



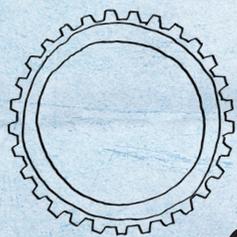
WARNING

SCIENCE IN PROGRESS

KA-BOOM!



$$W = \frac{M}{2} v^2$$



EXPLORE SCIENCE THE MYTHBUSTERS WAY!

MYTHBUSTERS

THE EXPLOSIVE EXHIBITION





The Mythbusters mix scientific method, gleeful curiosity and plain old-fashioned ingenuity to create their own signature style of explosive experimentation. Using simple instructions and easy to find materials, you too can discover at home or at school!

This guide contains 10 hands-on activities related to myths explored in Mythbusters: The Explosive Exhibition. Each activity includes everything you need to get started – a question to investigate, the stuff you'll need, a “how-to” guide and a bit about the science behind it all. Use the Blueprint attached to each activity to follow along and keep track of your findings, then share your results. So select an activity, gather your materials and get started! What can you discover?

THE MYTHBUSTERS METHOD STARTS HERE

| | |
|-----------------|--|
| WONDER | What crazy questions can we ask? |
| RESEARCH | What is already known about those questions? |
| GUESS | What do you think the answers are? |
| TEST | Design experiments to answer the questions. |
| DISCOVER | Test and test again... and break some stuff too. |
| RESULTS | What did your experiments tell you? |
| SHARE | Shout it from the rooftops. Make a TV show about it! |

SAFETY FIRST!

Stepping into the shoes of a MythBuster should not mean sacrificing your safety. Keep these guidelines in mind for each activity:

1. Read or listen carefully to all the directions before your start the experiment.
2. Use the equipment and materials only as instructed.
3. Keep your work area clean and organized.
4. Take care when using scissors, or restrict their use to adults.
5. Use plastic instead of glass wherever possible.

Note to Teachers: Each activity lists Tips for Teachers and the National Science Education Standards addressed by the lesson, making it easier to tie the experience to your classroom curricula.

ACTIVITY 1: AIRSPEED

When you blow up a balloon and let go, why does it fly all over the place? How can you control its speed?

Mythbusters: The Explosive Exhibition related exhibit - Airplane on a Conveyor Belt

ACTIVITY 2: STABLE STRUCTURES

Can you build a structure to withstand the elements? What's the strongest shape?

Mythbusters: The Explosive Exhibition related exhibit - Big Bad Wolf

ACTIVITY 3: TABLECLOTH CHALLENGE

Can you pull a tablecloth off a set table – without breaking anything?

Mythbusters: The Explosive Exhibition related exhibit - Tablecloth Challenge

ACTIVITY 4: PRACTICE MAKES PERFECT

Challenge yourself with a physical task. Do you get better with practice?

Mythbusters: The Explosive Exhibition related exhibit - Change Like a Superhero

ACTIVITY 5: FLIP IT

Can you predict if a coin flip will land as heads or tails? How does the design of your experiment affect the outcome?

Mythbusters: The Explosive Exhibition related exhibit - Butter Side Up

ACTIVITY 6: WIND AND RAIN

Does the angle of rain impact how much falls on a particular spot?

Mythbusters: The Explosive Exhibition related exhibit - Running in the Rain

ACTIVITY 7: SUPERHERO STRENGTH

How long can you keep a rubber band stretched before your muscles quit in protest?

Mythbusters: The Explosive Exhibition related exhibit - Cliff Hanger

ACTIVITY 8: REFLEXES

How fast are your reactions? Can you compete with a Mythbuster?

Mythbusters: The Explosive Exhibition related exhibit - Dodge a Bullet

ACTIVITY 9: TELL ME ABOUT IT

Can your keen observation and communication skills help a partner to identify something they can't see?

Mythbusters: The Explosive Exhibition related exhibit - Blind Driving

ACTIVITY 10: SPIN IT

How does the shape of paper effect how it flies through the air?

Mythbusters: The Explosive Exhibition related exhibit - Killer Card Toss

This guide has been developed for use by educators, group leaders and families for use in connection with "Mythbusters: The Explosive Exhibition" (the "Educators"). The activities described in this guide are potentially dangerous and could result in injury or damage. This guide is provided on an "AS IS" basis and the MythBusters Exhibition, LLC disclaims all warranties, express or implied, regarding the guide. Use of this guide is done at the risk of the Educators. By using this guide, you release the MythBusters Exhibition, LLC, its officers, employees, directors, contractors, agents and volunteers from and against any and all liability, claims, actions, costs, expenses, damages, attorney fees, breach of contract actions and all causes of actions whatsoever, that you may now have or may acquire in the future, arising out of or relating to any loss, damage or injury that may be sustained by you, the people you are educating, or to any property belonging to you or the people you are educating, as a result of the use of the guide.

ACTIVITY #1

AIRSPEED



MYTHBUSTERS: THE EXPLOSIVE EXHIBITION COMPONENT:
AIRPLANE ON A CONVEYOR BELT

MYTHBUSTERS
THE EXPLOSIVE EXHIBITION.

 **Discovery**
EDUCATION

WONDER

When you blow up a balloon and let go, why does it fly all over the place? How can you control its speed?

RESEARCH

A force is a push or a pull used to make an object move. Forces can be used to start an object in motion, stop an object's motion, or make it speed up, slow down or change direction. Sir Isaac Newton discovered three laws that can be used to describe forces and motion.

Newton's First Law of Motion says that an object will keep moving or stay still until an outside force pushes or pulls on it. You've probably experienced Newton's First Law while riding in a car. If the driver has to slam on the brakes (thus applying a force), you continue to move forward until an outside force, your seatbelt, pushes you back against your seat. Crazy drivers!

Newton's Third Law says that for every action there is an equal and opposite reaction. Take, for example, sitting in a chair. You are pushing down on the chair because of the force of gravity. In return, the chair pushes back up on you with an equal but opposite force.

Energy is an important part of Newton's Laws as well. Energy is the ability to do work – it lets us do things. One kind of energy is called potential, or stored, energy. An un-inflated balloon resting on a table is in a state of equilibrium – it's not moving because the forces acting upon it are balanced. But if you start inflating it, the work you are doing changes the shape of the balloon and gives it potential energy. How can you tell? Let go! It flies across the room, darting here and there as the air inside is pushed out and the balloon returns to its original shape. The stored (potential) energy is transformed into kinetic energy, or energy of motion, as the air pushes against the balloon.

TEST AND DISCOVER

MATERIALS

- 2 three meter pieces of string
- Scissors
- Drinking straw (cut in half)
- Tape
- Stopwatch (optional)
- Balloons (medium-large)
- Meter stick
- Blueprint
- Partner (to help you set up your track and launch the balloons)

SAFETY FIRST!

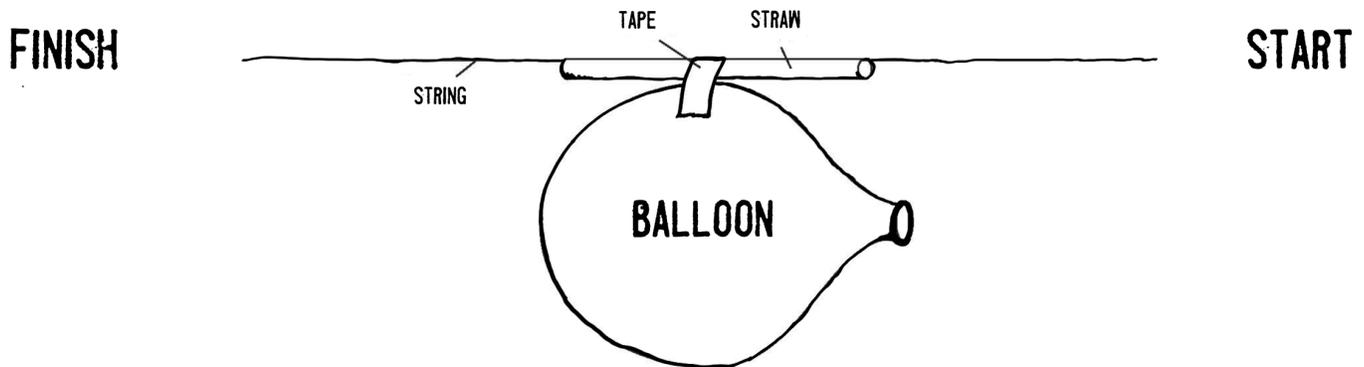
Stepping into the shoes of a MythBuster should not mean sacrificing your safety. Keep these guidelines in mind for each activity:

1. Read or listen carefully to all the directions before your start the experiment.
2. Use the equipment and materials only as instructed.
3. Keep your work area clean and organized.
4. Take care when using scissors, or restrict their use to adults.
5. Use plastic instead of glass wherever possible.

Special notes: Take care when using balloons. Some students may have latex allergies. Balloons may pose choking hazard for younger children.

PROCEDURE

1. Blow up a balloon, but do not tie the end. Make a hypothesis (an educated guess) of what will happen when you let go. Record your guess on your Blueprint.
2. Let go! Make observations and explain what you saw.
3. Set up your race track by tying one end of the string to a chair or doorknob. Thread the free end through the straw, and tie it to another chair, making sure that the string is pulled tight and runs parallel to the ground. Repeat with the second string.
4. Together with your partner, blow up two balloons and pinch them off at the mouth (where you blow into), but do not tie. Take note on your Blueprint of which balloon is bigger.
5. Tape the straws to the top of the balloons so that the mouths are in line with the string and straw (see sketch).
6. Slide the mouths of the balloons to your starting line and 3...2...1...let go!



7. Which balloon reaches the finish line first? Why?
8. Race again, but this time change how much you inflate the balloon.

THINK ABOUT IT

- What kinds of energy are involved in making the balloons move?
- When did the balloons move the fastest down the string? Why?
- When did the balloons move the slowest down the string? Why?
- What makes the balloons stop?
- What is the relationship between how inflated the balloon is and the time it took to travel down the string?

RESULTS

Newton's Third Law says that for every action there is an equal and opposite reaction. When you inflate the balloon and pinch it closed, the air molecules inside push against the balloon's stretchy sides and the balloon's stretchy sides push against the air molecules inside with an equal amount of force – balanced forces mean the balloon doesn't move.

Newton's First Law says that when one force is greater than other forces, the unbalanced force will cause an object to move. When you let go and open the mouth, the walls of the balloon push in with greater force than the air molecules inside can push back, forcing the air out of the balloon. The unbalanced forces between the air molecules inside the balloon and the force of the walls of the balloon cause its forward motion.

There are more air molecules inside a fully inflated balloon, stretching the balloon more and giving it more potential energy. Once the balloon starts moving, it transfers its potential energy to kinetic energy, or the energy of motion.

Air resistance, friction between the straw and the string and finally the chair at the end of the string all provide forces that slow down and eventually stop the balloon.

TIPS FOR TEACHERS

Ask students to time how long it takes the balloons to reach the other end of the string or how far the balloons travel. Record data in the Blueprint and answer the guiding questions, using data gathered from the investigation to support claims. Challenge to see if they can get their balloons to travel a predetermined distance or speed, with the fewest number of attempts.

KEEP DISCOVERING!

Solve for the velocity (speed in a given direction) of the balloon. To do this, divide the distance traveled by the time. For example, if a balloon traveled 6 meters in 2 seconds, its velocity was 3 meters per second (m/s). See who can make the fastest balloon!

$$\text{VELOCITY} = \frac{\text{DISTANCE}}{\text{TIME}} = \frac{6 \text{ METERS}}{2 \text{ SECONDS}} = 3 \text{ METERS/SECOND}$$

TEST ADDITIONAL VARIABLES: Will the type of string affect how far the balloon will travel? How about the length of the straw or the type of balloon? The sky is the limit. Remember that when conducting an experiment, it's important to only change one variable at a time. For instance, if you think that the starting size of the balloon affects how far the it travels, make sure that everything else (distance, size of straw, etc.) stays the same. That way you can be sure (well, almost) that size is the culprit.

TRY THE CONVEYER BELT EXPERIMENT YOURSELF! You can find inexpensive, rubber band-powered airplane kits at hobby and toy stores, or build your own (hint: do a web search for “rubber band airplane” – there are some great tutorials out there, many with videos). Construct a conveyer belt by taping sheets of paper together. Wind up your plane, place it on the beginning of the paper belt, and have a friend pull the paper backward as the plane moves forward. What happens? Now try it with a wind-up car? What's the difference?

WANT TO LEARN MORE?

TEST YOUR KNOWLEDGE OF AIRPLANE MYTHS WITH THIS QUIZ!

<http://dsc.discovery.com/games-quizzes/airplane-myths-quiz/>

CURIOUS ABOUT HOW AIRCRAFT WINGS ARE MADE?

<http://science.discovery.com/videos/how-its-made-mini-episodes-aircraft-wings.html>

LEARN MORE ABOUT NEWTON'S THIRD LAW.

<http://player.discoveryeducation.com/index.cfm?guidAssetId=4749C27E-315F-4DAB-919F-42178EFE698D&InFromSearch=1&productcode=US>

TEST YOUR NEWTON-KNOWLEDGE.

<http://science.discovery.com/interactives/literacy/newton/newton.html>

EXPLORE ACTION AND REACTION WITH THE MYTHBUSTERS.

