. Pull the fabric fairly taut, and be sure to tape it down completely around the can. You do not want air to escape this end.
3. Hold or set the can horizontally. Fill the can with fog.
4. Slap the membrane (made from the shower curtain) and observe the response.

Alternatives to fog machine:
- Dry ice and warm water
- Incense
- Smoke balls (outside only)

Follow-up Questions:
1. How are the rings being formed?
2. What would happen if the can were a box rather than a cylinder? (Try it!)
3. What would happen if the hole were bigger or smaller?
4. What if the hole were triangular instead of circular? (Try it!)

Explanation:
When we hit on the end of the air cannon, we are moving the air through the cannon at high speed. The air in the center continues to move at high speed, the air around the edges is slowed down, twisted around upon itself, which makes the air vortex.

Demonstration adapted from "*Doktor Kaboom! Educator's Resource Guide.*"

RESOURCES AND SOURCES

CLASSROOM RESOURCES

Print Resources:

Spangler, Steve. Naked Eggs and Flying Potatoes: Unforgettable Experiments that Make Science Fun. Austin, TX: Greenleaf Book Group Press, 2010.

Spolin, Viola. Theater Games for the Classroom: A Teacher's Handbook. Evanston, IL: Northwestern University Press, 1986.

Wheeler-Toppen, Jodi. Science Experiments that Fizz and Bubble: Fun Projects for Curious Kids. Mankato, MN: Captsone Press, 2011.

Web Resources:

Edheads— Activate Your Mind!. http://www.edheads.org/
Provides free, educational online games focused on science, math, and critical thinking. The section on simple machines contains a glossary, lesson plans, and an interactive game in which students explore different simple machines and their uses in a fictional house and tool shed.

Doktor Kaboom! Official Website. www.doktorkaboom.com
Contains photos and video clips of several of the demonstrations for teachers to preview or to watch again as a class following the performance.

"Science for Kids." American Chemical Society.
http://portal.acs.org/portal/acs/corg/content_nfpb=true&_pageLabel=PP_TRANSITIONMAIN&node_id=878&use_sec=false&sec_url_var=region1&__uuid=1ed935bb-905a-4279-97db-65e37daba6ad
Contains wide variety of science lesson plans for elementary and middle school students, including activities that explore chemical and physical change.

STUDY GUIDE SOURCES

Print Sources:

"*Doktor Kaboom!* Educator's Resource Guide"

John F. Kennedy Center's "*Doktor Kaboom!* Cuesheet Performance Guide"

Online Sources:

Doktor Kaboom! Official Website. www.doktorkaboom.com

"It's a Gas" Lesson Plan. American Chemical Society. http://portal.acs.org/portal/PublicWebSite/education/whatischemistry/scienceforkids/chemicalphysicalchange/chemicalreactions/CSTA_014883

"Simple Machines." Edheads— Activate Your Mind!. www.edheads.org/activities/simple-machines