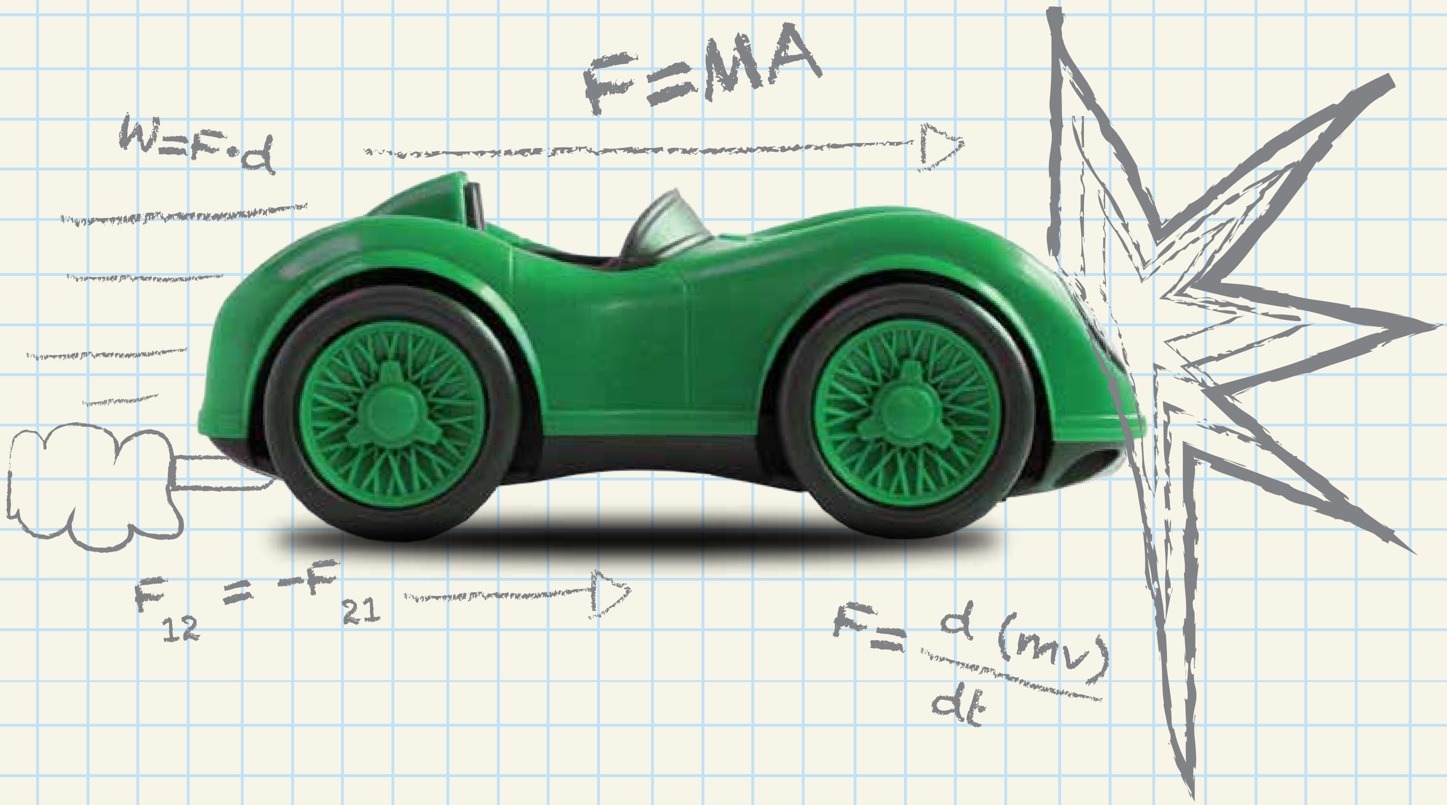
4-H NATIONAL YOUTH SCIENCE DAY

MOTION COMMOTION



FACILITATOR GUIDE

4-H PLEDGE

I PLEDGE MY **HEAD** TO CLEARER THINKING,

MY **HEART** TO GREATER LOYALTY,

MY **HANDS** TO LARGER SERVICE, AND

MY **HEALTH** TO BETTER LIVING,

FOR MY CLUB, MY COMMUNITY, MY COUNTRY,

AND MY WORLD.

HEAD | HEART | HANDS | HEALTH

INTRODUCTION

For more than 100 years, 4-H has been at the forefront of teaching young people about science, technology, engineering, and math (STEM). Our hands-on programs empower youth and provide them with opportunities to grow, learn, and become confident. According to the *Positive Development of Youth: Findings from the 4-H Study of Positive Youth Development*, a longitudinal study that began in 2002, youth who participate in 4-H are more likely to pursue STEM careers.