<http://curiosity.discovery.com/question/Newton-third-law-of-motion>

NATIONAL SCIENCE EDUCATION STANDARDS

Grades 5-8, Standard A: Abilities necessary to do scientific inquiry

Grades 5-8, Standard A: Understandings about scientific inquiry

Grades 5-8, Standard B: Motions and Forces

Grades 5-8, Standard E: Abilities of technological design

Grades 5-8, Standard E: Understanding about science and technology

Grades 5-8, Standard G: Nature of Science

This guide has been developed for use by educators, group leaders and families for use in connection with "Mythbusters: The Explosive Exhibition" (the "Educators"). The activities described in this guide are potentially dangerous and could result in injury or damage. This guide is provided on an "AS IS" basis and the Museum of Science and Industry disclaims all warranties, express or implied, regarding the guide. Use of this guide is done at the risk of the Educators. By using this guide, you release the Museum of Science and Industry, its officers, employees, directors, trustees, agents and volunteers from and against any and all liability, claims, actions, costs, expenses, damages, attorney fees, breach of contract actions and all causes of actions whatsoever, that you may now have or may acquire in the future, arising out of or relating to any loss, damage or injury that may be sustained by you, the people you are educating, or to any property belonging to you or the people you are educating, as a result of the use of the guide.



MAKE A HYPOTHESIS

WHAT WILL HAPPEN WHEN A BALLOON IS BLOWN UP AND THEN RELEASED WITHOUT TYING THE END?

OBSERVATIONS

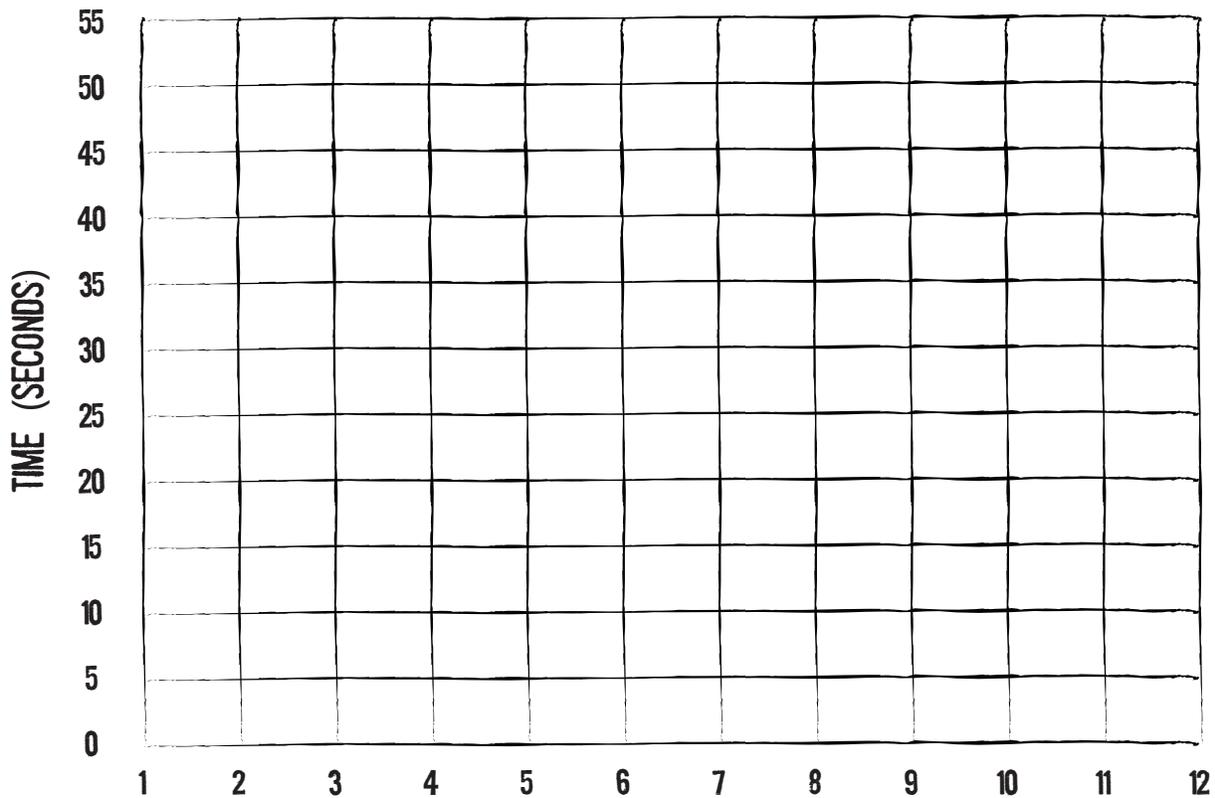
WHAT DID YOU SEE HAPPEN WHEN YOU RELEASED THE BALLOON?

PREDICTION

WHICH BALLOON WILL TRAVEL DOWN THE STRING THE FASTEST?

EXPERIMENT

RECORD YOUR RESULTS FOR THE THREE TESTS IN THE TABLE BELOW.



CONCLUSION

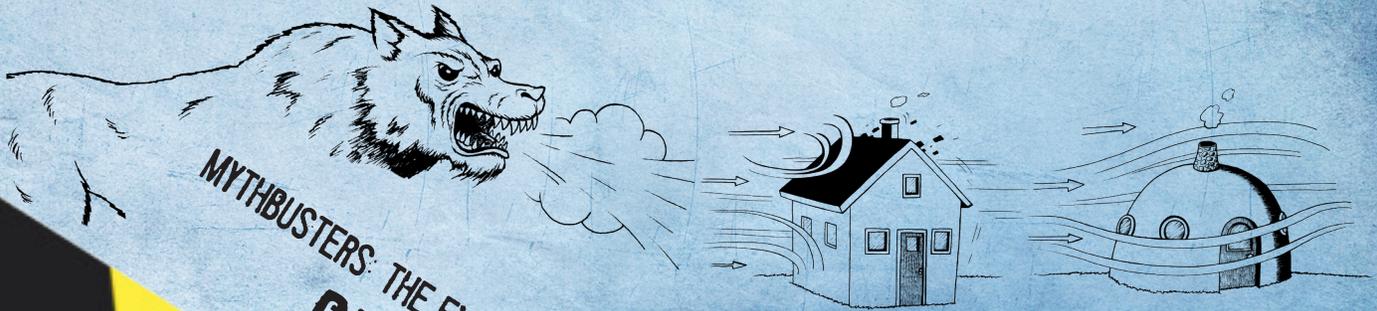
WHAT IS THE RELATIONSHIP TO THE AMOUNT OF AIR IN THE BALLOON AND THE TIME IT TAKES TO TRAVEL THE LENGTH OF THE STRING?

WHAT OTHER VARIABLES COULD BE EFFECTING THE TIME IT TAKES FOR THE BALLOON TO TRAVEL THE LENGTH OF THE STRING?



ACTIVITY #2

STABLE STRUCTURES



MYTHBUSTERS: THE EXPLOSIVE EXHIBITION COMPONENT:
BIG BAD WOLF

MYTHBUSTERS
THE EXPLOSIVE EXHIBITION.

 **Discovery**
EDUCATION

WONDER

Can you build a structure to withstand the elements? What's the strongest shape?

RESEARCH

When designing a building or structure, architects and engineers consider many factors, including all of the outside forces - the pushes and pulls that the structure may encounter. Weather and other natural forces such as earthquakes can apply stress to structures. Certain shapes, such as rectangles, circles, squares and triangles are stronger than others, depending on how these forces affect them. A shape that equally distributes a force along all of its sides is especially stable.

TEST AND DISCOVER

MATERIALS

- Toothpicks
- Mini marshmallows
- Paper plates
- Pennies, washers or some other small items to use as weights

Note – to maintain consistency, all students should use the same type of weight

SAFETY FIRST!

Stepping into the shoes of a MythBuster should not mean sacrificing your safety. Keep these guidelines in mind for each activity:

1. Read or listen carefully to all the directions before you start the experiment.
2. Use the equipment and materials only as instructed.
3. Keep your work area clean and organized.
4. Take care when using scissors, or restrict their use to adults.
5. Use plastic instead of glass wherever possible.

Special Notes: Consider student allergies when working with marshmallows.

Toothpicks and other small items may pose a choking hazard for younger children.

PROCEDURE

1. Stick the toothpicks into the marshmallow and construct some basic shapes. Can you make a cube? A pyramid?
2. Place a paper plate on top of your cube. How many weights can you add to the plate before the cube collapses? Record the number of weights on your Blueprint.
3. Poke a hole in the center of a paper plate so that you can balance it on your pyramid shape. How many weights can you add to this shape before it collapses? Record the number of weights on your Blueprint.
4. Construct additional shapes (or modify those you already tried by adding more toothpicks and marshmallows), and test them for how much weight they can hold.
5. As you test different shapes, sketch or describe the design, record how much weight each shape can hold and explain why you think it either supported the weight or failed on your Blueprint.

THINK ABOUT IT

- Which shape is strongest? Why?
- Is it better to have more or less sides to make a structure strong?
- What types of structures need to be strong? Why?
- What outside forces need to be considered when building a structure?
- What types of structures are shaped similar to the ones that you built? Why?

RESULTS

In this experiment, gravity is the primary force acting on the structures you built. With real structures however (and in the Big Bad Wolf exhibit in Mythbusters: The Explosive Exhibition), forces such as wind, weather and even earthquakes can impact the stability of a structure. Triangles are the strongest shape because any added force is evenly spread through all three sides. Look closely at your pyramid – it's made of triangles! Squares or cubes can be strengthened by adding a diagonal piece across the middle, making it two triangles linked together. Join a series of triangles together creates a truss. Look around you – trusses are used in buildings, houses and bridges.

KEEP DISCOVERING!

- Use the marshmallows and toothpicks to build different types of polygons (a shapes with straight sides that are all connected together). Which shapes are strongest?
- How can you simulate the effect of different conditions, such as wind and earthquakes, on the stability of your structures? Construct your own experiment.
- Try building with different types of materials to see how the stability changes. Use straws, paperclips, gumdrops – anything you have – to experiment.
- Challenge your family and friends to a contest! Build bridges between two tables or chairs and test them by seeing whose can hold the most weight.

WANT TO LEARN MORE?

TEACHERS - BUILD SKY-HIGH SKYSCRAPERS WITH YOUR STUDENTS!

<http://www.discoveryeducation.com/teachers/free-lesson-plans/higher-and-higher-amazing-skyscrapers.cfm>

COOL SCIENCE JOBS: ARCHITECT

<http://science.discovery.com/videos/head-rush-cool-jobs-in-science-danny-forster.html>

COOL SCIENCE JOBS: WIND SCIENTIST

<http://science.discovery.com/videos/head-rush-cool-jobs-in-science-heather-dohan.html>

WHERE DOES WIND COME FROM?

<http://player.discoveryeducation.com/index.cfm?guidAssetId=0E6453F2-01DE-4A55-B5A8-543048F61273&lnFromSearch=1&productcode=US>

TEACHERS – CHECK OUT THIS LESSON PLAN ON WITHSTANDING ANOTHER POWERFUL FORCE – EARTHQUAKES!

<http://www.discoveryeducation.com/teachers/free-lesson-plans/constructing-earthquake-proof-buildings.cfm>

NATIONAL SCIENCE EDUCATION STANDARDS

- Grades 5-8, Standard A: Abilities necessary to do scientific inquiry
- Grades 5-8, Standard A: Understandings about scientific inquiry
- Grades 5-8, Standard B: Motions and forces
- Grades 5-8, Standard E: Abilities of technological design
- Grades 5-8, Standard E: Understanding about science and technology
- Grades 5-8, Standard F: Natural hazards
- Grades 5-8, Standard F: Risks and Benefits
- Grades 5-8, Standard F: Science and technology in society
- Grades 5-8, Standard G: Science as a human endeavor
- Grades 5-8, Standard G: Nature of science

This guide has been developed for use by educators, group leaders and families for use in connection with "Mythbusters: The Explosive Exhibition" (the "Educators"). The activities described in this guide are potentially dangerous and could result in injury or damage. This guide is provided on an "AS IS" basis and the Museum of Science and Industry disclaims all warranties, express or implied, regarding the guide. Use of this guide is done at the risk of the Educators. By using this guide, you release the Museum of Science and Industry, its officers, employees, directors, trustees, agents and volunteers from and against any and all liability, claims, actions, costs, expenses, damages, attorney fees, breach of contract actions and all causes of actions whatsoever, that you may now have or may acquire in the future, arising out of or relating to any loss, damage or injury that may be sustained by you, the people you are educating, or to any property belonging to you or the people you are educating, as a result of the use of the guide.



Geoffrey M. Curley + Associates, LLC
Exhibition and Theatrical Consultation and Design



TRIAL 1

SKETCH OR DESCRIBE YOUR STRUCTURE.

HOW MUCH WEIGHT DID IT HOLD?

WHY DO YOU THINK YOUR STRUCTURE
SUPPORTED THE WEIGHT OR COLLAPSED?

**BLUEPRINT:
STABLE STRUCTURES**



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

TRIAL 2

SKETCH OR DESCRIBE YOUR STRUCTURE.

HOW MUCH WEIGHT DID IT HOLD?

WHY DO YOU THINK YOUR STRUCTURE
SUPPORTED THE WEIGHT OR COLLAPSED?

**BLUEPRINT:
STABLE STRUCTURES**



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

TRIAL 3

SKETCH OR DESCRIBE YOUR STRUCTURE.

