

# Pop Rockets

**Grades:** 4<sup>th</sup>-5<sup>th</sup> grades

**Duration:** 60 minutes

---

## Program Description

Create a chemical reaction to launch a film canister rocket. Students will collect data and use it to make adjustments in their rocket.

## Louisiana GLE:

### Grade 4 Science

1. Ask questions about objects and events in the environment (e.g., plants, rocks, storms) (SI-E-A1)
2. Pose questions that can be answered by using students' own observations, scientific knowledge, and testable scientific investigations (SI-E-A1)
3. Use observations to design and conduct simple investigations or experiments to answer testable questions (SI-E-A2)
4. Predict and anticipate possible outcomes (SI-E-A2)
5. Identify variables to ensure that only one experimental variable is tested at a time (SI-E-A2)
6. Use a variety of methods and materials and multiple trials to investigate ideas (observe, measure, accurately record data) (SI-E-A2)
7. Use the five senses to describe observations (SI-E-A3)
8. Measure and record length, temperature, mass, volume, and area in both metric system and U.S. system units (SI-E-A4)
9. Select and use developmentally appropriate equipment and tools (e.g., magnifying lenses, microscopes, graduated cylinders) and units of measurement to observe and collect data (SI-E-A4)
10. Express data in a variety of ways by constructing illustrations, graphs, charts, tables, concept maps, and oral and written explanations as appropriate (SI-E-A5) (SI-E-B4)
11. Combine information, data, and knowledge from one or more of the science content areas to reach a conclusion or make a prediction (SI-E-A5)
12. Use a variety of appropriate formats to describe procedures and to express ideas about demonstrations or experiments (e.g., drawings, journals, reports, presentations, exhibitions, portfolios) (SI-E-A6)
13. Identify and use appropriate safety procedures and equipment when conducting investigations (e.g., gloves, goggles, hair ties) (SI-E-A7)
18. Base explanations and logical inferences on scientific knowledge, observations, and scientific evidence (SI-E-B4)
19. Describe procedures and communicate data in a manner that allows others to understand and repeat an investigation or experiment (SI-E-B5)
23. Determine linear, volume, and weight/mass measurements by using both metric system and U.S. system units to compare the results (PS-E-A2)
27. Describe how the amount of force needed to cause an object to change its motion depends on the mass of the object (PS-E-B4)

## **Grade 4 Math**

- 6. Model, read, write, compare, order, and represent fractions with denominators through twelfths using region and set models (N-1-E) (A-1-E)
- 21. Describe the concept of volume, and measure volume using cubic in. and cubic cm and capacity using fl. oz. and ml (M-2-E) (M-3-E)

## **English Language Arts**

### *Speaking and Listening*

#### *Standard 4*

- 34. Adjust pacing to suit purpose, audience, and setting when speaking
- 35. Interpret, follow, and give multi-step directions
- 37. Demonstrate active listening strategies, including asking questions, responding to cues, and making eye contact
- 38. Adjust speaking content according to the needs of the audience

## **Grade 5-8 Science and Inquiry**

- 1. Generate testable questions about objects, organisms, and events that can be answered through scientific investigation (SI-M-A1)
- 2. Identify problems, factors, and questions that must be considered in a scientific investigation (SI-M-A1)
- 4. Design, predict outcomes, and conduct experiments to answer guiding questions (SI-M-A2)
- 5. Identify independent variables, dependent variables, and variables that should be controlled in designing an experiment (SI-M-A2)
- 6. Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3)
- 7. Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)
- 11. Construct, use, and interpret appropriate graphical representations to collect, record, and report data (e.g., tables, charts, circle graphs, bar and line graphs, diagrams, scatter plots, symbols) (SI-M-A4)
- 12. Use data and information gathered to develop an explanation of experimental results (SI-M-A4)
- 22. Use evidence and observations to explain and communicate the results of investigations (SI-M-A7)
- 23. Use relevant safety procedures and equipment to conduct scientific investigations (SI-M-A8)
- 25. Compare and critique scientific investigations (SI-M-B1)

## **Grade 5 Science**

- 1. Measure a variety of objects in metric system units (PS-M-A1)
- 6. Describe new substances formed from common chemical reactions (e.g., burning paper produces ash) (PS-M-A6)
- 9. Demonstrate a change in speed or direction of an object's motion with the use of unbalanced forces (PS-M-B5)

## **Grade 5 Math**

- 20. Identify appropriate tools and units with which to measure time, mass, weight, temperature, and length (M-3-M)

## **English Language Arts**

### *Speaking and Listening*

#### *Standard 4*

- 32. Adjust diction and enunciation to suit the purpose for speaking
- 33. Use complete sentences and standard English grammar, diction, syntax, and pronunciation when speaking

35. Restate or describe oral directions/procedures for tasks
36. Adjust volume and inflection to suit the audience and purpose of presentations
38. Demonstrate active listening strategies
39. Deliver formal and informal presentations for a variety of purposes, including:
41. Participate in group and panel discussions

### **Key Terms:**

**Acceleration** – Rate at which the speed or direction changes

**Balanced force** - Results whenever two or more forces act upon an object in such a way as to exactly counteract each other.