4-H National Youth Science Day (NYSD) is an exciting, interactive learning experience that engages thousands of youth across the country. It is the premier national rallying event for year-round 4-H Science programming, bringing together volunteers, youth, and educators from the nation's 109 land-grant colleges and universities to simultaneously complete the **National Science Experiment.**

The **2015 National Science Experiment, Motion Commotion**, explores the science of motion through the relationship of speed and stopping distance. The activity extends to real-world investigations on reaction time and safety, making connections to the dangers of distracted driving.

This experiment is designed to take about an hour and is appropriate for youth in grades 4 and above. If you have additional time, consider expanding the experiment to include one or more additional activities included at the end of the guidebook and on www.4-H.org.

USING THIS GUIDE

The Facilitator Guide features content from the Youth Guide as well as additional information that can assist you in teaching and facilitating each part of the experiment. Throughout the guide, you will find:

Did you know?	Talk About It	Leader Notes
Additional information for youth.	Questions you can use to facilitate group discovery and inquiry.	Additional background information and tips for facilitating the experiment.

THE EXPERIMENT

The Motion Commotion experiment is designed to take about an hour. It includes two investigations—**Stop & Go Science** and **We Need More Time!**-in which students explore the physical and human factors of motion.

Below is a sample timeline to help you structure the experiment:

1. **Introduction** (5 min): Welcome and **4-H Pledge.**
2. **Why Motion?** (5 min): Set the stage for today's experiment.
3. **Let's Talk Physics** (10 min): Engage students to explore motion.
   Encourage students to use science vocabulary in their discussions.
4. **Activity 1 - Stop & Go Science** (15 min): Examine the physical factors of motion.
   If you have additional time, add the quantitative investigation of motion, **Calculate It!**
   (Appendix A: Available online at www.4-H.org/nysd).
5. **Activity 2 - We Need More Time!** (15 min): Explore the human factors of motion.
   For younger participants, you may want to replace this activity with **Pulse!** *(Appendix C: Available online at www.4-H.org/nysd).*
6. **Get the Facts (5 min):** Consider the dangers of distraction and ways we can improve safety in motion.
7. **Take Action:** Make a Difference (5 min): Discuss ways to apply what students learned about motion and distractions to real life.

Optional Activities

- Consider expanding the experiment to include an engineering activity, such as the **Take It Further: Make It Safe** (Appendix B) or the **Reaction Time Challenge** available online at www.4-H.org/nysd.
- If you have access to iOS devices, you may want to incorporate the **Vernier Video Physics** and **Graphical Analysis** apps, which help students record video and analyze their car's motion in order to to determine its speed.
- Encourage students to extend their investigation beyond NYSD by performing one or more **Additional Activities** to better understand the relevance of motion in today's world.

OBJECTIVES

The 2015 National Science Experiment is designed to align with the Science and Engineering Practices defined by *A Science Framework for K-12 Science Education,* the blueprint for developing the Next Generation Science Standards (NGSS).

Through this experiment, youth will:

1. Construct an understanding of motion, stopping distance, and reaction time through engagement in hands-on, experiential learning.
2. Engage in individual and group exploration of the effect of motion and reaction time on our daily lives, with an emphasis on healthy living
3. Plan an activity to engage their community while extending STEM knowledge beyond the experiment.

WHY MOTION?

The world is constantly in motion. From riding the bus to school to crossing a busy street, or playing sports after school, we encounter motion every day. What we may not realize is how science is a part of each of these activities.

In science, **motion** is defined as how something moves through space and time. Take, for example, a baseball speeding toward a batter at home plate. But it isn't only the ball that's in motion. As the pitcher throws the ball toward home plate, his body is in motion. So are the trees swaying in the breeze and the mascot who is entertaining spectators. So is the crowd as they perform a "wave" – standing, raising their arms, then returning to their seats. All of that – and so much more – is motion.

Professional scientists, including physicists, engineers, and safety analysts, study all types of motion and implement technologies to keep us safe. They research and develop solutions to problems. These types of **STEM** careers are projected to remain high in demand. Project-based, hands-on experience with STEM activities like the 4-H National Science Experiment helps us build the skills we need to innovate, achieve, and succeed.

LET'S TALK PHYSICS

Physics is the branch of science that studies matter and its interactions. It provides us with a framework—language, equations, and observations—to explore and discuss motion. One of the first types of motion that physicists studied was the motion of planets in our solar system.

In 1687, physicist and mathematician Sir Isaac Newton described the motion we observe and experience on Earth.

His three laws of motion help us understand *why* and *how* objects move.

1. Newton's First Law:

An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion continues in motion with the same speed and in the same direction unless acted upon by an unbalanced force.

2. Newton's Second Law:

Acceleration is produced when a force acts on a mass. The greater the mass (of the object being accelerated) the greater the amount of force needed (to accelerate the object).

3. Newton's Third Law:

For every action there is an equal and opposite reaction. Action and reaction refer to forces, which are simultaneous interactions between objects. The force of one object on a second object has equal strength and opposite direction compared to the force from the second object on the first object.

Leader Notes

Get things rolling. Begin by discussing what your group knows about motion. Have participants roll an object, such as the toy car included in the Science Kit, across a table.