HOW MUCH WEIGHT DID IT HOLD?

WHY DO YOU THINK YOUR STRUCTURE
SUPPORTED THE WEIGHT OR COLLAPSED?

**BLUEPRINT:
STABLE STRUCTURES**



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

ACTIVITY #3

TABLECLOTH CHALLENGE



MYTHBUSTERS: THE EXPLOSIVE EXHIBITION COMPONENT:
TABLECLOTH CHAOS

MYTHBUSTERS
THE EXPLOSIVE EXHIBITION.

 **Discovery**
EDUCATION

WONDER

Can you pull a tablecloth off of a set table – without breaking anything?

RESEARCH

Newton's First Law of Motion, also known as the Law of Inertia, says that an object will keep moving or stay still until an outside force pushes or pulls on it. When you kick a soccer ball, the outside force applied by your foot sets the ball in motion. The ball stays in motion until other forces – in this case, gravity and friction - act on it. Gravity pulls the ball toward the center of the earth and friction (from the air and ground) resists its forward motion, eventually bringing it to a stop. You've probably also experienced inertia while riding in a car. If the driver has to slam on the brakes (thus applying a force), you continue to move forward until an outside force, your seatbelt, pushes you back against your seat.

TEST AND DISCOVER

MATERIALS (PER GROUP)

- Tablecloths (include different kinds of cloths such as cotton, polyester, plastic, etc.)
- Table or desktop
- Assortment of tableware – forks, spoons, cups, plates, etc. Be sure to use plastic - NOT glass, metal or ceramic
- Food items (fruit, vegetables, eggs – if you're brave!)
- Weights (coins, washers, other small items)

SAFETY FIRST!

Stepping into the shoes of a MythBuster should not mean sacrificing your safety.

Keep these guidelines in mind for each activity:

1. Read or listen carefully to all the directions before your start the experiment.
2. Use the equipment and materials only as instructed.
3. Keep your work area clean and organized.
4. Take care when using scissors, or restrict their use to adults.
5. Use plastic instead of glass wherever possible.

Special Notes: Take care to use only non-breakable tableware. Ask children who are watching to stand back from the table. Small items may pose a choking hazard for younger children.

PROCEDURE

1. Set the table with the plates, food, etc. If your plates and cups are especially light, you might want to add some weight to simulate food or liquids. Or use the real thing! Use the Blueprint to draw or describe your set up.
2. Grasp the edge of the tablecloth. Count backwards from 3 and quickly but firmly pull the cloth down and back. What happens? Why? Use the Blueprint to draw or describe your set up.
3. Try the experiment several more times, changing just one variable at a time for each trial. What if the arrangement of items is the same, but you add more weight? What if you keep the weight the same, but change the layout of items? What if you use the same items, but a different type of tablecloth?

THINK ABOUT IT

- Which objects were too heavy? Which were too light? What stayed on the table or desk and what did not? Why? Do different types of tablecloths produce different results?
- Which set-up is most effective, allowing you to pull the tablecloth out without disturbing the items on top? Why?
- What is the role of inertia in this activity?
- What is the role of friction in this activity? How can you reduce the friction between a tablecloth and the items on top?

RESULTS

As the experiment begins, inertia is at work – the items on the table won't move unless an outside force moves them. If you try to s-l-o-w-l-y pull the tablecloth away, the friction between the items and the tablecloth makes the stuff move right along with the cloth. But if you quickly pull the tablecloth down and back, the force of your pull overcomes the force of the friction between the items and the tablecloth. The friction acts on the objects in the direction of the pull for just a short time, and the cloth slides out from underneath the objects. As the cloth slides out, gravity pulls the objects down onto the tabletop.

KEEP DISCOVERING!

For an added challenge with older students (high school), try the Egg Drop Challenge!

MATERIALS (PER GROUP)

- 4 toilet paper or paper towel tubes
- Smooth, stiff piece of cardboard (the front cover of an old 3-ring binder works well)
- 4 identical plastic cups
- Broom
- Paper towels
- All-purpose cleaner
- Water
- Safety goggles

PROCEDURE

1. Put on your safety goggles.
2. Fill the cups half way with water and arrange them in a square near the edge of a low table.
3. Place the cardboard on top of the cups. Be sure to have the cups and cardboard arranged in a such a way that the cardboard protrudes over the edge of the table. Later in the experiment, you want the broomstick to hit the edge of the cardboard, NOT the table top.
4. Position your toilet paper or paper towel tubes on top of the binder, trying your best to center the tubes over the middle of each cup.
5. Carefully place the eggs length-wise across the top of the tubes. Be sure the eggs are not stuck inside the tube tops, but resting atop them.
6. Make a hypothesis (an educated guess) – how can you apply force that causes the eggs to fall into the plastic cups?
7. Practice your launch first by stepping on the broom bristles with your foot while pulling the broomstick back to a 45 degree angle. Let go and catch it with your other hand.
8. Ask observers to stand back, away from the table.
9. Aim carefully at the cardboard, pull the broomstick back and release! What happens?



TIPS

- Before releasing the broomstick into the structure, make sure the cardboard shelf is hanging over the edge of the table. The stick needs to hit the cardboard shelf, NOT the table itself.
- Make sure all the tubes are directly over the cups
- All eggs should be placed horizontally over the tubes, not stuck inside the tube.

WANT TO LEARN MORE?

NEWTON EXPLAINS INERTIA.

<http://player.discoveryeducation.com/index.cfm?guidAssetId=A432E5C3-0B80-4FCD-B70B-24CD0E6934FF&blnFromSearch=1&productcode=US>

INVESTIGATE NEWTON'S FIRST LAW- INERTIA.

<http://player.discoveryeducation.com/index.cfm?guidAssetId=AB734C0A-4479-49B1-AF03-FCF922CFA9F4&blnFromSearch=1&productcode=US>

CHECK OUT THE MYTHBUSTERS' TABLECLOTH TRICK!

<http://dsc.discovery.com/videos/mythbusters-tablecloth-chaos-high-speed.html>

NATIONAL SCIENCE EDUCATION STANDARDS

- Grades 5-8, Standard A: Abilities necessary to do scientific inquiry
- Grades 5-8, Standard A: Understandings about scientific inquiry
- Grades 5-8, Standard B: Motions and Forces
- Grades 5-8, Standard G: Nature of Science

This guide has been developed for use by educators, group leaders and families for use in connection with "Mythbusters: The Explosive Exhibition" (the "Educators"). The activities described in this guide are potentially dangerous and could result in injury or damage. This guide is provided on an "AS IS" basis and the Museum of Science and Industry disclaims all warranties, express or implied, regarding the guide. Use of this guide is done at the risk of the Educators. By using this guide, you release the Museum of Science and Industry, its officers, employees, directors, trustees, agents and volunteers from and against any and all liability, claims, actions, costs, expenses, damages, attorney fees, breach of contract actions and all causes of actions whatsoever, that you may now have or may acquire in the future, arising out of or relating to any loss, damage or injury that may be sustained by you, the people you are educating, or to any property belonging to you or the people you are educating, as a result of the use of the guide.



Geoffrey M. Curley + Associates, LLC
Exhibition and Theatrical Consultation and Design



1. SET THE TABLE WITH THE PLATES, FOOD, ETC. IF YOUR PLATES AND CUPS ARE ESPECIALLY LIGHT, YOU MIGHT WANT TO ADD SOME WEIGHT TO SIMULATE FOOD OR LIQUIDS. DRAW OR DESCRIBE YOUR SET UP BELOW.
2. GRASP THE EDGE OF THE TABLECLOTH. COUNT BACKWARDS FROM 3 AND QUICKLY BUT FIRMLY PULL THE CLOTH DOWN AND BACK. WHAT HAPPENS? WHY?
3. TRY THE EXPERIMENT SEVERAL MORE TIMES, CHANGING JUST ONE VARIABLE AT A TIME FOR EACH TRIAL. WHAT IF THE ARRANGEMENT OF ITEMS IS THE SAME, BUT YOU ADD MORE WEIGHT? WHAT IF YOU KEEP THE WEIGHT THE SAME, BUT CHANGE THE LAYOUT OF ITEMS? WHAT IF YOU USE THE SAME ITEMS, BUT A DIFFERENT TYPE OF TABLECLOTH?

TRIAL 1:

DRAW OR DESCRIBE YOUR SET UP BEFORE YOU PULL THE TABLECLOTH AWAY.

WHAT HAPPENED WHEN YOU PULLED THE TABLECLOTH AWAY? WHICH OBJECTS MOVED MOST? DRAW OR DESCRIBE BELOW:

BLUEPRINT: TABLECLOTH CHALLENGE



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

TRIAL 2:

DRAW OR DESCRIBE YOUR SET UP BEFORE YOU PULL THE TABLECLOTH AWAY.

WHAT HAPPENED WHEN YOU PULLED THE TABLECLOTH AWAY?
WHICH OBJECTS MOVED MOST? DRAW OR DESCRIBE BELOW:

BLUEPRINT: TABLECLOTH CHALLENGE



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

TRIAL 3:

DRAW OR DESCRIBE YOUR SET UP BEFORE YOU PULL THE TABLECLOTH AWAY.

WHAT HAPPENED WHEN YOU PULLED THE TABLECLOTH AWAY?
WHICH OBJECTS MOVED MOST? DRAW OR DESCRIBE BELOW:

BLUEPRINT: TABLECLOTH CHALLENGE



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

WHICH OBJECTS WERE TOO HEAVY? WHICH WERE TOO LIGHT?
WHAT STAYED ON THE TABLE OR DESK AND WHAT DID NOT? WHY?
DO DIFFERENT TYPES OF TABLECLOTHS PRODUCE DIFFERENT RESULTS?

WHICH SET-UP IS MOST EFFECTIVE, ALLOWING YOU TO PULL
THE TABLECLOTH OUT WITHOUT DISTURBING THE ITEMS ON TOP? WHY?

WHAT IS THE ROLE OF INERTIA IN THIS ACTIVITY?

WHAT IS THE ROLE OF FRICTION IN THIS ACTIVITY? HOW CAN YOU
REDUCE THE FRICTION BETWEEN A TABLECLOTH AND THE ITEMS ON TOP?

BLUEPRINT: TABLECLOTH CHALLENGE



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

ACTIVITY #4

**PRACTICE
MAKES
PERFECT**

MYTHBUSTERS: THE EXPLOSIVE EXHIBITION COMPONENT:
CHANGE LIKE A SUPERHERO



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION.

 **Discovery**
EDUCATION™

WONDER

Challenge yourself with a physical task. Do you get better with practice?

RESEARCH

When you tie your shoe or ride your bike, you're following a learned procedure – a particular set of steps followed in a regular order. Life is full of procedures we follow - getting dressed, walking to school, even making a paper airplane! Once you've got it down, you may not even have to think about the procedure because you have done it so many times. You can learn to complete procedures quickly and efficiently through practice, repetition and training. A good memory helps too!

TEST AND DISCOVER

MATERIALS

- Quarter
- Stopwatch
- Blueprint

SAFETY FIRST!

Stepping into the shoes of a MythBuster should not mean sacrificing your safety. Keep these guidelines in mind for each activity:

1. Read or listen carefully to all the directions before you start the experiment.
2. Use the equipment and materials only as instructed.
3. Keep your work area clean and organized.
4. Take care when using scissors, or restrict their use to adults.
5. Use plastic instead of glass wherever possible.

Special Notes: Coins may pose a choking hazard for younger children.

PROCEDURE

1. Form a group of two. Find the directions on the Blueprint.
2. One person will follow the directions to move the coin, while his/her partner times how long it takes to complete the instructions.
3. Start with the instructions and game board face down. When your partner says GO, follow the directions as fast as you can. DO NOT touch the coin until the game starts.
4. Clap your hands once between each step of the procedure.
5. Stop timing when the player yells "STOP."
6. Record your time on the Blueprint.
7. Switch roles and repeat Steps 2-4.
8. Repeat Steps 2-5 until all 5 trials are completed.

THINK ABOUT IT

- Why does it take so long the first time you follow the procedure?
- Why do you seem to get faster the more you try it?

RESULTS

The first time you ran through the directions, you had no idea where the correct boxes were located, or the order in which to touch them. But you may have noticed that the more times you repeated the procedure, the easier it became to find the correct box. By the end of the fifth trial, you probably didn't even have to look for the right spot, and were pretty sure where to go next. The procedure becomes easier as you practice and begin to remember the steps.

Memory is the ability to store, retain and recall experiences and information. Each time you repeat the procedure, your brain stores information about the steps and the location of the boxes. As you practice again and again, you get even faster at accessing and using that stored information.

KEEP DISCOVERING!

Use the following ideas to create an obstacle course at your school or in your backyard. Set up a series of 5 or more of the challenges listed below, and ask a partner to use a stopwatch to time how long it takes you to run the course. Switch roles and have your partner follow the same steps. Try it several times – do you get better with practice?

BALANCE

- Lay a board across some bricks to make a balance beam. Can you walk across?
Safety alert! Be sure your balance beam is low to the ground to avoid injury from a fall.
- Stand on one foot and count to ten. 20? Even better - stand on one foot on the balance beam!

TOSS

- Throw balls or beanbags into a bucket.
- Toss rings (cut the middle out of a paper plate) onto a water bottle.

JUMP

- Line up some hula hoops (or make rings with rope) and jump from ring to ring.
- Make some hurdles with swimming pool noodles set across buckets.

