Marshmallow Shooters

Lesson Overview

In this lesson, students will collaborate on an investigation to test how varying amounts of force on a marshmallow, affects the speed and direction of the marshmallow coming out of the shooter.

Alignment

Standard/Indicator Addressed

8.P.2A.1	Plan and conduct controlled scientific investigations to test how varying the amount of force or mas of an object affects the motion (speed and direction), shape, or orientation of an object.

Science and Engineering Practices

S.1A.1	Ask questions and define problems
S.1A.2	Develop and use models
S.1A.3	Plan and carry out investigations
S.1A.4	Analyze and interpret data.

S.1A.8 Obtain, evaluate, and communicate information.

Standards for Mathematical Practice (as appropriate)

Standard 1.	Make sense of problems and persevere in solving them.
Standard 5.	Use a variety of mathematical tools effectively and strategically
Standard 7.	Identify and utilize structure and patterns.

ELA Inquiry Standards (as appropriate)

Standard 3	Construct knowledge, applying disciplinary concepts and tools, to build deeper understanding of the world through exploration, collaboration, and analysis.
Standard 6	Read, write, and communicate using knowledge of a particular discipline.

Standard 7 Integrate the Reading, Writing, and Communication Standards and the Inquiry-Based Literacy Standards to communicate and create understanding within content areas.

Standard 8 Extend and deepen understanding of content through purposeful, authentic, real-world tasks to show understanding and integration of content within and across disciplines.

Connections

Disciplinary Literacy Strategies (for Purposeful Reading, Meaningful Writing, and Productive Dialogue)

Graphic Organizers
Favorite animal grouping strategy
3 – 2 – 1 Exit Ticket
Elbow Partners

Computational Thinking:

- Logically organizing and analyzing data by completing the data table on the data collection sheet.
- Representing data through abstractions such as models and simulations by building the shooter and completing the simulation trials to analyze what happens to the mini marshmallows.
- Automating solutions through algorithmic thinking (a series of ordered steps) by following the steps to assemble and carry out the simulations.

Lesson Plan

Time Required – Two 60-minute class periods

Disciplinary Vocabulary –

- Force
- Mass
- Speed
- Direction
- Motion
- Orientation

Materials Needed:

- Video https://youtu.be/gtCgquOsXeo

For each pair of students

- balloon
- clear plastic cup
- meter stick
- scissors
- metric ruler
- transparent tape
- mini marshmallows
- procedure sheet (data table and questions)

Formative Assessment Strategies:

- Student dialogue
- Graphic Organizers
- Exit Ticket
- I used to think…But now I know

Misconceptions:

- Students often think that mass and weight are interchangeable.
- The students may think the more marshmallows there are in the shooter, the farther the the marshmallows will fly.

Lesson 1, Part A

Engage

- Tell the students they will be starting a new unit of study on forces and motion. Have them write in their journal what they know about force and motion.
- Show the video clip of football players hitting each other https://youtu.be/gtCgquOsXeo . You can use the whole video clip or cut it down to just the parts you need.
- After the video clip, have the students discuss with their elbow partner what happened when the players made contact with each other, and why the player moved the way he did after getting hit. Call on pairs of students to share out their answers.
- Groups students using the “favorite animal” strategy.
    - Have the students think about their favorite zoo animal, then have them line up in the back of the room alphabetically by the first letter of the animal's name.

- Have the students tell the class the name of the animal and why they like it.
- Group the students by counting off the number of students needed for the group (pairs works best for the marshmallow activity).

Explore

- Tell the class they will be investigating force and mass and how those affect the motion of an object. “In this lab, you will construct marshmallow shooters to determine what factors can affect force.”
- Ask one person from each pair to come up and collect the materials to construct the marshmallow shooter.
  - Plastic cup
  - Scissors
  - Balloon
  - Transparent tape
- The students work together to assemble the shooter. Circulate the room to help students having trouble.
  - Cut the off the bottom of the plastic cup
  - Tie a knot in the open end of the balloon and cut the tip off the other end
  - Wrap the open end of the balloon around the top of the cup, it should stick snug around the cup but if you want, you can use the tape to secure the balloon to the cup.
  - Have students write their name on the cup with a marker (this way they get the cup they constructed to use during the investigation)





- There most likely will not be enough time to actually carry out the investigation until the next day. Have a place for students to store the shooters and direct the student who did not collect the materials to place the shooter in the storage place and return the scissors.
- Pass out the exit ticket for the day and have the students fill it out, collect the exit ticket as the students leave the classroom.