Ask questions to help the students engage in a conversation on motion.

- *What happened on the table?*
- *What was the speed like?*
- *What was the direction like?*
- *When did it change speed or direction? Why?*
- *What kinds of motion did we see?*

In this experiment, we will focus on Newton's first and second laws.

Newton's first law of motion addresses how objects move. Newton concluded that an object at rest stays at rest. In order for that object to start or stop moving – or change direction – it must be *interacting* with something. We call that interaction a **force**.

Picture the baseball as it reaches home plate. The force applied by a swinging bat will cause the baseball to change its **trajectory** toward the field. If the batter misses the ball, the force of the catcher's mitt will stop the ball, ending its motion. Newton's second law of motion describes *how* forces change the motion of an object.

Talk About It

Have you experienced one of Newton's Laws of Motion?

Example answers:

- Riding a roller coaster
- Snowboarding
- Biking

HOW IS MOTION MEASURED?

Speed is the measure of motion. To determine an object's speed, we measure the distance the object travels through space in a certain amount of time. Fast objects cover a larger distance in a given time compared to slow objects that cover a shorter distance in that same amount of time.

For example, if a baseball's speed were 100 mph, it would travel a distance of 100 miles during the time duration of one hour.

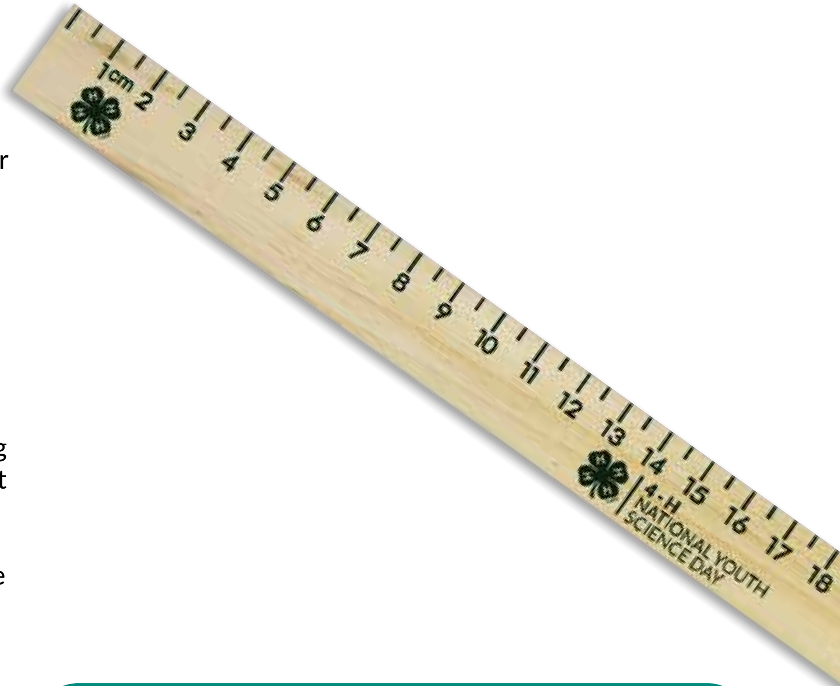
When an object with mass and speed is moving in a particular direction, we say it has **momentum**. A fast-moving object has more momentum than the same object moving at a slower speed.

A moving object also has **kinetic energy**, meaning that some work needs to be done in order to accelerate that **mass** from a lower speed to a higher speed or a higher speed to a lower speed. The fast-moving object has more kinetic energy compared to the same object moving slower.

What happens when an object stops moving? Its speed, momentum, and kinetic energy all reduce to zero. This can be gradual, or sudden.