CRAWL

- Lay a broomstick across some chairs and crawl under.
- Make a tunnel with empty boxes (open the tops and bottoms and tape them together), or use a pop-up tunnel to crawl through.

RUN

- Set up a series of cones (or empty boxes or milk jugs) and weave back and forth between each one.
- Run in a figure 8 pattern around the entire obstacle course, cutting through the middle.

WANT TO LEARN MORE?

THIS GUY'S JOB IS TO MAKE SURE MOVIES ARE SCIENTIFICALLY ACCURATE – COOL!

<http://science.discovery.com/videos/head-rush-cool-jobs-in-science-phil-plait.html>

SOMETIMES REAL PEOPLE EXHIBIT SUPER-HUMAN STRENGTH. FIND OUT HOW.

<http://player.discoveryeducation.com/index.cfm?guidAssetId=17043579-E5BB-4302-A588-F0F190D620E4&blnFromSearch=1&productcode=US>

NATIONAL SCIENCE EDUCATION STANDARDS

Grades 5-8, Standard A: Abilities necessary to do scientific inquiry

Grades 5-8, Standard A: Understandings about scientific inquiry

Grades 5-8, Standard C: Structure and Function in living systems

Grades 5-8, Standard C: Regulation and Behavior

Grades 5-8, Standard F: Personal Health

Grades 5-8, Standard G: Nature of Science

This guide has been developed for use by educators, group leaders and families for use in connection with "Mythbusters: The Explosive Exhibition" (the "Educators"). The activities described in this guide are potentially dangerous and could result in injury or damage. This guide is provided on an "AS IS" basis and the Museum of Science and Industry disclaims all warranties, express or implied, regarding the guide. Use of this guide is done at the risk of the Educators. By using this guide, you release the Museum of Science and Industry, its officers, employees, directors, trustees, agents and volunteers from and against any and all liability, claims, actions, costs, expenses, damages, attorney fees, breach of contract actions and all causes of actions whatsoever, that you may now have or may acquire in the future, arising out of or relating to any loss, damage or injury that may be sustained by you, the people you are educating, or to any property belonging to you or the people you are educating, as a result of the use of the guide.



Geoffrey M. Curley + Associates, LLC
Exhibition and Theatrical Consultation and Design



COMPLETE THE FOLLOWING STEPS AS FAST AS YOU CAN.

DON'T FORGET TO CLAP YOUR HANDS AFTER EACH STEP.

START WHEN YOUR PARTNER SAYS "GO".

1. PLACE THE COIN ON THE SPACE MARKED START. CLAP.
2. PLACE THE COIN ON THE MYTHBUSTERS LOGO. CLAP.
3. PLACE THE COIN ON ADAM'S FACE. CLAP.
4. PLACE THE COIN ON THE BIG BAD WOLF. CLAP.
5. PLACE THE COIN ON THE KING OF HEARTS. CLAP.
6. PLACE THE COIN ON JAMIE'S FACE. CLAP.
7. PLACE THE COIN ON THE CLIFF. CLAP.
8. PLACE THE COIN ON THE EXPLOSION. CLAP.
9. PLACE THE COIN ON KARI'S FACE. CLAP.
10. PLACE THE COIN ON THE RAIN. CLAP.
11. PLACE THE COIN ON THE SUPERHERO. CLAP.
12. TELL THE TIMER TO "STOP!" CLAP.

RECORD YOUR RESULTS.

1

2

3

4

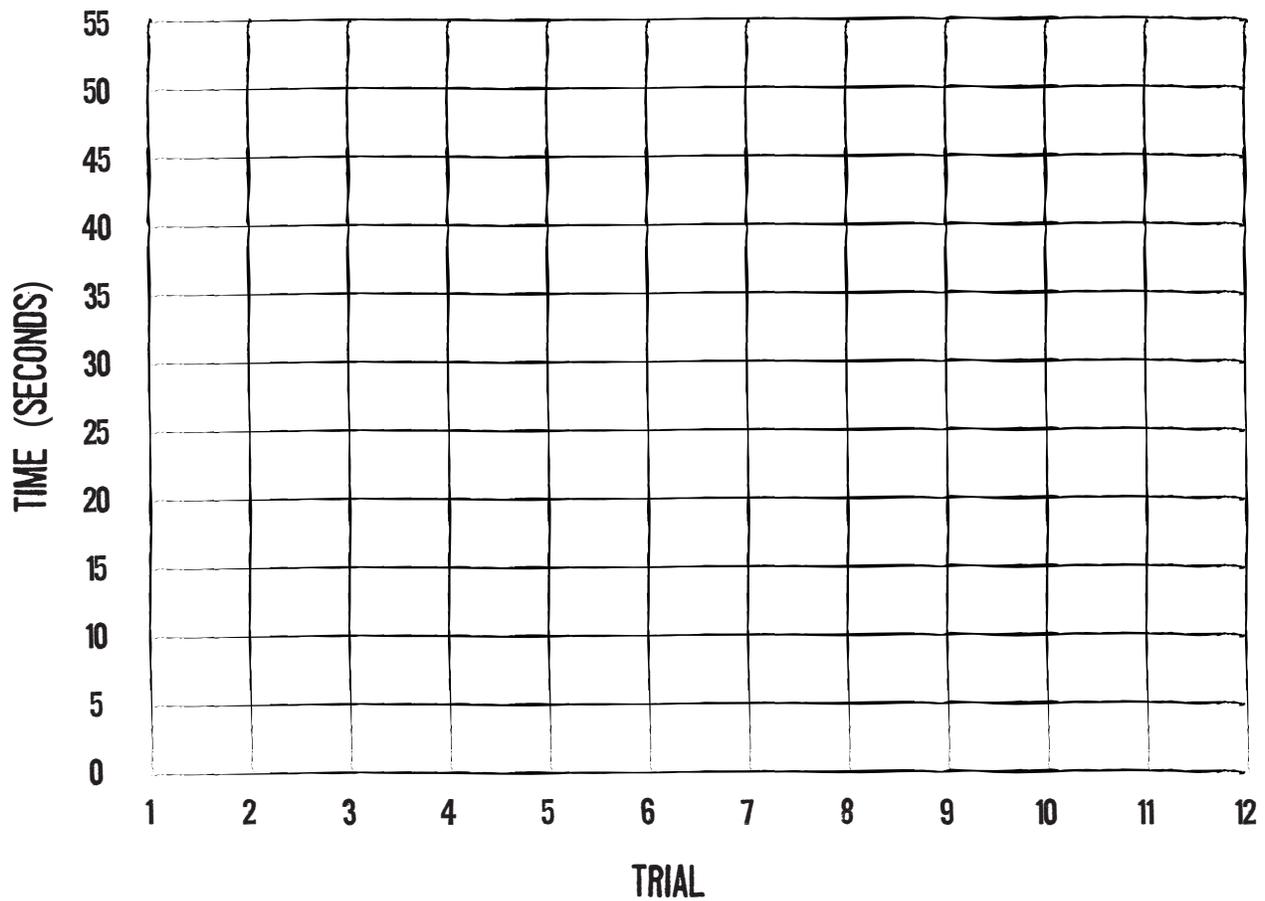
5

**BLUEPRINT:
PRACTICE MAKES PERFECT**



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

GRAPH YOUR RESULTS.



WHY DOES IT TAKE SO LONG THE FIRST TIME YOU FOLLOW THE PROCEDURE?

WHY DO YOU SEEM TO GET FASTER THE MORE YOU TRY IT?

**BLUEPRINT:
PRACTICE MAKES PERFECT**

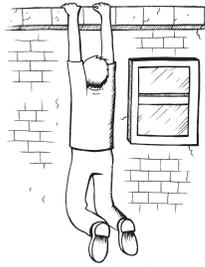


MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

MYTHBUSTERS
THE EXPLOSIVE EXHIBITION



TORY



KARI



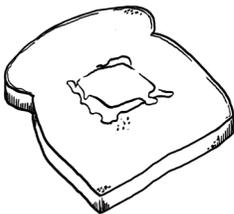
JAYME



START!



GRANT



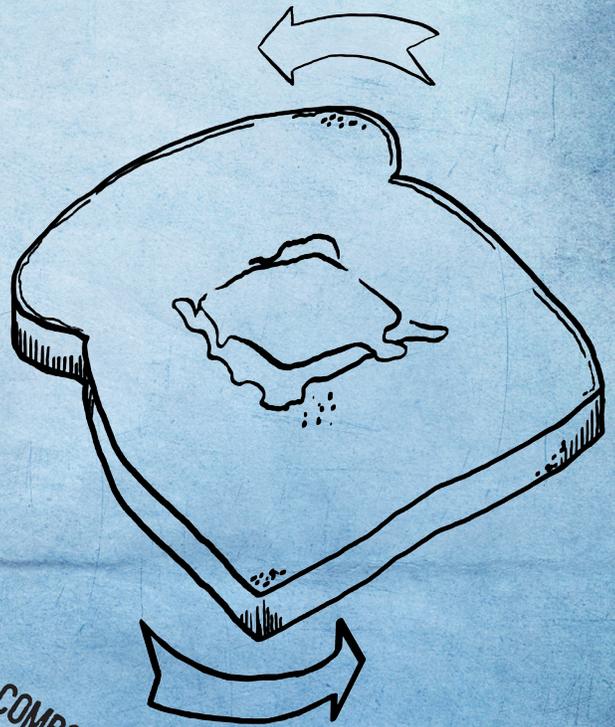
ADAM

GAME BOARD

MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

ACTIVITY #5

FLIP IT!



MYTHBUSTERS: THE EXPLOSIVE EXHIBITION COMPONENT:
BUTTER SIDE UP

MYTHBUSTERS
THE EXPLOSIVE EXHIBITION.

 **Discovery**
EDUCATION

WONDER

Can you predict if a coin flip will land as heads or tails? How does the design of your experiment affect the outcome?

RESEARCH

Probability is a measure of how often a particular event will happen when something with several possible outcomes happens over and over again. The probability of a coin landing heads-up is one example. The chance of rain is another. Determining probability requires carefully constructing experiments, making observations, collecting data and calculating predictions using math.

TEST AND DISCOVER

MATERIALS

- Paper
- Pen or pencil
- Coin
- Blueprint

SAFETY FIRST!

Stepping into the shoes of a MythBuster should not mean sacrificing your safety. Keep these guidelines in mind for each activity:

1. Read or listen carefully to all the directions before you start the experiment.
2. Use the equipment and materials only as instructed.
3. Keep your work area clean and organized.
4. Take care when using scissors, or restrict their use to adults.
5. Use plastic instead of glass wherever possible.

Special Notes: Coins may pose a choking hazard for younger children.

PROCEDURE

PART 1

1. If a coin is flipped 100 times, how many times will it land heads up? Record your prediction on the Blueprint.
2. Flip a coin and use the Blueprint to record your result – heads or tails?
3. Repeat 19 more times for a total of 20 flips, recording on the Blueprint as you go. It is important to keep variables constant in a good experiment, so try to flip the coin the same way each time (i.e. use the same hand, same fingers, etc.).
4. Look at your results in groups of 4. Do you notice any trends?
5. As a whole, how many times did the coin land heads up? What percentage is that of your total number of flips? How many times did the coin land tails up? What percentage is that of your total number of flips?
6. Make a prediction – if you flip the coin 5 more times, how many times will it land heads up? How many times will it land tails up? Try it, and record your results.
7. Combine data from the entire class to see if an increased number of trials impacts the results.

PART 2

1. How does your experimental design affect the outcome of the coin flips? Repeat the steps above, but use a different method to “flip” your coin. For example, what happens if you push the coin off the edge of a table instead of tossing it into the air? What if you always start with the coin heads up?
2. For each method used to flip the coin, repeat the flip 20 times. Then try another method and repeat.
3. Look for trends in your results. Does the setup of your experiment seem to affect the ultimate outcome?

THINK ABOUT IT

- Was your prediction correct? Why do you think the results may have differed from your prediction?
- What factors might have affected your experiment to give you different results from a partner performing the same task?
- Think of other ways you might use probability to understand the likelihood of an event or outcome.

RESULTS

There are two possible outcomes in your average coin toss – heads or tails. And since you're equally likely to get heads or tails, the probability of flipping a coin and having it land heads up is 50%. But if you look at sequence of tosses (T, H, T, T, T, H, etc.), it can get confusing. Is the probability really 50%?

In this experiment, “user error” may also be at play. Since each individual tosses a coin – even the same exact coin – in a slightly different way, might that affect the outcomes? In a very small number of tries – say 2 or 3 – it may seem that way. But as you toss again and again, the total number of times the coin lands on heads or tails gets closer and closer to 50%.

KEEP DISCOVERING!

- Play with probability by predicting the number of different colors in a bag of M&Ms™ or similar candy. Count the number of candies of each color in one bag and record the result. Use that data to make a prediction of what the number of each color in another bag will be. After making your predictions, open and see. Make sure to eat your experiment when you are done!
- Place ten red marbles and five white marbles in a bag. Without looking, select one marble and record the color. Put it back in the bag. Repeat ten times, then calculate the percentage of pulling out a white marble and pulling out a red marble. Based on this percentage, you can calculate the probability of pulling out a marble of a particular color. Make a prediction and see what happens.

WANT TO LEARN MORE?

THE MYTHBUSTERS BUILT A COMPLICATED CONTRAFTION FOR COMPLETING A SIMPLE TASK – DROPPING THE TOAST. USE THIS GUIDE TO CREATE A COMPLEX CONTRAFTION OF YOUR OWN!

