

Inertia Makerspace

Newton's First Law of Motion

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Grade Level	6th – 9th Grade	**Time Frame**	140 minutes
Subject	Science	**Duration**	4-5 class periods
Course	Physical Science		

Essential Question

How do the properties of inertia affect us?

Summary

In this lesson, students will learn how to characterize Newton's First Law of Motion as a cause-and-effect relationship and use these relationships to make predictions about how the natural world functions.

Snapshot

Engage

Students watch "NFL video: Newton's First Law" and use the Elbow Partner strategy to generate a list of other sports, hobbies, or activities that use inertia.

Explore

Students recreate the Minute to Win It Bottle Flip challenge. Students collect data, calculate the group average, and construct a graph to see which group was the winner.

Explain

Students watch videos of everyday examples of inertia and acquire appropriate lesson vocabulary.

Extend

Student teams use items from the makerspace to create and present a demonstration on inertia to the class.

Evaluate

Students watch peer inertia demos and reflect on the lesson with an Exit Ticket.

Standards

ACT College and Career Readiness Standards - Science (6-12)

IOD302: Understand basic scientific terminology
IOD402: Compare or combine data from a simple data presentation (e.g., order or sum data from a table)
IOD403: Translate information into a table, graph, or diagram
SIN401: Understand a simple experimental design
EMI301: Identify implications in a model

Next Generation Science Standards (Grades 6, 7, 8)

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.

Oklahoma Academic Standards (8th Grade)

8.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.

Attachments

- Bell Ringer—Inertia Makerspace - Spanish.docx
- Bell Ringer—Inertia Makerspace - Spanish.pdf
- Bell Ringer—Inertia Makerspace.docx
- Bell Ringer—Inertia Makerspace.pdf
- Exit Ticket—Inertia Makerspace - Spanish.docx
- Exit Ticket—Inertia Makerspace - Spanish.pdf
- Exit Ticket—Inertia Makerspace.docx
- Exit Ticket—Inertia Makerspace.pdf
- Inertia Demo Day Resources—Inertia Makerspace - Spanish.docx
- Inertia Demo Day Resources—Inertia Makerspace - Spanish.pdf
- Inertia Demo Day Resources—Inertia Makerspace.docx
- Inertia Demo Day Resources—Inertia Makerspace.pdf
- Lesson Slides—Inertia Makerspace.pptx
- Rubric—Inertia Makerspace - Spanish.docx
- Rubric—Inertia Makerspace - Spanish.pdf
- Rubric—Inertia Makerspace.docx
- Rubric—Inertia Makerspace.pdf
- Stick the Landing—Inertia Makerspace - Spanish.docx
- Stick the Landing—Inertia Makerspace - Spanish.pdf
- Stick the Landing—Inertia Makerspace.docx
- Stick the Landing—Inertia Makerspace.pdf

Materials

- Lesson Slides (attached)
- Bell Ringer handout (attached, 1 half-sheet per student)
- Stick the Landing handout (attached, 1 per group)
- Rubric (attached, 1 per group)
- Inertia Demo Day Resources (share digitally with each student, or 1 per group)
- Exit Ticket (attached, 1 half-sheet per student)
- Empty water bottles (1 per group of 3 or 4 students)
- Water
- Timer and calculator
- Colored pencils or markers (optional for graphing)
- Meter stick (optional for bottle flipping)

- Masking tape (optional for bottle flipping)
- Chromebooks or iPads for students
- Makerspace items (since this is an open-ended activity, bring a variety of the following items for students to choose from: index cards, decks of cards, coins, toy cars, varying sizes of plastic cups, large plastic soda bottles, marbles, dice, craft or popsicle sticks, wooden or plastic building blocks, paper plates, plastic eggs, toilet paper tubes, balls of various masses and sizes)

10 minutes

Engage

Introduce the lesson's essential question and learning objectives using **slides 3–4** of the attached **Lesson Slides**.

Go to **slide 5** and give students the following prompt as a Bell Ringer: "What are some sports, hobbies, or activities that involve forces?" Give students the **Bell Ringer** handout, and invite them to create a list of such activities. Use the instructional strategy Elbow Partners to allow students to discuss their list with the person next to them. Then, show the video "Newton's First Law of Motion - Science of NFL Football."