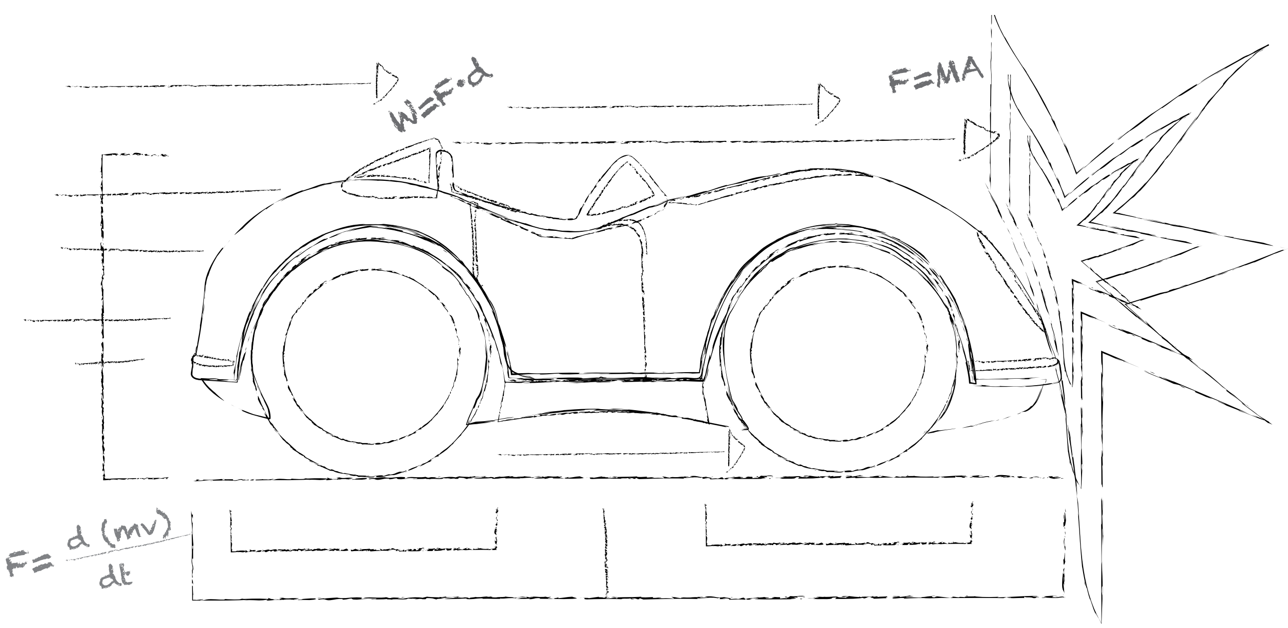
Let's Use Physics to Investigate!

Have you ever felt the difference between slowing to a stop and slamming on the brakes? What physical factors influence how fast an object can stop? Do human factors play a role?
Let's use physics to investigate!



Leader Notes

Encourage participants to think about the physical factors that affect how fast an object can stop. This builds the foundation for the later investigation on human factors.



ACTIVITY 1: STOP & GO SCIENCE

Time required: 15 minutes

Objective:

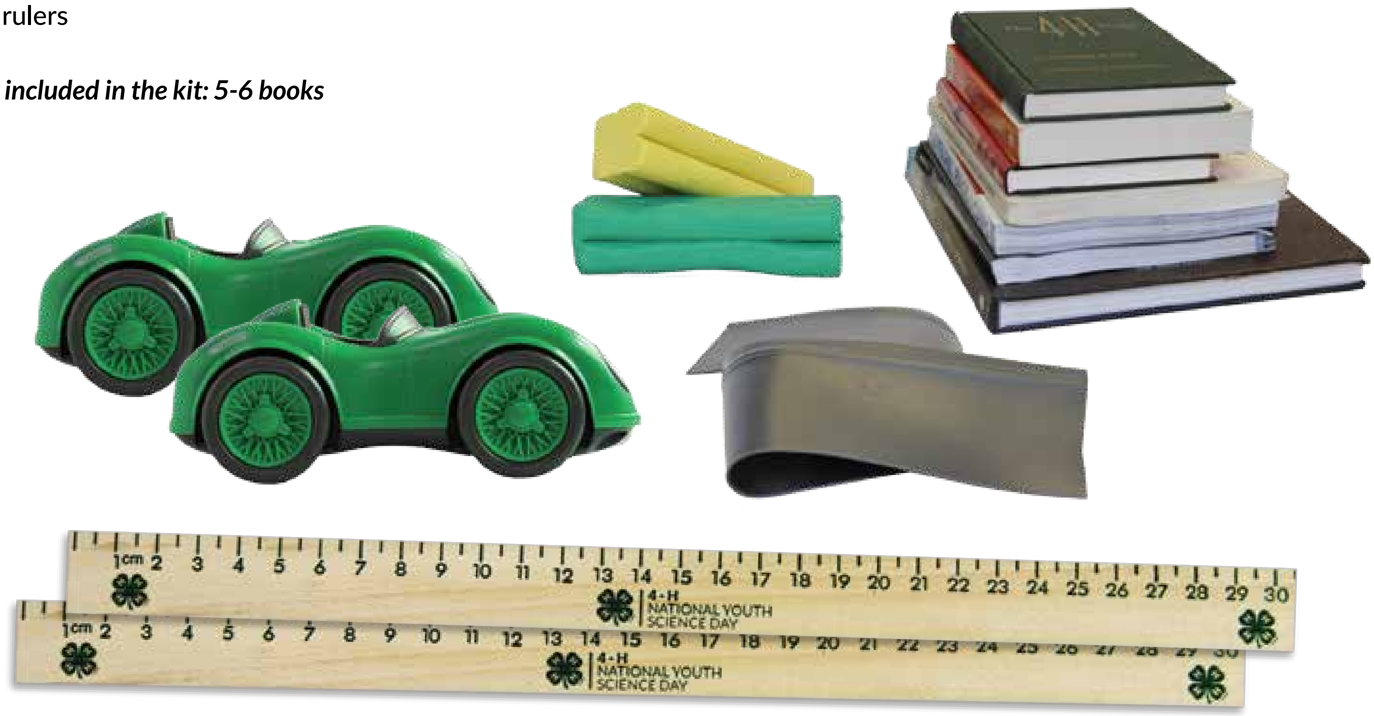
In this experiment, participants will observe collisions and investigate the physical factors that govern safety.