Exit Ticket for **Lesson 1, Part A**

3 – 2 – 1

- 3 ideas from today’s work that were new to me that I think I understand now.
- 2 ideas from today’s work that were a review of something I already knew.
- 1 question I have about the work we did today.

END of Lesson 1, Part A

Lesson 1, Part B

- Begin the day by going over some of the responses from yesterday's exit ticket.
- Have students get back with their partner from yesterday.
- One partner collects the shooter, and the other partner collects the materials for today
    - Meter stick
    - Metric ruler
    - Mini marshmallows
    - Procedure sheet

Explore (continued from Lesson 1, Part A)

- When the students are paired up with all the materials, they will place a mini marshmallow into the cup so it rests on the center of the balloon covering the cup.
- Pointing the opening of the cup away from self and others, pull the knot back and release it so that it snaps and shoots the mini marshmallow out of the cup. This is a practice round to make sure the shooter works.
- Repeat the above step but pull back the knot on the balloon 2 cm and release. Students will need to use the metric ruler to measure and record the distance the marshmallow lands from the edge of the cup onto the data collection sheet.
- Repeat the distance of 2 cm two more times recording the distance each time.
- Pull the knot on the balloon 4 cm and record the distance on the data sheet.
- Repeat the above step two more times at 4 cm recording the distance.
- Place two mini marshmallows into the center of the balloon and pull the knot 2 cm and record the distance.
- Repeat two more times.
- Place four marshmallows into the center of the balloon and pull the knot 2 cm and record the distance.
- Repeat two more times.
- When the students have completed the trials and the data sheet is completed they will use their results to answer the five discussion questions.

Explain

- The teacher will circulate the classroom and ask questions as students shoot the marshmallows and record the data.
- When all students have completed the discussion questions the class will come together whole group and discuss the answers.
- Pass out the exit ticket for the day and have the students fill it out, collect the exit ticket as the students leave the classroom.

Exit Ticket for **Lesson 1, Part B**

- Respond to the following prompt: The thing that surprised me the most today was _____. Explain why you were surprised by this.

HANDOUTS FOR LESSON BEGIN ON THE FOLLOWING PAGE.

Marshmallow Shooter

MATERIALS:

- balloon
- paper cup
- meter stick
- scissors
- metric ruler
- transparent tape
- mini marshmallows

PROCEDURE:

1. Tie a knot in the end of the balloon, then snip off about 2 cm from the top of the balloon.
2. Cut the bottom out of the paper cup.
3. Stretch the balloon over the end of the cut off paper cup so that the knot is in the center of the cup.
4. Tape the stretched balloon securely onto the paper cup so that when you pull on the knot of the balloon it stretches with your pull but does not come off the paper cup.
5. Place one mini marshmallow inside the cup so that it rests on the center of the balloon covering the end of the cup.
6. Pointing the opening of the cup away from you and others, pull the knot back and release it so that it snaps and shoots the mini marshmallow out of the cup.
7. Repeat Step 6 but pull the knot a distance of 2 cm and release it. Use the metric ruler to measure and then record the distance the marshmallow lands from the edge of the cup.
8. Repeat Step 7 two more times.
9. Repeat Steps 7 and 8, but this time pull the knot 4 cm and release it.
10. Repeat Steps 7 and 8, using two marshmallows.
11. Repeat Steps 7 and 8, using four marshmallows instead of two.





MARSHMALLOW SHOOTER DATA COLLECTION SHEET & DISCUSSION QUESTIONS

DATA:

VARIABLE	TRIAL 1 Distance (cm)	TRIAL 2 Distance (cm)	TRIAL 3 Distance (cm)	AVERAGE Distance (cm)
2 cm Pull 1 Marshmallow				
4 cm Pull 1 Marshmallow				
2 cm Pull 2 Marshmallows				
2 cm Pull 4 Marshmallows				

QUESTIONS:

1. What property of matter must be overcome in order for the marshmallow to shoot out of the cup?

2. What force causes the marshmallow to shoot out of the cup?

3. How does the distance the marshmallow flew when the balloon was pulled back 2 cm compare with how far it flew when the balloon was pulled back 4 cm? Why?

4. Why do the two marshmallows fly further than the 4 marshmallows?

5. In this experiment, what are the independent variables? What are the dependent variables?