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# ***Doktor Kaboom!***

## ***It's JUST Rocket Science!***

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Educator's Resource Guide

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### Introduction

Welcome, this study guide is intended to assist educators as a supplement to live performances of “*Doktor Kaboom! It’s JUST Rocket Science*” The resources on the following pages are designed to help your students fully grasp the scientific and theatrical concepts they have experienced, and to nourish the seeds of discovery and adventure that we hope to have planted.

### Mission

*Doktor Kaboom!* strives to remind audiences of all ages that the foundations of scientific discovery can be joyful tools for a lifetime. Through highly interactive comic performances we encourage students to express their awe of scientific demonstrations, to creatively explore the world around them, and to realize that science and mathematics are meant for everyone.

### Artist Bio

Doktor Kaboom is the creation of Actor/Comedian David Epley.

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

Since creating the character of Doktor Kaboom, science education has become David’s life, taking him to theatres and schools all over the world. He has had multiple national television appearances, performances at the John F. Kennedy Center, and recently participated in a Global Online Town Hall hosted by former Vice President Al Gore.

David lives in Seattle, Washington, and is the proud papa of his 7-year-old daughter, Jindalee. He believes strongly in service, is a veteran of the US Army, and for five years volunteered as an EMT and firefighter with his local Fire/Rescue department.

Vocabulary

**Apex:** the top or highest part of something

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

**Centripetal Force:** a force that acts on a body moving in a circular path and is directed toward the center around which the body is moving.

**Centrifugal Force:** apparent force that acts outward on a body moving around a center, arising from the body's inertia.

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

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

**Gravity:** force that attracts a body toward the center of the earth, or toward any other physical body having mass.

**Inertia:** property in which an object at rest stays at rest, or an object in motion stays in motion, until acted upon by an outside force.

**Momentum:** quantity of motion of a moving body, measured as a product of its mass and velocity.

**STEM:** Acronym for Science Technology Education Mathematics

**Speed:** the rate of movement of an object

**Trajectory:** the path described by a projectile flying or an object moving under the action of given forces.

**Thrust:** the propulsive force of a jet or rocket engine.

**Velocity:** the speed of something in a given direction

### Topics for Discussion

These topics are great conversation starters for classroom discussions following the performance:

#### The Final Frontier?

What benefits are there for mankind in exploring space?

#### Math

Rocket Science is science, why do we need math to travel in space?

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 the **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.

#### Being Right

When we have an idea in science, we call it a hypothesis. We test our hypothesis with experiments. Does it matter in science whether we are right or wrong?

#### Math Patterns

(grades 5 and higher)

Math patterns

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

For example, counting is a pattern: 1, 2, 3, 4, 5... The next number in the pattern is, of course, 6. And on, and on, and on.

For Example, Multiples of 9:

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

A fun pattern:

Using this pattern you can multiply 11 by any 2-digit number faster than someone else can do it with a calculator.

To multiply any two digit number by 11:

- \* For this example we will use 26.
- \* Separate the two digits in your mind (2\_\_6).
- \* Notice the hole between them!
- \* Add the 2 and the 6 together ( $2+6=8$ )
- \* Put the resulting 8 in the hole: 286. That's it!  $26 \times 11 = 286!$

The only thing tricky to remember is that if the result of the addition is greater than 9, you only put the "ones" digit in the hole and carry the "tens" digit from the addition. For example  $49 \times 11 \dots 4\_9 \dots 4 + 9 = 13 \dots$  put the 3 in the hole and add the 1 from the 13 to the 4 in order to get 5 for a result of 539  $\dots 49 \times 11 = 539$ .

Google the term Math magic to find thousands of these patterns, and the tools for learning them

[Classroom Demo, Film Can Rockets](#)

Materials:

- \* Old style film cans (the white/translucent ones work the best)
- \* Alka Seltzer Tablets
- \* Water
- \* Construction paper, Tape, Scissors
- \* Safety goggles!

Procedure:

1. Put on those safety.
2. Break the seltzer tablet into fourths.
3. Remove the lid from the film canister and put a teaspoon (5 ml) of water into the canister.
4. Drop the tablet half into the canister and snap the cap onto the canister (make sure that it snaps on tightly.)
5. Quickly put the canister on the down and step back
6. About 10 seconds later, you will hear a POP! and the film canister lid will launch into the air!
7. Now use the construction paper to build a rocket body around the film can, with the film can upside down. Be creative, have fun!
8. Repeat steps 1-5. BLAST OFF!

Discussion:

1. Does water temperature affect how fast the rocket launches?
2. Does the size of the tablet piece affect how long it takes for the rocket to launch?
4. How much water in the canister will give the highest flight?
5. How much water will give the quickest launch?

Explanation:

When you add the water it starts to dissolve the alka-seltzer tablet. This creates a gas call **carbon dioxide**. As the carbon dioxide is being released, it creates pressure inside the film canister. The more gas that is made, the more pressure builds up until the cap it blasted down and the rocket is blasted up. This system of thrust is how a real rocket works whether it is in outer space or here in the earth's atmosphere.

Classroom Demo, Centripetal Force

A fun demo for students to do themselves and generate discussion on centripetal force, and the incorrect term, "centrifugal force".

Materials:

1. Clear balloons, one per child or lab group
2. Pennies
3. Hex nuts
4. Safety goggles

Procedure:

1. Place a penny in a balloon.
2. Inflate the balloon, and tie it off.
3. Hold the balloon from one end and spin it around quickly, for a few moments, then hold it still.

Due to Centripetal Force, the penny will begin to roll around the inside of the balloon, imitating a satellite in orbit, or the motion of the planets around the sun.

Use a hex nut instead of a penny for a fun sound effect.

Discussion:

The penny is moving around the balloon, seeking a center point. CENTRipetal Force. A satellite does the same thing, literally falling constantly around the planet.

According to Newton's first law of motion, a moving body travels along a straight path with constant speed unless it is acted on by an outside force. For circular motion to occur there must be a constant force acting on a body, pushing it toward the center of the circular path.

An Invitation

Join me online for fun videos, links and daily discussion at

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

See you there!

Ja? Ja!