Materials Each Team Will Need:

Included in 2015 NYSD Science Kit

- 225 modeling clay
- 120 cm rubber wall base
- 2 toy car
- 2 rulers

Not included in the kit: 5-6 books



Leader Notes

Available for purchase at 4-HMall.org, each 2015 NYSD Kit includes:

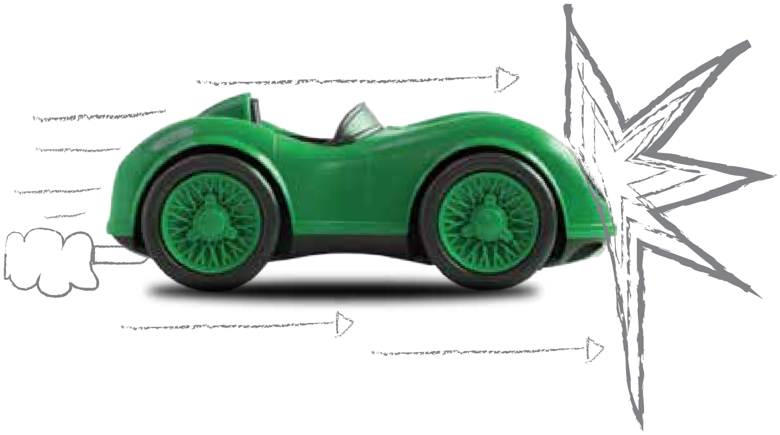
- 225 modeling clay
- 120 cm rubber wall base
- 2 toy cars
- 2 rulers

The kit serves two groups of participants. The baseboard can either be cut in half to form two ramps or shared. These items can also be purchased at a local hardware or craft store. The vinyl baseboard material can be substituted with any other suitable ramp material, including plywood, a stiff sheet of plastic, or a baking sheet.

STEP 1: SET UP THE EXPERIMENT

To set up a ramp for rolling the car, stack five or six books or any other object(s) that can elevate and support the ramp about 20 cm high. Unroll the ramp material and set it up on the books to form the ramp. The car should have a clear area to roll. It may be helpful to secure the ramp by tucking the edge of the ramp material into the stack of books.

Make a figure out of the clay that will sit in the seat of the car. Place a book or heavy object at the bottom of the ramp. This object will be used for your first collision.



STEP 2: CREATE A COLLISION

Position the car at the top of the ramp. Prepare to release the car and observe the crash. Let the car go and observe as it collides with the obstacle.

- What happens to the clay figure?
- What might happen to a person in a crash like this?
- Experiment with other obstacles. Try a tissue box. How is this collision different? Record what you observe.

Leader Notes

The clay figure should be ejected from the car. You can adjust the setup by increasing the ramp height or modifying the shape of the figure.

STEP 3: DISCUSS WHAT YOU OBSERVED

There are many ways to measure the differences between the two collisions.

Leader Notes

Ask participants to describe how the following factors are different in the two collisions:

- The distance the *car* travels after the crash
- The distance the *figure* travels after the crash
- The distance the *obstacle* moves

What can you conclude about the physical factors that influence a car's ability to stop?
How did the car's speed affect the collisions? How did the obstacle's mass affect the collision?

Sample answers:

- Upon impact, the lightweight obstacle moved, allowing the car to slowly come to a stop. As such, the car traveled a greater distance after a collision with a lightweight obstacle than with a heavy obstacle.
- Collision with the heavy obstacle caused the figure to be ejected from the car. As such, the figure traveled a smaller distance after a collision with a lightweight obstacle than with a heavy obstacle.
- Upon impact, the lightweight obstacle moved whereas the heavy obstacle stayed in place. As such, the lightweight obstacle traveled a greater distance than the heavy obstacle.

Another way to describe the two collisions is to consider the amount of *time* it takes for the car to stop.

Leader Notes

To this point, we have focused on the *distance* the car traveled after impact. Try steering the conversation toward the topic of how motion relates to *time*. Ask youth to consider the time it took for the car to come to a stop.

How did this parameter differ for the two collisions?

Sample answers:

- The car took longer to come to a complete stop upon impact with the lightweight obstacle, and the clay figure remained in the car.
- The car stopped almost immediately upon impact with the heavy obstacle, and the clay figure was ejected from the car.

How does time relate to safety?

Sample answers:

- When the car had more time to stop, the clay figure remained safe in the car.
- Physical factors such as the car's mass and speed made impact with the obstacle imminent. By increasing the length of time over which the car slowed to a stop, we dramatically increased the safety of the clay figure.

If time allows, complete the **Calculate It!** activity (Appendix A: Available online at www.4-H.org/nysd).

STEP 4: MAKE CONNECTIONS

We just examined the motion of a toy car and a clay figure.