Embedded video

https://youtube.com/watch?v=08BFCZJDn9w

Possible Student Responses

Sports and activities that involve forces might include auto racing, soccer, air hockey, skating, skiing, bowling, skateboarding, archery, hunting, gymnastics, etc. The list is endless!

20 minutes

Explore

Display **slide 6**. Place students in groups of 3 or 4. Show students the "Minute to Win It 'Stick the Landing'" video.

Embedded video
https://youtube.com/watch?v=5t4NYJbERZ0

Give each group a **Stick the Landing** handout. Each student in the group should complete the challenge of flipping a water bottle 10 times in 60 seconds, and the group should record how many times each student sticks the landing. You may want to have students measure a meter stick away from the table/desk and place tape on the floor to ensure consistency among the groups.

Teacher's Note: Prepare the Class Bar Graph

As students are gathering data, set up the class bar graph. This is a great time to review graphing basics, such as including a title for graph, labeling each axis with its appropriate variable (in this case, x-axis would be group names and y-axis would be the average number of successful bottle flips), and number intervals. Work with the class to set up the graph they will post their averages on.

If your class doesn't need a review, set up the class bar graph yourself in a prominent location.

After completing the bottle flip attempts, each group should calculate their average number of successful flips using the example provided on **slide 7** as a reference. Once the average is determined, each group will construct a bar representing their data and add it to the class bar graph. Make sure the bar is accurately labeled to reflect your group's results. After all groups have contributed their data, the class will analyze the graph to identify the group with the highest average of successful bottle flips. The group with the highest average will be announced as the winner of the challenge!

20 minutes

Explain

Go to **slide 8** and show the "Forces of Motion: The Physics of Car Crashes" video. After showing the video, ask students to identify the main point of the video or why the seatbelts helped protect the crash test dummies. Ask if there are any other car features that reduced the inertia of the crash test dummies during the crash.

Embedded video
https://youtube.com/watch?v=wV2UTkkQ0Fg

Sample Student Responses

Students will likely say the seatbelts stopped the dummies from moving forward. This is the purpose of other restraints, such as airbags and child safety seats/car seats, as well.

Go to **slide 9**, and introduce each vocabulary word listed. Be sure to make references back to the football video, bottle flipping activity, and the car crash video by asking students where they saw an example of each term in those examples.

45 minutes

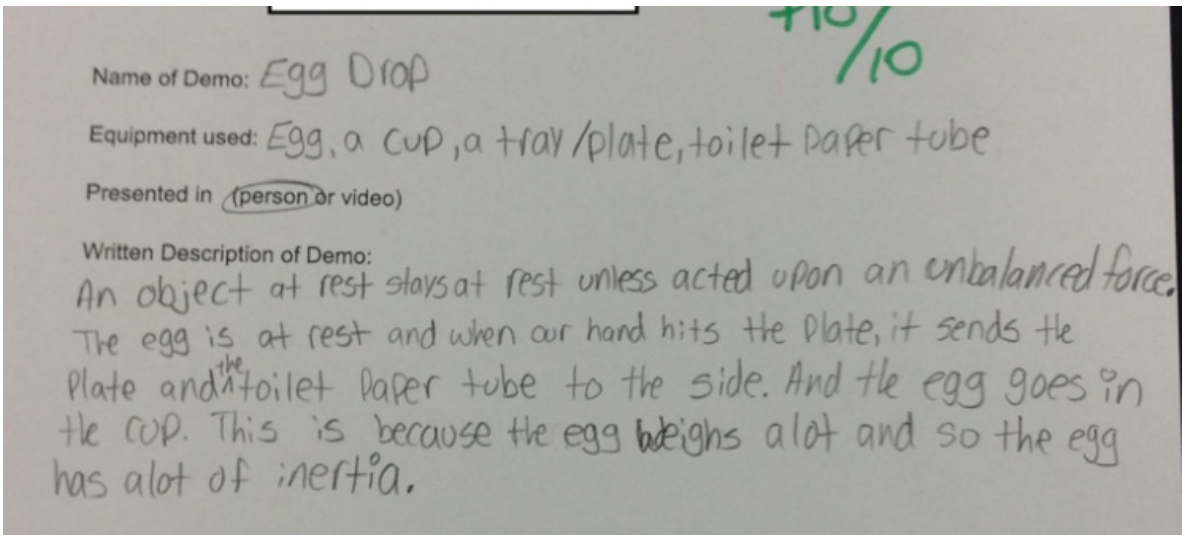
Extend

Teacher's Note: Preparation

1. Set up a table with "gadgets" for the makerspace. (See makerspace items list in the Materials section.)
2. You may want to digitally share (or upload into your Google Classroom) the Inertia Demo Day Resources handout with students for easier access to web resources
3. This makerspace will use common, easily found objects, but you can incorporate technology if you have access. More information about makerspaces can be found here: "Designing a School Makerspace" or "What is a Makerspace?".

