

Science Challenge

Driving Question	Part Two: How does mass affect acceleration? (Newton's Second Law of Motion)
Grade group	Laws of motion are prevalent in grades 1st, 3rd, and 7th.
Safety Considerations	<p>While constructing your Car, students will be using scissors or other sharp objects to cut out cardstock. Be careful while using sharp objects.</p> <p>If making the advanced version of Newton's Car: make sure there is adult supervision as this requires the use of power tools.</p> <p>While doing the experiment it requires participant to cut or burn string to set off reaction. Have adult supervision on this task.</p>
Materials	<p>Experiment Mass and Acceleration:</p> <ul style="list-style-type: none"> ● Straws or colored pencils or other objects the Car can roll across ● Art supplies to make your Newton's Car like construction paper, cardstock, etc. <ul style="list-style-type: none"> ○ Tape, glue, or staples to keep it together ● Measuring tape, meter stick, string to track distances ● Pennies or other objects to increase the mass of the car to test ● Balloon pump, bike pump, hand fan to act as a force on car (you'll want this to be the same amount of air each time to be considered a constant in your experiment) <p>Tying it Together:</p> <ul style="list-style-type: none"> ● Flip Chart made during Part 1 ● Art Supplies: markers, crayons, colored pencils, etc. <p>Taking it Further (advanced newton's car)</p> <ul style="list-style-type: none"> ● Wood ● Screws or dowels ● Rubber bands ● String ● Weights ● Scissors

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Lesson Standard:

Vocabulary:

Mass
Acceleration
Motion
Friction
Force

Lesson Objective: Students will be able to describe how mass affects the acceleration of an object.

Schedule:

Days 1-2: Part 1 - Newton's First Law of Motion. Watch Challenge Video and have fun doing experiments

Days 3-4: Bonus Challenge - Inertia Tower! Submit Inertia Tower Videos and Pictures!

Days 5-7: Part 2 - Newton's Second Law of Motion. Watch Video and build Newton's Car

Day 8: Submit videos and pictures of your Newton's Car

Days 8-10: Part 3 - Newton's Third Law of Motion. Watch Video and Build Balloon Car

Days 10-14: Part 4 - Design a Rocket Ship!

Days 13-14: Submit your rocket design to be showcased!

Instructions:

Experiment on Mass and Acceleration:

1. Create a Newton Car by cutting and folding cardstock or thick paper into a box. (if you need a print off follow the instructions on this page from NASA (https://www.nasa.gov/sites/default/files/atoms/files/stemonstrations_newtons-second-law.pdf))

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2. Lay out your course using many plastic straws, or colored pencils, or other objects that you have in large quantities starting at the 0 mark on your meter stick or tape measurer. Each pencil or straw will be roughly 2 centimeters apart.
3. Place your empty car on the 0 mark and then use a bike pump or a consistent pump of air to make the car move down the track.
4. Record where it stopped and then reset the track.
5. Each time you reset add a little weight/mass to the car and then document how far it goes.
6. Ultimately your student will find how mass affects the acceleration of your car.
7. Have your student then write down the answer to why is it important to think about the mass of your rocket ship while designing?
8. Take pictures of your Newton's Car in action and it's final design and submit it to ScienceChallenge@lowell.edu

Tying it Together:

1. Pull out your Flip-Up chart you made in Part One!
2. On the top of the Second flip-up section draw or write "Newton's Second Law of Motion" and it's definition
3. Under the flip-up draw your favorite demonstration for Newton's Second Law and then how this Law will help your Rocket Ship while designing with mass in mind.
4. Keep for the next part of the challenge in several days.

Resources:

NASA's Lesson Plan

https://www.nasa.gov/sites/default/files/atoms/files/stemonstrations_newtons-second-law.pdf

Taking it Further: Build your own Newton's Car

Do you want to take your Newton's Car to the next level?! Do you need a little extra challenge?

Follow the instructions from the link below from NASA on creating your own Newton Car out of wood, screws, and rubber bands. Don't forget to share with us your finished car at ScienceChallenge@lowell.edu

Make sure you get help from a parent as this car requires tools handled with adult supervision.

https://www.nasa.gov/pdf/153412main_Rockets_Newton_Car.pdf