<http://www.discoveryeducation.com/teachers/free-lesson-plans/junkyard-wars-air-movers.cfm>

WHAT ARE THE CHANCES? UNDERSTANDING PROBABILITY.

<http://player.discoveryeducation.com/index.cfm?guidAssetId=A43B9BFF-D955-480E-85F5-FA636808F9A8&lnFromSearch=1&productcode=US>

WHAT IS THE ROLE OF PROBABILITY IN BASEBALL? EXPLORE BATTING AVERAGE IN THIS VIDEO.

<http://player.discoveryeducation.com/index.cfm?guidAssetId=38F34205-F32B-48B8-812B-6C464477F0D4&lnFromSearch=1&productcode=US>

NATIONAL SCIENCE EDUCATION STANDARDS

Grades 5-8, Standard A: Abilities necessary to do scientific inquiry

Grades 5-8, Standard A: Understandings about scientific inquiry

Grades 5-8, Standard G: Nature of Science

This guide has been developed for use by educators, group leaders and families for use in connection with "Mythbusters: The Explosive Exhibition" (the "Educators"). The activities described in this guide are potentially dangerous and could result in injury or damage. This guide is provided on an "AS IS" basis and the Museum of Science and Industry disclaims all warranties, express or implied, regarding the guide. Use of this guide is done at the risk of the Educators. By using this guide, you release the Museum of Science and Industry, its officers, employees, directors, trustees, agents and volunteers from and against any and all liability, claims, actions, costs, expenses, damages, attorney fees, breach of contract actions and all causes of actions whatsoever, that you may now have or may acquire in the future, arising out of or relating to any loss, damage or injury that may be sustained by you, the people you are educating, or to any property belonging to you or the people you are educating, as a result of the use of the guide.



Geoffrey M. Curley + Associates, LLC
Exhibition and Theatrical Consultation and Design



TAKE A GUESS - IF YOU FLIP A COIN 100 TIMES, HOW MANY TIMES WILL IT LAND HEADS UP? _____

TAILS UP? _____

WHAT MAKES YOU THINK SO?

TOSS A COIN 20 TIMES, RECORDING IF IT LANDS HEADS UP (H) OR TAILS UP (T) EACH TIME,

Look at your results in groups of 4. Do you notice any trends?

Take the total number of heads and divide by 20 to find the percentage of times the coin lands on each side:

$$\frac{\# \text{ OF HEADS UP}}{20} \times 100 = \underline{\hspace{2cm}} \%$$

This percentage will give you the probability of the coin landing on heads or tails. Using your data, make a prediction how many times the coin will land heads up when you flip it five more times:

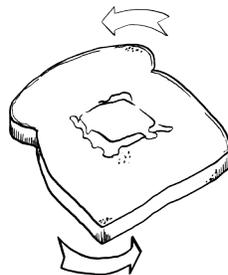
"I PREDICT THE COIN WILL LANDS HEADS UP _____ TIMES."

Record if the coin lands on heads or tails (H or T) for each of 5 flips.

Was your prediction accurate? Why or why not?

| TRIAL | HEADS? | TAILS? |
|--------|--------|--------|
| 0 | | |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |
| 11 | | |
| 12 | | |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | | |
| TOTALS | | |

BLUEPRINT: FLIP IT!



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

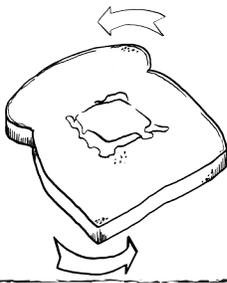
1. How does your experimental design affect the outcome of the coin flips? Repeat the steps above, but use a different method to “flip” your coin. For example, what happens if you push the coin off the edge of a table instead of tossing it into the air? What if you always start with the coin heads up?
2. For each method used to flip the coin, repeat the flip 20 times. Then try another method and repeat.
3. Look for trends in your results. Does the setup of your experiment seem to affect the ultimate outcome?

EXPERIMENTAL DESIGN No.1

Describe your tossing method. Be sure to include which parts of the design remain the same and which part (remember – only change one thing at a time) changes.

TOSS A COIN 20 TIMES, RECORDING IF IT LANDS HEADS UP (H) OR TAILS UP (T) EACH TIME.

| TRIAL | HEADS? | TAILS? |
|--------|--------|--------|
| 0 | | |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |
| 11 | | |
| 12 | | |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | | |
| TOTALS | | |



BLUEPRINT: FLIP IT!

MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

EXPERIMENTAL DESIGN №2

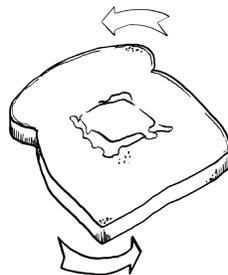
Describe your tossing method. Be sure to include which parts of the design remain the same and which part (remember – only change one thing at a time) changes.

TOSS A COIN 20 TIMES, RECORDING IF IT LANDS HEADS UP (H) OR TAILS UP (T) EACH TIME.

DOES THE SETUP OF YOUR EXPERIMENT SEEM TO AFFECT THE ULTIMATE OUTCOME? IF SO, WHY DO YOU THINK THAT IS? IF NOT, WHY NOT?

| TRIAL | HEADS? | TAILS? |
|--------|--------|--------|
| 0 | | |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |
| 11 | | |
| 12 | | |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | | |
| TOTALS | | |

BLUEPRINT: FLIP IT!



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

ACTIVITY #6



**WIND
AND
RAIN**

MYTHBUSTERS: THE EXPLOSIVE EXHIBITION COMPONENT:
RUNNING IN THE RAIN



MYTHBUSTERS

THE EXPLOSIVE EXHIBITION.

 **Discovery**
EDUCATION

WONDER

Does the angle of rain impact how much falls on a particular spot?

RESEARCH

Raindrops falling straight down and raindrops falling at an angle because of wind have different impacts on the surfaces they hit. Scientists study these differences to understand how rainstorms can affect things like soil erosion and surface runoff that flows into our lakes, rivers and streams.

Scientists use a number of tools to measure and predict the weather and its impacts. A rain gauge is a tool used to measure the amount of rain that falls over a given period of time. Anemometers are tools used to measure wind speed. Scientists need accurate measurements of rain and wind to help them understand how storms can impact our earth. Designing instruments to collect such data is not always so easy!

TEST AND DISCOVER

MATERIALS

- 2 wide mouth clear jars (preferably glass since it won't blow over)
- Permanent marker
- Protractor
- String
- Tape
- Ping pong ball
- Piece of graph paper

SAFETY FIRST!

Stepping into the shoes of a MythBuster should not mean sacrificing your safety.

Keep these guidelines in mind for each activity:

1. Read or listen carefully to all the directions before you start the experiment.
2. Use the equipment and materials only as instructed.
3. Keep your work area clean and organized.
4. Take care when using scissors, or restrict their use to adults.

Special Note: Handle permanent markers and glass jars with care.

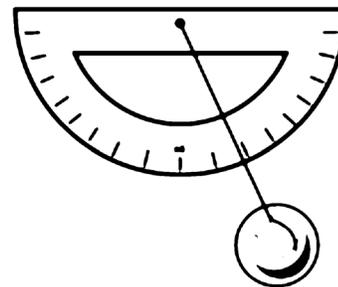
PROCEDURE

BUILD A RAIN GAUGE

1. Use the ruler to measure and mark 1cm increments on the side of each of your two jars.

BUILD AN ANEMOMETER

1. Tape the thread to a ping pong ball. Tape or tie the other end of the thread in middle of the straight side of the protractor.



TEST YOUR RAIN GAUGE

1. On a rainy and preferably windy day, place one rain gauge in an open area, away from anything that might block the wind. Place the other rain gauge somewhere that is protected by the wind, but not covered from above. Decide on a length of time to collect rain – try 15 to 20 minutes to start.
2. After the allotted time, gather your rain gauges and record the amount of rain collected in each on your Blueprint. Is the amount in the 2 jars the same or different?

TEST YOUR ANEMOMETER

1. While your rain gauges are collecting water, measure the wind speed at each location. Using the ruler as a handle, point the anemometer into the wind. Be sure that the ruler is level with the ground and the string and ping pong ball are hanging down. When the wind blows the ball and thread will move. Use the protractor to measure the angle of the ball and thread.
2. Back inside, use the Wind Speed Table on your Blueprint to compare the angle of the string and ping pong ball to the actual wind speed. Record the wind speed at each location.

THINK ABOUT IT

- Compare the wind speed and amount of rain collected at each location. Did you collect as much rain in the windy location as you did in the protected location? Why?
- You may find there is less rain collected in the windy location. Is less rain actually falling there, or is your collection instrument “missing” some of the drops? How might this impact the data you collect?

RESULTS

The design and location of weather instruments can greatly affect their accuracy. Gauges located in windy areas will produce different results because wind blowing around the mouth and body of the collector will keep a portion of rain from falling into the jar. The stronger the wind, the more it will impact how much rain lands inside. This is especially true when the gauges are located above the ground where wind speeds are higher. Scientists must take all of these variables into account when analyzing the data they collect.

KEEP DISCOVERING!

- Repeat this experiment in several different locations during a given rainstorm, AND during several different storms. How do your results vary?
- Go online to find rainfall and wind speed measurements for the day of your experiment. How do they compare to your results?
- With an adult’s help, try a version of this experiment in your sink using a sink sprayer to simulate rain and a strong fan to simulate wind.



WANT TO LEARN MORE?

CHECK OUT A SURPRISING JOB THAT RELIES ON GEOMETRY AND TRIGONOMETRY

<http://science.discovery.com/videos/head-rush-cool-jobs-in-science-matt-lundin.html>

CHECK OUT THE MYTHBUSTERS RUNNING IN THE RAIN!

<http://dsc.discovery.com/videos/mythbusters-running-in-the-rain-minimyth.html>

WHAT MAKES IT RAIN?

<http://player.discoveryeducation.com/index.cfm?guidAssetId=B05E5DE8-C296-462D-88C8-1C8E068469D4&blnFromSearch=1&productcode=US>

NATIONAL SCIENCE EDUCATION STANDARDS

- Grade 5-8, Standard A: Abilities necessary to do scientific inquiry
- Grade 5-8, Standard A: Understandings about scientific inquiry
- Grade 5-8, Standard B: Motions and Forces
- Grade 5-8, Standard D: Structure of the earth system
- Grades 5-8, Standard E: Abilities of technological design
- Grade 5-8, Standard F: Natural hazards
- Grade 5-8, Standard G: Nature of science

This guide has been developed for use by educators, group leaders and families for use in connection with "Mythbusters: The Explosive Exhibition" (the "Educators"). The activities described in this guide are potentially dangerous and could result in injury or damage. This guide is provided on an "AS IS" basis and the Museum of Science and Industry disclaims all warranties, express or implied, regarding the guide. Use of this guide is done at the risk of the Educators. By using this guide, you release the Museum of Science and Industry, its officers, employees, directors, trustees, agents and volunteers from and against any and all liability, claims, actions, costs, expenses, damages, attorney fees, breach of contract actions and all causes of actions whatsoever, that you may now have or may acquire in the future, arising out of or relating to any loss, damage or injury that may be sustained by you, the people you are educating, or to any property belonging to you or the people you are educating, as a result of the use of the guide.

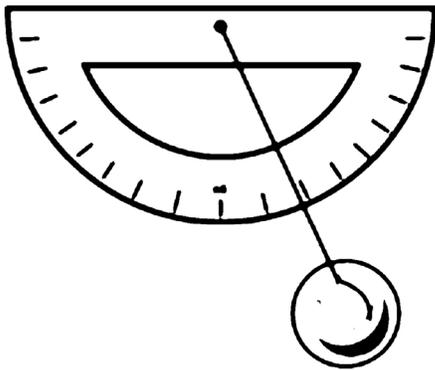


Geoffrey M. Curley + Associates, LLC
Exhibition and Theatrical Consultation and Design



BUILD AN ANEMOMETER

1. Tape one end of the string to the ping pong ball.
2. Tape the other end of the string to the hole in the straight section of the protractor.
3. When held up with the straight side of the protractor parallel to the floor, the string should hang down the middle of the curved part of the protractor (at 90 degrees)
4. Test your anemometer outside. When the wind blows, the ball and thread will move. Use the curved part of the protractor to measure the angle made by the ball and thread.
5. Compare the angle of the string and ping pong ball to the actual wind speed using the Wind Speed Table.



| ANGLE RECORDED | WIND SPEED (KM/HR) |
|----------------|--------------------|
| 90° | 0 |
| 95° | 9 |
| 100° | 13 |
| 105° | 16 |
| 110° | 19 |
| 115° | 21 |
| 120° | 24 |
| 125° | 26 |
| 130° | 29 |
| 135° | 31 |
| 140° | 34 |
| 145° | 37 |
| 150° | 41 |
| 155° | 46 |
| 160° | 52 |

BUILD A RAIN GAUGE:

1. Use the ruler to measure and mark 1cm increments on the side of each of your two jars.

BLUEPRINT: WIND AND RAIN



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

TEST YOUR RAIN GAUGE

Place one rain gauge in an open area, away from anything that might block the wind. Place the other rain gauge somewhere that is protected by the wind, but not covered from above. Decide on a length of time to collect rain – try 15 to 20 minutes to start.