- How is this motion similar to other activities like skateboarding or riding a bike?
- How are these activities different?
- Do the same physical factors such as speed and mass influence our body's motion?
- What are some other factors to take into account when considering outcomes of a collision?

Brainstorm examples.

CONCLUSION

Physicists use the term **model** to describe an investigation like the one above with the toy car. Based on this model, you observed that physical factors such as speed and weight might be factors during a collision.

The toy car's motion is a model for other types of motion. For example, the toy car could represent real-life motion, such as riding your bike or skateboarding. However, the toy car is an over-simplified model. In reality, the motion of humans is much more complex. We have a heart, brain, lungs, and muscles that need to coordinate and function together to move our bodies. This takes more time!

ACTIVITY 2:
WE NEED MORE TIME!

Time required: 15 minutes

Objective:

Take your investigation further by exploring the human factors of motion. What is your reaction time?

Materials Each Team Will Need:

Included in 2015 NYSD Science Kit

- Ruler

Not included in the kit: Calculator or cell phone

STEP 1: SET UP THE EXPERIMENT

Reaction time is the measure of how quickly you can respond to a particular stimulus. To measure your reaction time, you will try to catch a free-falling ruler.

Break up into groups of two. You will take turns being the "Dropper" and the "Grabber." For large groups, you will need to take turns until everyone has a chance to drop and grab the ruler.

Leader Notes

- The calculator or cell phone will be used to simulate a distraction. Other objects may easily be substituted. The goal is to encourage participants to engage in a familiar behavior such as texting, reading, etc. so that their findings are more meaningful and relevant to their daily activities.
- For elementary-school-aged youth, you may choose to replace **We Need More Time!** with an alternate activity, **Pulse (Appendix C: available online at www.4-H.org/nysd)**, then skip to the next section, **Get the Facts.**

STEP 2:
PERFORM THE EXPERIMENT

Dropper: Hold the ruler lightly between two fingers in a vertical position near the high numbers on the ruler.

Grabber: Position your thumb and forefinger just below the 0 cm mark on the ruler. Get ready to grab. Keep your eyes on the ruler!

Dropper: Without warning, let the ruler fall.

Grabber: When you see the ruler start to fall, grab it as quickly as you can between your thumb and forefinger. Hang onto the ruler and don't move your fingers yet. Read the position of your fingers on the ruler, in centimeters, and record the value below.

Ruler value: ______ cm

STEP 3: CALCULATE YOUR REACTION TIME

Since the ruler began dropping at the 0 cm mark, the value at which you caught the ruler is directly related to the time it took you to catch the ruler. This is your reaction time.

Use the provided table to find the reaction time that corresponds to your distance value and record your reaction time below.

Reaction time: ________ s

REACTION TIME TABLE

Grabbing Distance (cm)	Reaction Time (s)
1	0.05
2	0.06
3	0.08
4	0.09
5	0.10
6	0.11
7	0.12
8	0.13
9	0.14
10	0.14
11	0.15
12	0.16
13	0.16
14	0.17
15	0.17
16	0.18
17	0.19
18	0.19
19	0.20
20	0.20
21	0.21
22	0.21
23	0.22
24	0.22
25	0.23
26	0.23
27	0.23
28	0.24
29	0.24
30	0.25

Leader Notes

If time permits, you may choose to have students repeat the activity and calculate their average reaction time. Use the following discussion points to help students understand why repeated measurements improve data accuracy.

- If any event happens once, it could be a fluke, a coincidence, or an accident. *How do you know if that is the case?* Scientists look for repeatability of results. Before linking smoking cigarettes to lung cancer, many different scientists all have to see the connection in a large number of subjects. They use the branch of math called statistics to analyze the results and make sure it is very unlikely to have been a coincidence.
- In order to obtain a good value for your reaction time that is not a fluke or a coincidence, it is a good idea to do the activity several times and average your results.
- To calculate the average reaction time, add together the calculated reaction times for all of your ruler catches, and divide the result by the number of times you caught the ruler.

Talk About It

- How does your reaction time compare to your team members?
- Why might they be different?

Leader Notes

- Some participants may experience trouble even catching the ruler. If needed, substitute a meter stick for the ruler.
- If a whiteboard or poster board is available, consider graphing each group member's reaction time. Use different colors to represent the non-distracted reaction times and distracted reaction times. What patterns do you see?

Talk About It

- How does your distracted reaction time compare to your undistracted reaction time?

STEP 4: DISTRACT AND REACT

Repeat the activity. Only this time, ask the "grabber" to simultaneously grab the ruler while typing a value into a calculator or pretending to dial a phone. Record your results:

Ruler value (distracted): ______ cm
Reaction time (distracted): ______ s

STEP 5: DISCUSS YOUR FINDINGS

Based on your observations:

- How do distractions affect your reaction time?
- Do distractions increase or decrease your reaction time?
- What conclusions can you draw about how human factors such as reaction time affect your body's motion?