**Experiment** – A scientific test of a theory or hypothesis

**Force** – A push or a pull

**Friction** – A force that resists the motion of an object

**Independent Variable** – The variable you purposely manipulate (change)

**Dependent Variable** – The variable that is being observed, which changes in response to the independent variable

**Data** – Information about the results of your experiment

**Chemical Bond** – Electrostatic forces which hold together molecules or compounds

**Inertia** – A tendency of an object to resist change in its state of motion

**Mass** – amount of matter in an object

**Newton's First Law** – A body at rest will stay at rest or a body in motion will stay in motion until a force acts upon it

**Newton's Second Law** – States that acceleration equals force divided by mass or  $a = f/m$

**Newton's Third Law** – States that for every action there is an equal and opposite reaction

**Unbalanced force** – Results whenever two or more forces act upon an object in such a way as to create movement in the direction of the stronger force

### **Connections to Permanent Exhibits: These exhibits are upstairs in the Exploring Space Cluster.**

**Rocket Fuel Exhibit:** What chemical is broken down? What is used for rocket fuel in this exhibit?

**Gravity Traps:** Try to hit the target. What do the surfaces around the bodies on this exhibit represent?

**Gravity Assists:** Try to launch a ball and hit a target. How many targets did you hit?

### **Web Resources:**

3 Puck Chuck Zoom by Kids for Kids  
<http://pbskids.org/zoom/games/3puckchuck/3puckgame.html>

This is an interactive game where students put different forces on different mass pucks to try to make a puck hit a target.

JumpStart - Physical Science Newton's Laws of Motion-Does It Matter?  
 Science Master  
[http://www.sciencemaster.com/jump/physical/newton\\_law.php](http://www.sciencemaster.com/jump/physical/newton_law.php)

This website contains information that explains Newton's three laws of motion.

Newton's First Law of Motion: Inertia and Unbalanced Forces

Goddard Space Flight Center

[http://swift.sonoma.edu/education/newton/newton\\_1/index.html](http://swift.sonoma.edu/education/newton/newton_1/index.html)

This website contains a pdf version of the student activity that explores Newton's First Law of Motion and a link to a downloadable poster that illustrates the first law. The activity uses toy cars and clay figures to explore inertia.

Newton's Laws of Motion

NASA Guided Tour

<http://exploration.grc.nasa.gov/education/rocket/newton.html>

This is an explanation of Newton's Laws as it relates to rocketry. On each page there are activities. For example for the first law students can make a Hero Engine and for the third law they can make a Newton car.

Science Investigations

Intel Education

<http://www.intel.com/education/projects/wildride/learning/sciencelabs.htm>

This is a list of demonstrations for each of Newton's laws. This would be a great evaluation tool to perform a demonstration and identify the law that best explains what is happening.

### **Pre-Visit Activities**

Moving Objects activity – next page.

# Moving Objects

How much do you know about these words?  
Mark your answers with an **X**.

Word	I know what this word means.	I have seen or heard this word.	I don't know what this word means.
force			
gravity			
mass			
weight			
newton			
speed			
instantaneous speed			
speedometer			
velocity			
acceleration			
law			
inertia			
friction			
air-resistance			
relative motion			
frame reference			
net force			
balanced force			

Put a check (✓) in the box after you complete each task.

- Practice saying each science word out loud.
- Spell each science word out loud.
- On a separate sheet of paper, write a sentence for each vocabulary word you know.



**Notes for Home** Your child practiced writing and spelling the science vocabulary words.  
**Home Activity:** Ask your child to use the science words in oral sentences.

## Post-Visit Activities

### Inertia in Motion

**Grade Levels:** 3 - 6

#### Objectives

- Students will use observation skills to draw conclusions and make predictions.
- Students will understand the first law of motion, inertia, force, and friction.

#### Materials

- Wagon
- 2 Tennis balls
- Journal

#### Procedure

Start with a mini lesson about **inertia and friction**. Here is some information:

Sir Isaac Newton's **First Law of Motion** defines **inertia**: An object in motion wants to stay in motion, and an object at rest wants to stay at rest.

OK, now what does that mean?

Imagine you have a toy car. It's sitting on the floor in front of you. You want the car to move, but it isn't going to unless some force, like your finger, gives it a push. The car is **at rest** and, unless **a force** like a push or a pull acts on it, it's going to stay at rest. Simple, right? Now here comes the tricky part.

Once you give the car a push, it is in motion. And guess what? It wants to stay in motion. But we all know that the toy car will eventually slow down and stop. Why? Because a force called **friction** is slowing it down. **Friction** happens when things rub against each other, and it slows down things in motion. The toy car's tires rub against the floor, causing the friction that slows it down. Even the air the car moves through creates friction.

The best place to test inertia is outer space. In outer space there is no air, or anything else to create friction. So moving objects will keep moving forever, and objects that aren't moving will stand still forever.

#### Instructions for the Project:

1. Place the tennis balls in the back of the wagon.
2. Pull the wagon forward several feet and then stop quickly.
3. **Write** about what you observe.