Gather your rain gauges and record the amount of rain collected in each on the table below.

| RAIN GAUGE | LOCATION | AMOUNT COLLECTED |
|------------|--------------------|------------------|
| 1 | WINDY LOCATION | ___ CM |
| 2 | PROTECTED LOCATION | ___ CM |

TEST YOUR ANEMOMETER

Measure the wind speed at each location. Using the ruler as a handle, point the anemometer into the wind. Be sure that the ruler is level with the ground and the string and ping pong ball are hanging down. When the wind blows the ball and thread will move.

Use the protractor to measure the angle of the ball and thread and record in on the table below.

| LOCATION | ANGLE OF BALL AND STRING | WIND SPEED |
|--------------|--------------------------|------------|
| 1. WINDY | _____° | ___ KM/HR |
| 2. PROTECTED | _____° | ___ KM/HR |

Compare the angle to the Wind Speed Table to find the speed at each location.

Compare the wind speed and amount of rain collected at each location. Did you collect as much rain in the windy location as you did in the protected location? Why?

You may find there is less rain collected in the windy location. Is less rain actually falling there, or is your collection instrument “missing” some of the drops? How might this impact the data you collect?

BLUEPRINT:
WIND AND RAIN

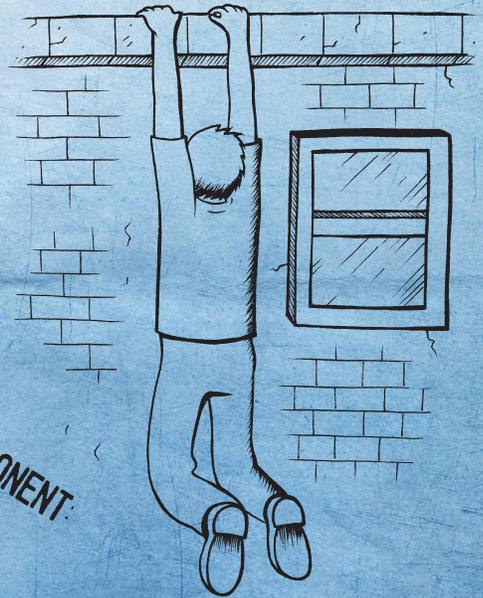


MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

ACTIVITY #7

SUPERHERO STRENGTH

MYTHBUSTERS: THE EXPLOSIVE EXHIBITION COMPONENT
CLIFFHANGER



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION.

 **Discovery**
EDUCATION

WONDER

How long can you keep a rubber band stretched before your muscles quit in protest?

RESEARCH

We use our muscles to walk, talk and even play video games! Muscles need energy—fuel from the foods we eat—in order to function. Muscle fatigue can set in when our body runs out of energy to fuel a muscle’s movement and as waste products made by using the muscles builds up. You might “feel the burn” as your muscles tire during strenuous exercise.

TEST AND DISCOVER

MATERIALS

- 2 inch rubber band
- Pencil
- Blueprint
- Stopwatch
- Partner

SAFETY FIRST!

Stepping into the shoes of a MythBuster should not mean sacrificing your safety. Keep these guidelines in mind for each activity:

1. Read or listen carefully to all the directions before you start the experiment.
2. Use the equipment and materials only as instructed.
3. Keep your work area clean and organized.
4. Take care when using scissors, or restrict their use to adults.
5. Use plastic instead of glass wherever possible.

Special Note: Rubber bands should be handled with care and may pose a choking hazard for younger children.

PROCEDURE

1. Gather your materials
2. Outline your hand in the box on the Blueprint, starting and ending at your wrist. Draw a line across your wrist from one side to the other. Draw a star in the center of the line.
3. Draw an “X” on the middle knuckle of the index (pointer) finger on your sketch.
4. Make a prediction – how long can you keep the rubber band stretched between you thumb and ring finger?
5. Using your real hand, stretch the rubber band from the top knuckle of your thumb to the top knuckle of your ring finger.
6. Place your thumb on the star on your sketch and s-t-r-e-t-c-h your ring finger (with the rubber band looped around it) to hover over (but not touching) the “X” mark. For an added challenge, keep your thumb hovering above the star, rather than resting on the paper. Hold that pose!
7. Have your partner use the stopwatch to see how long you can keep your finger hovering above the “X”. Stop timing when your finger moves away from that spot.

THINK ABOUT IT

- Try to point out all of the muscles used in this experiment. Certainly those in your fingers, but where else? What do you usually use these muscles for?
- What did you notice about your hand as you stretched the rubber band for a longer and longer period of time? How did your muscles feel? Why?

RESULTS

Using a particular muscle or set of muscles for a long period of time can cause muscle fatigue - a decline in the ability of a muscle to generate a force (push or pull). In this case, the muscle set used to stretch the rubber band is not usually used to produce so much force for such a long time. The muscles burn through energy quickly and soon tire of pushing against the rubber band. At the same time, waste products that can interfere with the messages running between the muscle and your brain start to build up in your muscle fibers. As your energy level begins to decline and the waste products begin to build, your muscles may cramp, tire and even start to shake with the effort!

TIPS FOR TEACHERS

Have students perform this experiment three times, and calculate the average time they were able to keep the rubber band stretched. Ask students to share their times with the class, and discuss and discuss why the times differ. Brainstorm the various variables that effect muscle fatigue.

KEEP DISCOVERING!

Try using different fingers in the experiment. Is your index (pointer finger) able to hang on longer? What if switch hands?

Take a look at a model or drawing of a human hand and arm. Can you find and name the muscles used in this experiment?

Repeat this experiment every day for at least two weeks – do you notice changes in your ability over time?

TRY THIS AT-HOME VERSION OF THE CLIFFHANGER EXHIBIT!

Stand about 3 feet away from a wall. Stretch out your arms and lean in close to the wall, holding yourself up with your fingertips. Slowly begin lifting your fingers so that you're holding yourself up with less and less fingers over time (for example, try lifting your ring fingers, then your middle fingers, then your pinky fingers, etc.). What happens as you use less and less fingers to hold yourself up? Why? Can you hold your pose using just a few fingers longer than a partner?



WANT TO LEARN MORE?

TEACHERS – THIS LESSON PLAN SHOWS STUDENTS HOW SCIENCE IS ESSENTIAL IN ATHLETIC TRAINING, EQUIPMENT AND COMPETITION.

<http://www.discoveryeducation.com/teachers/free-lesson-plans/the-science-of-lance-armstrong.cfm>

EXPLORE THE TYPES OF MUSCLE TISSUE IN THIS VIDEO.

<http://player.discoveryeducation.com/?guidAssetId=fca912f5-63f0-4785-8e4b-444f993e15b2>

NATIONAL SCIENCE EDUCATION STANDARDS

Grades 5-8, Standard A: Abilities necessary to do scientific inquiry

Grades 5-8, Standard A: Understandings about scientific inquiry

Grades 5-8, Standard C: Structure and Function in living systems

Grades 5-8, Standard C: Regulation and Behavior

Grades 5-8, Standard F: Personal Health

Grades 5-8, Standard G: Nature of Science

This guide has been developed for use by educators, group leaders and families for use in connection with "Mythbusters: The Explosive Exhibition" (the "Educators"). The activities described in this guide are potentially dangerous and could result in injury or damage. This guide is provided on an "AS IS" basis and the Museum of Science and Industry disclaims all warranties, express or implied, regarding the guide. Use of this guide is done at the risk of the Educators. By using this guide, you release the Museum of Science and Industry, its officers, employees, directors, trustees, agents and volunteers from and against any and all liability, claims, actions, costs, expenses, damages, attorney fees, breach of contract actions and all causes of actions whatsoever, that you may now have or may acquire in the future, arising out of or relating to any loss, damage or injury that may be sustained by you, the people you are educating, or to any property belonging to you or the people you are educating, as a result of the use of the guide.



Geoffrey M. Curley + Associates, LLC
Exhibition and Theatrical Consultation and Design



SUPERHERO STRENGTH BLUEPRINT

1. Outline your hand on the Blueprint, starting and ending at your wrist. Draw a line across your wrist from one side to the other. Draw a star in the center of the line.
2. Draw an "X" on the middle knuckle of the index (pointer) finger on your sketch.
3. Make a prediction – how long can you keep the rubber band stretched between you thumb and ring finger?
4. Using your real hand, stretch the rubber band from the top knuckle of your thumb to the top knuckle of your ring finger.
5. Place your thumb on the star on your sketch and s-t-r-e-t-c-h your ring finger (with the rubber band looped around it) to hover over (but not touching) the "X" mark. For an added challenge, keep your thumb hovering above the star, rather than resting on the paper. Hold that pose!
6. Have your partner use the stopwatch to see how long you can keep your finger hovering above the "X". Stop timing when your finger moves away from that spot.

**BLUEPRINT:
SUPERHERO STRENGTH**



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

TRY TO POINT OUT ALL OF THE MUSCLES USED IN THIS EXPERIMENT. CERTAINLY THOSE IN YOUR FINGERS, BUT WHERE ELSE? WHAT DO YOU USUALLY USE THESE MUSCLES FOR?

WHAT DID YOU NOTICE ABOUT YOUR HAND AS YOU STRETCHED THE RUBBER BAND FOR A LONGER AND LONGER PERIOD OF TIME? HOW DID YOUR MUSCLES FEEL? WHY?

TRY THE EXPERIMENT TWO MORE TIMES. CALCULATE THE AVERAGE TIME THEY WERE ABLE TO KEEP THE RUBBER BAND STRETCHED.

| TRIAL | PREDICTED HOLD TIME | ACTUAL HOLD TIME |
|-------|---------------------|------------------|
| 1 | | |
| 2 | | |
| 3 | | |

$$\text{AVERAGE HOLD TIME} = \frac{(\text{ACTUAL HOLD TIME, TRIAL 1}) + (\text{ACTUAL HOLD TIME, TRIAL 2}) + (\text{ACTUAL HOLD TIME, TRIAL 3})}{3}$$

BLUEPRINT: SUPERHERO STRENGTH



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

ACTIVITY #8

REFLEXES



MYTHBUSTERS: THE EXPLOSIVE EXHIBITION COMPONENT:
DODGE A BULLET

MYTHBUSTERS
THE EXPLOSIVE EXHIBITION.

 **Discovery**
EDUCATION

WONDER

How fast are your reactions? Can you compete with a Mythbuster?

RESEARCH

Your body's systems carry out the processes that keep you alive - your digestive system helps supply the fuel you need, your immune system keeps you from getting sick, and your muscular system lets you move around.

The nervous system keeps them all connected and working together. It's made of two parts, the central and peripheral nervous systems that work together to send electrical and chemical messages around the body very quickly.

The central nervous system contains your brain and spinal cord. Your peripheral nervous system contains the nerves that collect information from your body and send it to your brain, and carries messages from the brain to the rest of the body.

TEST AND DISCOVER

MATERIALS

- Ruler (12 in/30 cm)
- Partner
- Pen or pencil
- Blueprint

SAFETY FIRST!

Stepping into the shoes of a MythBuster should not mean sacrificing your safety. Keep these guidelines in mind for each activity:

1. Read or listen carefully to all the directions before you start the experiment.
2. Use the equipment and materials only as instructed.
3. Keep your work area clean and organized.
4. Take care when using scissors, or restrict their use to adults.
5. Use plastic instead of glass wherever possible.

PROCEDURE

1. Have your partner hold the ruler so that it hangs above your hand and between the thumb and index finger on the hand you use to write with. Your fingers should be level with the 0 on the ruler (right at the bottom); your partner holds the ruler at the other end (near the 12 in/ 30 cm mark).
2. Your partner drops the ruler without warning - can you catch it?
3. Note where your fingers land when you catch the ruler. Compare that number with the chart below to estimate your reaction time. Record it on your Blueprint.
4. Switch roles with your partner and try it again. Who has the faster reaction time?
5. Try it at least 5 more times, alternating turns with your partner. Do you notice a change in your reaction time as you get more practice?
6. Try it two more times. Switch positions and repeat all of the steps to see who has the fastest reaction times.