Reaction time is a complicated variable—there is no one reaction time that can be applied universally. Every person has a different reaction time depending on the situation and other variables.

- What factors can affect your reaction time?

Leader Notes

The goal of this discussion is for students to unite the concepts of motion and understand how both physical factors and human factors influence how our bodies move. In doing so, we can begin to make connections to safety.

Leader Notes

Older participants with more physics experience may be interested in learning how to calculate the time rather than use the table. To do this, they can examine the physics of the free-falling ruler using the formula below.

Here on Earth we live in a gravitational force field that never goes away. Earth's gravitational field pulls things directly toward the center of Earth. If the object is unsupported, it will fall at an increasing rate of speed. The increasing rate of speed is pretty much constant everywhere on Earth's surface. While the rate does vary with distance from Earth's center, Earth is so spherical that it makes very little difference where you are, be it at the top of Mt. Everest or at the bottom of Death Valley.

What is the rate?

A falling object on Earth gets 32 ft/s faster every second it falls. In metric units, it gets 9.8 m/s faster every second it falls. We can express this by saying that the acceleration of gravity here on Earth is 9.8 m/s^2.

There is a mathematical expression that can calculate the position of an object moving with a constant acceleration:

$$x = \frac{1}{2} at^2 + v_0 t + x_0$$

x represents the position at time *t*
t represents the time
x^0 represents the initial position, if any
a represents the acceleration
v^0 represents the initial velocity, if any

For a dropped object, we usually consider the initial velocity and initial position to be zero. In other words, the object was not moving right before it was let go. We measure the time from the instant the dropped object is let go. With this in mind, we can modify the equation to read:

$$x = \frac{1}{2} at^2$$

If we tried to measure reaction time using a stopwatch, our own reaction time would interfere with our measurement. But if we drop a ruler, we can use the distance it falls before being caught to calculate the reaction time.

Since the acceleration of a dropped object is 9.8 m/s^2, we will use that value for *a*. But according to the equation, we only need half that value, which is 4.9 m/s^2. However, since we are working in centimeters, and there are 100 centimeters in a meter, our equation looks like this:

$$x = (490 \frac{cm}{s^2})t^2$$

Rearranging this equation using algebra, we can solve for reaction time *t* based on *x*, the number of centimeters the ruler has fallen:

$$t = \sqrt{\frac{x}{490 \frac{cm}{s^2}}}$$

In lieu of the table, students can use this equation to determine the time, *t*, by replacing *x* with the distance measured on the ruler in centimeters.

GET THE FACTS

We have observed that both physical and human factors affect our motion. Based on our observations and discussions today, what actions can we take to improve our safety?

Play It Safe!

In a car, on a bike- even when using your own two feet- distractions can have devastating consequences.

Consider the following tips:

- Stay focused – avoid becoming distracted.
- In a car, wear a seatbelt.
- When biking or skateboarding, wear a helmet.
- If you are driving, don't exceed the speed limit.

Did You Know?

Your brain is still developing until your early 20s. Research has shown that the parts of the brain responsible for controlling impulses and planning ahead are among the last to mature—which may affect your decision-making ability.

Being aware of these limitations can help you make safer choices. For more information, see:

The Teen Brain: Still Under Construction
www.nimh.nih.gov/health/publications/the-teen-brain-still-under-construction/index.shtml.

DISTRACTIONS HAPPEN WHILE

... Driving

Distracted driving happens when a driver is engaged in an activity that could divert attention away from the primary task of driving. This includes texting, using a cell phone, eating and drinking, or talking with friends.

- In 2011, at least 23% of auto collisions—a total of 1.3 million crashes—involved cell phones.
- Five seconds is the minimum amount of time your attention is taken away from the road when you're texting and driving. For someone driving 55 miles per hour, that is the length of a football field!
- Texting while driving makes the possibility of a crash up to 23 times more likely.
- Teens who text while driving spend approximately 10% of the time outside of their lane.
- 48% of kids age 12-17 have been riding in a car while the driver was texting.
- According to AT&T's Teen Driver Survey, 97% of teens agree that texting while driving is dangerous, yet 43% do it anyway.

Eyes Up, Phone Down — It's the law!

While no state bans cell phone use altogether, many states have laws restricting how cell phones can be used. This includes restricting texting or using handheld cell phones while driving.

Make the right kind of impact. Check out your own state's laws at www.distraction.gov.

...Walking

Teens have the highest pedestrian death rates among children ages 19 and under. And injuries among older teens are on the rise – an increase of 25% over the previous five years. One of the main reasons? **Distractions.**

- Pedestrian injuries due to cell phone use are up 35% since 2010.
- 1 in 3 pedestrians are distracted by mobile devices while crossing a busy intersection.
- Texters are also almost 4 times more likely to ignore crosswalk lights, cross at the middle of an intersection, or fail to look both ways before crossing the street.