Go to **slide 10**, and place students in groups of 2 or 3. Give each group the **Rubric** handout and go over it. The goal is that groups will use items from the makerspace to create and present a demonstration on inertia. The suggested pacing for this activity is that, in one class period, teams will decide which demonstration they'll recreate, sign up with you to avoid duplication, and each student will turn in a written description and labeled sketch of their demo. Pass out the **Inertia Demo Day Resources** handout to students to help them with their research, although they may choose something not on this list.

On the second day, groups should gather materials they need, practice the demonstration they've selected, and prepare for their presentations in the first ten minutes of class. During the rest of the class period, the groups present their demonstrations. You may choose for students to play a recorded video of their demonstration during the ten minute preparation period to show their peers, or if they are confident in their ability to make their demonstration work, invite them to do it "live."



Name of Demo: Egg Drop

+10 10/10

Equipment used: Egg, a cup, a tray/plate, toilet paper tube

Presented in (person) or video)

Written Description of Demo:

An object at rest stays at rest unless acted upon an unbalanced force. The egg is at rest and when our hand hits the plate, it sends the plate and the toilet paper tube to the side. And the egg goes in the cup. This is because the egg weighs alot and so the egg has alot of inertia.

Sample student demonstration write-up

45 minutes

Evaluate

Slide 11 is intended for "live" demonstration performances. Depending on whether students are doing "live" or videotaped demonstrations, you may need to adjust the slide accordingly. If you are using videoed demonstrations, you may choose to show them to the entire class at the same time or allow them to watch individually on their own devices. Review the instructions on slide 11 and allow students time to gather materials and practice.

Teacher's Note: Demonstration Order

While they are practicing, randomly choose student group order and write this on the board so students will know when it's their turn. In the interest of time, if your class is doing live performances, tell the students they have only one chance to do their demonstration "live."

After all groups have presented their demonstrations, transition to **slide 12** and have students complete an Exit Ticket. Give students the **Exit Ticket** handout, which asks them to summarize their favorite demonstration using the four vocabulary words: gravity, force, motion, and inertia.

Option for Differentiation

In lieu of an Exit Ticket, have students create a poster titled "Physics of (insert name here)." Let students choose their activity to highlight (e.g., football, car racing, skateboarding, baseball, archery, ballet, golf, gymnastics). Establish your own set of guidelines to give students for this project. Some items to consider including in the guidelines: must be on 8th-grade level, no copying/pasting, must include an image, neatness, appropriate vocabulary words, and/or correct spelling. If you need ideas check out the One-Pager instructional strategy.

Resources

- Cooper, J. (2013, September 30). Designing a School Makerspace. Edutopia. https://www.edutopia.org/blog/designing-a-school-makerspace-jennifer-cooper
- K20 Center. (n.d.). Bell ringers and exit tickets. Strategies. https://learn.k20center.ou.edu/strategy/125
- K20 Center. (n.d.). Elbow partners. Strategies. https://learn.k20center.ou.edu/strategy/116
- K20 Center. (n.d.). One-pager. Strategies. https://learn.k20center.ou.edu/strategy/72
- National Science Foundation. (2015, January 27). Newton's First Law of Motion - Science of NFL Football [Video]. YouTube. https://youtu.be/08BFCZJDn9w
- Nonis, D. (2013, April 17). Minute to Win It - Stick the Landing [Video]. YouTube. https://youtu.be/5t4NYJbERZ0
- Pumpkin Interactive. (2015, July 2). Forces and Motion The Physics of Car Crashes (preview) [Video]. YouTube. https://youtu.be/wV2UTkkQ0Fg
- Whitby Public Library. (2022, February 24). What is a Makerspace? [Video]. YouTube. https://www.youtube.com/watch?v=0NfrKsQDoeU&t=7s