TABLE OF REACTION TIMES FOR THE RULER DROP

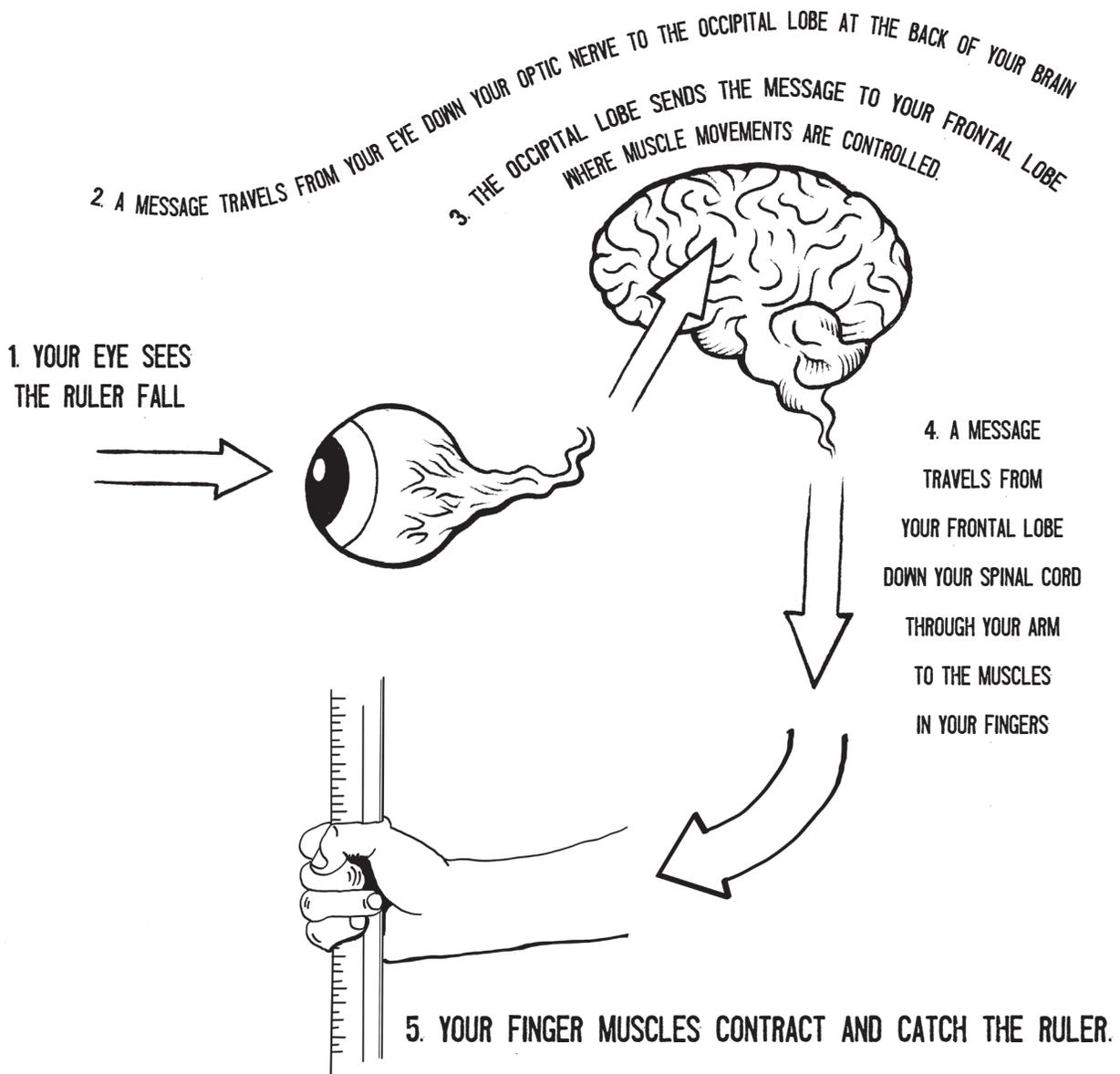
| DISTANCE RULER FELL | REACTION TIME (SEC) |
|----------------------------|---------------------|
| 2 INCHES (APPROX. 5 CM) | 0.10 |
| 4 INCHES (APPROX. 10CM) | 0.14 |
| 6 INCHES (APPROX. 15CM) | 0.17 |
| 8 INCHES (APPROX. 20CM) | 0.20 |
| 10 INCHES (APPROX. 25.5CM) | 0.23 |
| 12 INCHES (APPROX. 35CM) | 0.25 |

THINK ABOUT IT

- Can you trace the path through your nervous system? Describe it. How did you know when to catch it?
- Which of your five senses did you use?
- Who had the fastest reaction time? Why?
- What factors would affect reaction time?
- Can you train yourself to have a faster reaction time?
- What is your reaction time with your other hand?

RESULTS

Your peripheral and central nervous system both play a role in helping you catch the ruler, using the following steps:



And that all happens in less than a quarter of a second!

SO WHY ARE SOME PEOPLE FASTER THAN OTHERS?

It has to do with practice. The more times you do something, the faster and more accurate you get. When you first learned to tie your shoes or type on a keyboard, it probably took a while. After a while, using the same nerves over and over trains them (and your muscles) to perform the task.

TIPS FOR TEACHERS

Have your class calculate averages for both individuals and the entire class, as well as observe the minimums, maximums and trends as students build their skills. Try doing more than 5 trials to achieve more accurate results.

KEEP DISCOVERING!

Take some more data! Try this with your friends and family, making sure to record their distance, reaction time and something about them such as their age, hobbies or careers. What types of patterns do you see?

What is your reaction time to things that you feel? Touch a piece of ice – how soon do you feel the cold? Why does your reaction time differ for your sense of touch versus your sense of sight?

WANT TO LEARN MORE?

THE MYTHBUSTERS RESPOND TO THEIR DODGE A BULLET EPISODE.

<http://dsc.discovery.com/videos/mythbusters-dodge-a-bullet/>

<http://dsc.discovery.com/videos/mythbusters-dodge-a-bullet-aftershow.html>

LEARN ABOUT THE ROLE OF YOUR EYES AND NERVOUS SYSTEM IN YOUR REACTION TO A STIMULUS.

<http://player.discoveryeducation.com/index.cfm?guidAssetId=206D2834-9A23-419F-96AB-006B40DACF90&blnFromSearch=1&productcode=US>

HOW DOES THE BRAIN PROCESS STIMULI? CHECK IT OUT!

<http://player.discoveryeducation.com/index.cfm?guidAssetId=C7D9CB42-4F86-4DAE-BCF5-93E24A3F010D&blnFromSearch=1&productcode=US>

NATIONAL SCIENCE EDUCATION STANDARDS

Grades 5-8, Standard A: Abilities necessary to do scientific inquiry

Grades 5-8, Standard A: Understandings about scientific inquiry

Grades 5-8, Standard C: Structure and Function in living systems

Grades 5-8, Standard C: Regulation and Behavior

Grades 5-8, Standard G: Nature of Science

This guide has been developed for use by educators, group leaders and families for use in connection with "Mythbusters: The Explosive Exhibition" (the "Educators"). The activities described in this guide are potentially dangerous and could result in injury or damage. This guide is provided on an "AS IS" basis and the Museum of Science and Industry disclaims all warranties, express or implied, regarding the guide. Use of this guide is done at the risk of the Educators. By using this guide, you release the Museum of Science and Industry, its officers, employees, directors, trustees, agents and volunteers from and against any and all liability, claims, actions, costs, expenses, damages, attorney fees, breach of contract actions and all causes of actions whatsoever, that you may now have or may acquire in the future, arising out of or relating to any loss, damage or injury that may be sustained by you, the people you are educating, or to any property belonging to you or the people you are educating, as a result of the use of the guide.



Geoffrey M. Curley + Associates, LLC
Exhibition and Theatrical Consultation and Design



1. HAVE YOUR PARTNER HOLD THE RULER SO THAT IT HANGS ABOVE YOUR HAND AND BETWEEN THE THUMB AND INDEX FINGER ON THE HAND YOU USE TO WRITE WITH. YOUR FINGERS SHOULD BE LEVEL WITH THE 0 ON THE RULER (RIGHT AT THE BOTTOM); YOUR PARTNER SHOULD HOLD THE RULER AT THE OTHER END (NEAR THE 12).
2. YOUR PARTNER SHOULD DROP THE RULER WITHOUT WARNING -CAN YOU CATCH IT?
3. NOTE WHERE THE TOP OF YOUR THUMB LANDS WHEN YOU CATCH THE RULER. COMPARE THAT NUMBER WITH THE CHART BELOW TO ESTIMATE YOUR REACTION TIME. RECORD IT ON YOUR BLUEPRINT.
4. TRY IT AT LEAST 5 MORE TIMES. THEN SWITCH POSITIONS AND REPEAT ALL THE STEPS TO SEE WHO HAS THE FASTEST REACTION TIMES

TABLE OF REACTION TIMES FOR THE RULER DROP

DISTANCE RULER FELL REACTION TIME (SEC)

| | |
|----------------------------|------|
| 2 INCHES (APPROX. 5 CM) | 0.10 |
| 4 INCHES (APPROX. 10CM) | 0.14 |
| 6 INCHES (APPROX. 15CM) | 0.17 |
| 8 INCHES (APPROX. 20CM) | 0.20 |
| 10 INCHES (APPROX. 25.5CM) | 0.23 |
| 12 INCHES (APPROX. 35CM) | 0.25 |

BLUEPRINT: REFLEXES



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

CAN YOU TRACE THE PATH THROUGH YOUR NERVOUS SYSTEM? DESCRIBE IT.
HOW DID YOU KNOW WHEN TO CATCH IT?

WHICH OF YOUR FIVE SENSES DID YOU USE?

WHO HAD THE FASTEST REACTION TIME? WHY?

WHAT FACTORS WOULD AFFECT REACTION TIME?

CAN YOU TRAIN YOURSELF TO HAVE A FASTER REACTION TIME?

WHAT IS YOUR REACTION TIME WITH YOUR OTHER HAND?



BLUEPRINT: REFLEXES

MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

ACTIVITY #9



TELL
ME
ABOUT
IT



MYTHBUSTERS: THE EXPLOSIVE EXHIBITION COMPONENT:
BLIND DRIVING



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION.

 **Discovery**
EDUCATION

WONDER

Can your keen observation and communication skills help a partner to identify something they can't see?

RESEARCH

Have you ever reached out to feel something that you have never felt before? Can you tell what's for dinner just by the smell? People explore the world around them using the five senses: sight, touch, taste, hearing and smell. The five senses are used to make observations and to describe and define the world around us. Imagine how your life would be different if you lost just one of your senses.

TEST AND DISCOVER

MATERIALS

- A number of different objects from around your home. Examples could be:
 - o Bottle of water
 - o Orange
 - o Rock
 - o Cooked noodles
 - o Grapes
 - o Baseball
 - o Pencil
 - o Plastic silverware (be sure to avoid sharp items)
 - o Other items from around your home or classroom
- 2 boxes (make sure your objects fit inside)
- Partner
- Blueprint

SAFETY FIRST!

Stepping into the shoes of a MythBuster should not mean sacrificing your safety. Keep these guidelines in mind for each activity:

1. Read or listen carefully to all the directions before you start the experiment.
2. Use the equipment and materials only as instructed.
3. Keep your work area clean and organized.
4. Take care when using scissors, or restrict their use to adults.
5. Use plastic instead of glass wherever possible.

Special Notes: Be sure to use items that are safe to handle, with no sharp edges.

Small items may pose a choking hazard for small children.

PROCEDURE

BEFORE EXPERIMENT

Each partner should gather three to five objects and place them in their own box. Make sure your partner can't see what you select!

EXPERIMENT

1. Have your partner sit with their back to you. It's important that they can't see the objects in your box.
2. Select an object from your box, making sure that your partner can't see it. Using only your senses (sight, hearing, smell, touch – for safety purposes we will not use taste), describe the object out loud to your partner.

What shape is it? How does it feel? Does it make any noises? How does it smell? Remember to use descriptions based only on what you can directly observe, and not what you already know about what the object is or how it is used.

3. As you describe your observations, ask your partner to make 5 guesses about its identity and write them down on their Blueprint. They should also make a quick sketch of what they think the object looks like. After the “guesser” records their guesses and draws their sketch, , reveal the object.
4. Switch roles and repeat for all of the objects in your box.

THINK ABOUT IT

- What objects were the easiest for you to describe? For your partner to identify?
- What objects were the hardest for you to describe? For your partner to identify?
- What did you notice about your ability to describe the objects or guess their identities over time? Did you get better with practice? Why do you think that is?
- Why is making observations and communicating them clearly important?

RESULTS

We use our senses to make observations as we try to identify objects, people and places. Your senses work together to help you observe, understand and navigate the world around you. At the same time, your ability to describe your observations can help others understand things they cannot sense directly. As they listen to your descriptions, they remember similar things they have experienced with their own senses, helping them to understand and identify what you are talking about.

KEEP DISCOVERING!

Try the Smell Challenge! Choose three different liquids (ask an adult to help you make safe choices) and then pour into separate containers that you can't see through. Ask a partner to identify them using only their sense of smell.

WANT TO LEARN MORE?

MYTHBUSTERS DRIVING BLIND

<http://dsc.discovery.com/videos/mythbusters-driving-blind.html>

NATIONAL SCIENCE EDUCATION STANDARDS

- Grades 5-8, Standard A: Abilities necessary to do scientific inquiry
- Grades 5-8, Standard A: Understandings about scientific inquiry
- Grades 5-8, Standard C: Structure and Function in living systems
- Grades 5-8, Standard G: Nature of Science

This guide has been developed for use by educators, group leaders and families for use in connection with "Mythbusters: The Explosive Exhibition" (the "Educators"). The activities described in this guide are potentially dangerous and could result in injury or damage. This guide is provided on an "AS IS" basis and the Museum of Science and Industry disclaims all warranties, express or implied, regarding the guide. Use of this guide is done at the risk of the Educators. By using this guide, you release the Museum of Science and Industry, its officers, employees, directors, trustees, agents and volunteers from and against any and all liability, claims, actions, costs, expenses, damages, attorney fees, breach of contract actions and all causes of actions whatsoever, that you may now have or may acquire in the future, arising out of or relating to any loss, damage or injury that may be sustained by you, the people you are educating, or to any property belonging to you or the people you are educating, as a result of the use of the guide.



Geoffrey M. Curley + Associates, LLC
Exhibition and Theatrical Consultation and Design



1. Blindfold your partner or have them sit with their back to you.
2. Select an object from your box, making sure that your partner can't see it. Using only your senses (sight, hearing, smell, touch – for safety purposes we will not use taste), describe the object out loud to your partner. What shape is it? How does it feel? Does it make any noises? How does it smell? Remember to use descriptions based only on what you can directly observe, and not what you already know about what the object is or how it is used.
3. As you describe your observations, ask your partner to make 5 guesses about its identity. They can stop guessing sooner if they guess correctly. Record their guesses on the Blueprint. After the fifth guess, reveal the object to your partner.
4. Switch roles and repeat for all of the objects in your box.