...Cycling

Automobile drivers and pedestrians aren't the only ones who need to keep their eyes on the road. Distracted cycling increases the risk of injuries to riders.

- Bicyclists who text or talk on the phone or with a fellow bicyclist are more than twice as likely to engage in unsafe biking behaviors.
- The use of handheld cell phones while cycling is prohibited in Chicago, Illinois, and Flagstaff, Arizona.

Leader Notes

- If you have a computer available, help youth explore www.distraction.gov and facilitate discussions.
- You may also want to print out copies of the pledge for youth to sign.

Talk About It

- What types of distracted driving, walking, or cycling behaviors have you observed?
- What will you do to take action?

TAKE ACTION: MAKE A DIFFERENCE

In 4-H, one of our responsibilities is to be a positive force and get involved in our communities. What steps can you take to share what you have learned and make a difference in your community?

Take the Pledge!

The fight to end distracted driving starts with you. Make the commitment to promote phone-free driving today.

Distracted driving kills and injures thousands of people each year. I pledge to:

- Protect lives by never texting or talking on the phone while driving.
- Be a good passenger and speak out if the driver in my car is distracted.
- Encourage my friends and family to drive phone-free.

To download the pledge, visit www.distraction.gov/

Speak Up!

Sometimes it can be difficult or uncomfortable to take a stand. If the driver in your car is distracted, remind them about the facts. As a passenger, you can also offer to send a text for the driver or take a message for them.
Be creative! It's your life too.

Put a Lid On It!

No matter what your age or level of experience, whenever you ride a bike, scooter, ski, or engage in other activities during which your head is vulnerable to injury, protect yourself by wearing a helmet.

Bicycle helmets are 85-88% effective in mitigating head and brain injuries, making the use of helmets the single most effective way to reduce head injuries and fatalities resulting from bicycle crashes.

Additional steps you can take:

- **Organize a safety fair for your community.** Help educate people about the precautions they can take to increase their safety.
- **Run a text-free driving pledge.** Get great materials from, www.distraction.gov, the official U.S. government website for distracted driving.
- **Take a closer look at your community.** Observe a busy intersection or road in your town. How many drivers do you see using a cell phone in a given amount of time?
- **Find a local news story related to multitasking with a cell phone.** What can you do to prevent these outcomes?
- **Be a "roll model."** Wear a helmet — and encourage others to do the same!

Ready for More?

Continue your physics exploration with additional activities available for download at www.4-H.org/NYSDregister.

Take if further with:
Calculate It!
Make It Safe
Pulse
Physics Apps from Vernier Software & Technology

GLOSSARY

Collision: The meeting of objects in which each exerts a force upon the other, causing an exchange of energy and momentum

Distraction: Something that prevents someone from giving full attention to something else

Gravity: The mutual attraction of all mass in the universe, and the force that pulls unsupported objects toward the center of Earth

Kinetic energy: Energy that an object possesses due to its motion

Mass: A measure of how much matter is in an object. On Earth, when our mass is under the influence of gravity, we often substitute the term “mass” with “weight”

Model: A representation that allows scientists to predict an outcome based on initial conditions

Momentum: The product of mass and velocity for a moving object or system, sensed by how difficult it is to stop the object or system

Motion: The manner in which a person or object moves through space and time

Obstacle: Something that blocks motion, sight, or progress

Parameter: A measurable quantity that helps define a system, such as height, mass, temperature, etc.

Physics: The study of matter and its interactions

Potential energy: Energy stored in a system based on position(s) of objects

Qualitative: Descriptions of observations or qualities

Quantitative: Numerical data or measurements

Reaction time: The total time it takes our body to react and respond to a stimulus

Speed: The rate at which someone or something is able to move or operate

STEM: Science, Technology, Engineering and Mathematics

Stimulus: Any interaction that an organism responds to

Trajectory: The path an object takes when moving through space

Variable: A parameter that may change, either by human action or by the result of a change in a different parameter

Velocity: Speed of an object in a particular direction

4-H, the nation's largest youth development organization, grows confident young people who are empowered for life today and prepared for career tomorrow. 4-H programs empower nearly **six million young people** across the U.S. through experiences that develop critical life skills. In the U.S., 4-H serves every county and parish through our network of **110 universities** and more than **3000 local offices**. Globally, 4-H collaborates with independent programs to empower **one million youth in 50 countries**. The research-backed 4-H experience grows young people who are four times more likely to contribute to their communities; two times more likely to make healthier choices; two times more likely to be civically active; and two times more likely to participate in STEM programs. 4-H is led by a unique private-public partnership of universities, federal and local government agencies, foundations and professional associations. National 4-H Council is the private sector, non-profit partner of the Cooperative Extension System and 4-H National Headquarters located at the National Institute of Food and Agriculture (NIFA) within the United States Department of Agriculture (USDA).

Learn more about 4-H at **www.4-H.org**

facebook.com/4-H | @4H | @National4H | **#4HNYSD**

4-H NATIONAL YOUTH SCIENCE DAY