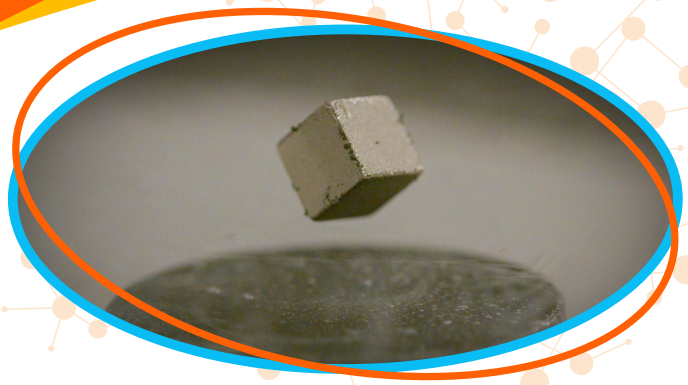
GENERATIONGENIUS
ALWAYS QUESTION. ALWAYS WONDER.



LESSON PLAN

NEWTON'S LAWS OF MOTION
GRADES 6-8

SUMMARY

Students will experiment with film canister rockets to investigate Newton's Laws of Motion.

NEXT GENERATION SCIENCE STANDARDS CORRELATION

MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

MS-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

Science & Engineering Practices	Connections to Classroom Activity
Planning and Carrying Our Investigations **Analyzing and Interpreting Data**	• For part one of this investigation, students will launch film canister rockets across the floor and collect data on distance traveled. • For part two of this investigation, students will investigate the impact of the film canister rocket colliding with a cardboard wall. They will then add design elements to their rocket to lessen the impact. • Throughout this investigation students will be collecting and analyzing data.

Disciplinary Core Ideas	Connections to Classroom Activity
The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (MS-PS2-2)	• Students will use the film canister rocket launch to explain all 3 of Newton's Laws of Motion. • Students will compare what happens when two rockets of varying mass are launched.

Cross Cutting Concepts	Connections to Classroom Activity
Cause and Effect	• The motion of the film canister rockets is caused by forces.

DURATION

1 hour

MATERIALS

- Film canister (1 per pair or small group)
- Alka Seltzer Tablets (Generic brands work well)
- Small cups of water
- Meter Sticks or tape measures
- Safety Goggles
- Textbook or Piece of cardboard
- Outside space for launching
- Variety of materials for part 2 (cotton balls, paper towels, cardboard, pipe cleaners, masking tape or whatever you have on hand)

ENGAGE

Show a video clip of the recent SpaceX rocket launch. Ask students what they notice. Ask some thought provoking questions such as, “How is something so heavy able to fly up into space like that?” “What forces are moving the rocket up?”

EXPLORE

Tell students “Today you will be launching your own rockets using a different kind of force. You will use film canister rockets as your rocket and a mixture of water and Alka Seltzer tablets as the fuel.” Show students what happens when an Alka seltzer tablet is put in water. Ask, “What do you notice?” They will notice bubbles. Ask, “How do you think this combination will help your film canister rocket to launch?” Hopefully, they will say that pressure will build up inside the canister and cause the lid to pop off. This is how the rockets will launch, but for this experiment they will launch along the floor. Students will need to quickly put the Alka Seltzer in the container and then put the lid side touching a wall along the ground. (Students must follow safety guidelines such as wearing safety goggles and making sure no one is in their launch space.) Students can measure the distance the rocket travels and collect data on how far it travels using different combinations of Alka Seltzer and water. (Water amounts to test could be ¼ full, ½ full, ¾ full. Alka Seltzer amounts to test could be a whole tablet, a half, a quarter)

For part 2 of this experiment, students will investigate what happens to the film canister rocket when it collides with a piece of cardboard or a textbook. Data can be collected to measure how far back the canister moves after colliding. Students will then add design elements to their rockets to lessen the impact. They can add cotton balls, pipe cleaners, fabric, cardboard or any other small items you have on hand.

EXPLAIN

Allow students to share their findings. What was the best combination of water and Alka Seltzer to keep the rocket aloft the longest? Did different teams of students have similar results. (Less water should have been better than more because it allowed for more pressure to build up inside the canister)

Discuss part 2 and let students share how they lessened the impact of the collision.

WATCH THE GENERATION GENIUS NEWTON'S LAWS OF MOTION VIDEO AS A GROUP

Facilitate a conversation using the Discussion Questions.

Begin a discussion of how Newton's Laws of Motion are demonstrated with the Film Canister Rockets. Ask students specifically about Newton's first law. (An object remains at rest unless acted upon by an outside force.) How does this relate to the rocket? It was at rest when first placed on the ground. What force acted upon it? (The lid popping off was the force that pushed the rest of the canister into the air.)

Next ask students how the film canister rockets demonstrated Newton's 3rd Law of Motion (for every action there is an opposite and equal reaction). Students should discuss that the gas and bubbles were pushing down on the lid which caused the rocket to move in the opposite direction up in the air.

ELABORATE

Ask students how they could experiment with the film canister rockets to prove Newton's 2nd Law of Motion (a larger mass needs more force to go the same distance). Students should suggest making one rocket heavier than another. The heavier rocket won't be able to fly for as long. If time allows, you could demonstrate this by placing some pebbles or rocks inside one of the canisters.

EVALUATE

Students can play the online Kahoot! quiz game located below the video which provides downloadable scores at the end of the quiz game. Alternatively, you can use the paper quiz or the exit ticket questions. All these resources are located right below the video in the assessment section.

EXTENSION

Challenge students to find examples of Newton's Laws of Motion at work in everyday life. Perhaps make posters students can add to in the classroom. Also, be sure to check out the Phet Simulations for motion and forces.