ITEM:

| | |
|---------|--|
| GUESS 1 | |
| GUESS 2 | |
| GUESS 3 | |
| GUESS 4 | |
| GUESS 5 | |

DRAW A SKETCH OF WHAT YOU THINK THE ITEM LOOKS LIKE:

**BLUEPRINT:
TELL ME ABOUT IT**



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

ITEM:

| | |
|---------|--|
| GUESS 1 | |
| GUESS 2 | |
| GUESS 3 | |
| GUESS 4 | |
| GUESS 5 | |

DRAW A SKETCH OF WHAT YOU THINK THE ITEM LOOKS LIKE:

**BLUEPRINT:
TELL ME ABOUT IT**



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

ITEM:

| | |
|---------|--|
| GUESS 1 | |
| GUESS 2 | |
| GUESS 3 | |
| GUESS 4 | |
| GUESS 5 | |

DRAW A SKETCH OF WHAT YOU THINK THE ITEM LOOKS LIKE:

**BLUEPRINT:
TELL ME ABOUT IT**



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

ACTIVITY #10

SPIN
IT

FLICK!



MYTHBUSTERS: THE EXPLOSIVE EXHIBITION COMPONENT:
KILLER CARD TOSS

MYTHBUSTERS
THE EXPLOSIVE EXHIBITION.

 **Discovery**
EDUCATION

WONDER

How does the shape of paper effect how it flies through the air?

RESEARCH

The air around us – even if we can't really see it – is made up of atoms and takes up space. Try waving your arms back and forth – you can feel it as your arms collide with the air molecules around them. You are experiencing a force called air resistance – the opposition to an object's motion through the air.

Size and shape are two factors that affect air resistance. The more surface area an object has, the more air resistance it will encounter. Imagine dropping two pieces of paper – one flat and one crumpled into a ball. The crumpled one falls faster because there is less air resistance acting on the paper.

TEST AND DISCOVER

MATERIALS

- Helicopter Template
- Scissors
- Small paper clips
- Stopwatch (optional)
- Blueprint

SAFETY FIRST!

Stepping into the shoes of a MythBuster should not mean sacrificing your safety. Keep these guidelines in mind for each activity:

1. Read or listen carefully to all the directions before your start the experiment.
2. Use the equipment and materials only as instructed.
3. Keep your work area clean and organized.
4. Take care when using scissors, or restrict their use to adults.
5. Use plastic instead of glass wherever possible.

Special Notes: Children should not climb on objects to drop helicopters.

PROCEDURE

1. Download and print helicopter template.
2. Use the helicopter template to cut out your flyer. Cut only on the solid lines.
3. Fold flap C up. Hold your helicopter up high and drop it. Observe what happens.
4. Fold flaps D and E in opposite direction to form the blades. Fold flap D towards you and flap E away from you. Hold your helicopter up high and drop it again. Observe what happens.
5. Cut out a new flyer and experiment with the design. What happens when you:
 - Add a paper clip to the stem? Two paper clips?
 - Fold the stem to make it shorter?
 - Cut the blades shorter?
 - Cut jagged edges on the blades, or make the blades rounded?
 - Bend the blades another way?
6. Describe or draw your fastest and slowest designs on your Blueprint. Include arrows to indicate where you think the helicopter is encountering air resistance.

THINK ABOUT IT

What makes the helicopter fall to the ground the fastest? Slowest? How can you explain the difference?

RESULTS

As the helicopter falls, air molecules colliding with it cause an opposing force that slows the helicopter down. The pressure of the air pushes the blades up into a slanted position. Because there is no forward movement, gravity pulls the helicopter downward, but the moving winds act against this force. The air under one blade is pushing one way and the air under the other blade is pushing the opposite way. These two forces of air push the blades around and make it spin. The faster the blades spin, the less the air can get by and the slower the helicopter falls.

By experimenting with the weight, shape and position of the blades, you can change how fast and how much air is pushed out of the way. In other words, you're changing how the air resistance is hitting your helicopter. This affects how it moves.

TIPS FOR TEACHERS

Have students find the average flight time after three trials. Analyze data from different types of helicopters to create the best helicopter.

KEEP DISCOVERING!

Investigate how changing one variable at a time impacts the flight of your helicopter. For example, what if you add one paperclip to the base, but keep everything else the same? What if you add another paperclip, but keep everything else the same? Use a stopwatch to accurately measure the flight times and record your results.

WANT TO LEARN MORE?

ADAM AND JAMIE TACKLE CARD TOSSING.

<http://dsc.discovery.com/videos/mythbusters-killer-deck-minimyth.html>

<http://player.discoveryeducation.com/?guidAssetId=186b635e-2ad8-432a-b6cf-138fc21cd230>

CHECK OUT A CHAMPION CARD TOSSER – IN SLOW MOTION!

<http://player.discoveryeducation.com/index.cfm?guidAssetId=B4817D80-3A5B-4239-8F6F-7241A356CFE5&blnFromSearch=1&productcode=US>

<http://player.discoveryeducation.com/index.cfm?guidAssetId=B4817D80-3A5B-4239-8F6F-7241A356CFE5&blnFromSearch=1&productcode=US>

INVESTIGATE THE BIOMECHANICS OF THROWING – WHETHER IT'S BASEBALLS OR PLAYING CARDS.

<http://player.discoveryeducation.com/index.cfm?guidAssetId=F158B3F4-E32C-4A83-B258-4695A9445311&blnFromSearch=1&productcode=US>

<http://player.discoveryeducation.com/index.cfm?guidAssetId=F158B3F4-E32C-4A83-B258-4695A9445311&blnFromSearch=1&productcode=US>

WHAT'S THE BEST WAY TO TOSS A PUMPKIN?

<http://science.discovery.com/tv/punkin-chunkin/game/>

WHAT ARE PLAYING CARDS MADE OF?

<http://science.discovery.com/videos/how-its-made-playing-cards.html>

NATIONAL SCIENCE EDUCATION STANDARDS

Grades 5-8, Standard A: Abilities necessary to do scientific inquiry

Grades 5-8, Standard A: Understandings about scientific inquiry

Grades 5-8, Standard B: Motions and Forces

Grades 5-8, Standard E: Abilities of technological design

Grades 5-8, Standard E: Understanding about science and technology

Grades 5-8, Standard G: Nature of Science

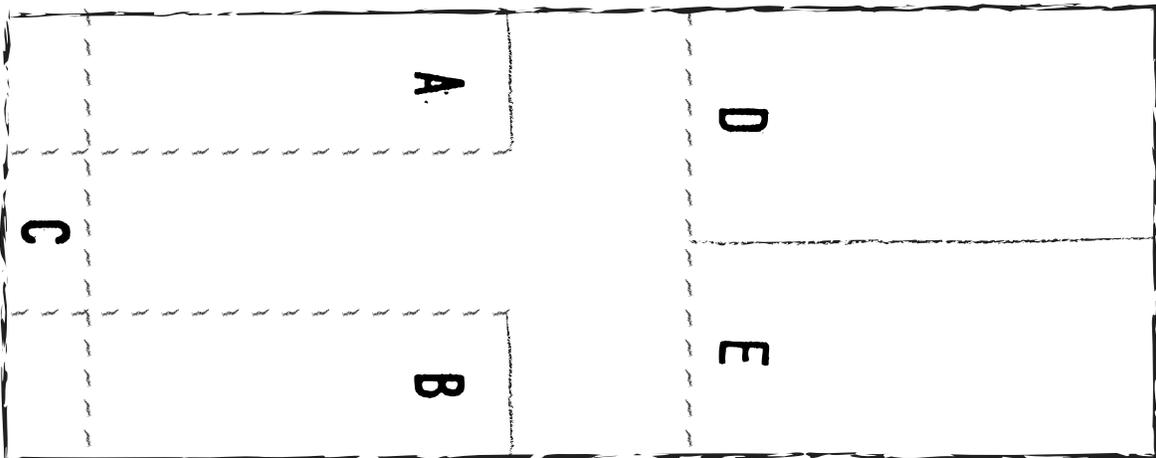
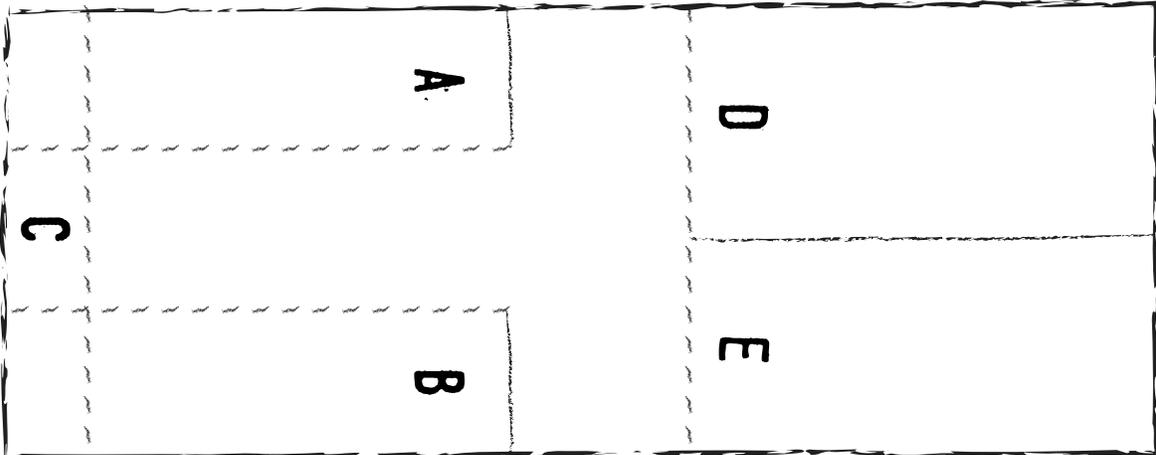
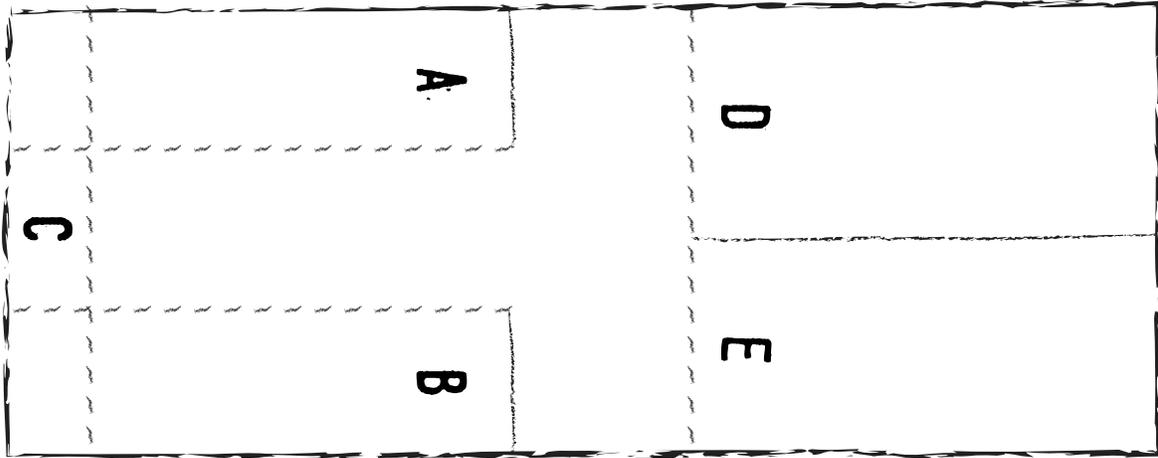
This guide has been developed for use by educators, group leaders and families for use in connection with "Mythbusters: The Explosive Exhibition" (the "Educators"). The activities described in this guide are potentially dangerous and could result in injury or damage. This guide is provided on an "AS IS" basis and the Museum of Science and Industry disclaims all warranties, express or implied, regarding the guide. Use of this guide is done at the risk of the Educators. By using this guide, you release the Museum of Science and Industry, its officers, employees, directors, trustees, agents and volunteers from and against any and all liability, claims, actions, costs, expenses, damages, attorney fees, breach of contract actions and all causes of actions whatsoever, that you may now have or may acquire in the future, arising out of or relating to any loss, damage or injury that may be sustained by you, the people you are educating, or to any property belonging to you or the people you are educating, as a result of the use of the guide.



Geoffrey M. Curley + Associates, LLC
Exhibition and Theatrical Consultation and Design



1. Use the helicopter template to cut out your flyer. Cut only on the solid lines.
2. Fold flap C up. Hold your helicopter up high and drop it. Observe what happens.
3. Fold flaps D and E in opposite direction to form the blades. Fold flap D towards you and flap E away from you. Hold your helicopter up high and drop it again. Observe what happens.



BLUEPRINT: SPIN IT!



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION

Which design fell the fastest? Describe or draw it below, using arrows to indicate where you think the helicopter in encountering air resistance:

Which design fell the slowest? Describe or draw it below, using arrows to indicate where you think the helicopter in encountering air resistance:

Why do you think certain designs fall faster or more slowly?

BLUEPRINT: SPIN IT!



MYTHBUSTERS
THE EXPLOSIVE EXHIBITION