FORTNITE

COLLISION DECISION

LESSON PLAN

SCIENCE

GRADE 8
FOUR 45-MINUTE PERIODS

Colliding objects offer a prime opportunity to explore the laws of physics. Fortnite Creative features collisions, making it an excellent way to experiment with the basic principles of physics, including Newton's third law.

Exactly how well do the physics in Fortnite replicate those found in real life? Do the game's physics support Newton's third law regarding the forces of action and reaction? Let's find out!

In this lesson, students will design an experiment to manipulate objects, measure object interactions, and draw conclusions about Newton's third law by bashing objects together.

During the process, **students** will:

- Design a solution to a problem.
- Model interactions before and after a collision.
- Collect evidence and make claims based on evidence.
- Compare and contrast real-world and video game physics.

Let's start smashing!

Link to Introductory Video: https://www.youtube.com/watch?v=C6-p2ON0zrA

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LESSON INFORMATION

Lesson Title: Collision Decision

Content/Grade: Science: Grade 8

Lesson Timeframe: Four 45-minute class periods

AUTHOR CONTACT

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DESCRIPTION OF CLASS/LEARNING ENVIRONMENT

The classroom or lab has one computer per student that can run Fortnite Creative Island. Rensselaer City School District is a small public school consisting of one pK–12 building. My current learning environment is a science classroom with tables for 24 students and six lab tables. I have four sections of eighth grade science with class sizes of 19 to 27 pupils. We are classified as a high-needs district. I also have ELL students and students with IEPs enrolled in the classes I teach.

The learning environment for this lesson requires computers or mobile devices able to run Fortnite Creative. Other than that requirement, any classroom would work, particularly for the extension activity.

LESSON OVERVIEW

Colliding objects offer a prime opportunity to explore the laws of physics. Fortnite Creative features collisions, making it an excellent way to experiment with the basic principles of physics, including Newton's third law.

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DESIRED RESULTS

ESSENTIAL QUESTIONS/BIG IDEAS

How can the behavior of objects during collisions be

predictable?How well do the physics of Fortnite match those of

real life?

LEARNING OUTCOMES/OBJECTIVES

Students will learn how to:

- Design a controlled experiment.
- Describe collisions in terms of Newton's third and second laws.
- Make predictions about motion resulting from collisions.
- Run an experiment in Fortnite Creative.
- Analyze data.

LESSON PLAN

LEARNING ACTIVITIES

The lesson is based on the 5E model of science instruction: Engage, Explore, Explain, Elaborate, Evaluate.

Extend is an additional application of the ideas within the 5E lesson that is often included as part of the 5E model.

ENGAGE

Students will learn about the phenomena of collisions through a variety of videos, including Newton's Cradle and a Safety Car Crash test video.

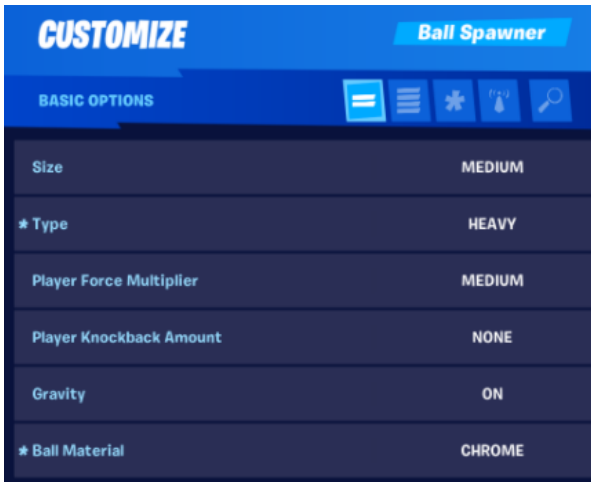
Video 1: Snow Collision
Video 2: EYC funny snow tube collision
Video 3: Keansburg, New Jersey's Bumper Car Psychos
Video 4*: BUMPER CARS For LOOT in Fortnite!

*Note: Video 4 is a bumper car mini-game in Fortnite.

EXPLORE

Students will explore the physics of collisions using Fortnite Creative.

Students will choose one independent variable related to the Ball Spawner to see how it changes the dependent variable. All other variables should be controlled. You can display the blank table below on a screen, along with the research question.



RESEARCH QUESTION

How does [independent variable] affect the distance a ball moves when colliding with another ball in Fortnite Creative?

INDEPENDENT VARIABLES	DEPENDENT VARIABLE
Ball size Ball Type Ball Material Ball distance up ramp	Distance ball moves

DATA TABLE:

INDEPENDENT VARIABLE	DISTANCE TRIAL 1	DISTANCE TRIAL 2	DISTANCE TRIAL 3	AVERAGE DISTANCE
PARAMETER 1				
PARAMETER 2				
PARAMETER 3				
PARAMETER 4				

SAMPLE DATA TABLE:

BALL SIZE	DISTANCE TRIAL 1	DISTANCE TRIAL 2	DISTANCE TRIAL 3	AVERAGE DISTANCE
SMALL				
MEDIUM				
LARGE				
SUPER				

Notes / Project Guidelines:

- Emphasize to students that in a controlled experiment, the scientist changes only one independent variable at a time. For example, if we are testing ball size, the size of the ball that is hit will remain the same, while the size of the ball colliding with it will change (or vice versa).
- Have students create a sketch (model) of what their device will look like in Fortnite.
- Students should decide all of the above BEFORE they construct their device in Fortnite.
- Students should have their data table prepared before they construct their rolling device in Fortnite Creative.
- Students will then use Fortnite to construct their ball rolling device and collect data using the following steps:
    - Change the ball settings under the "Customize" section of the editing menu for the ball spawner.
    - Select a "default" ball type and material to use as a control.
    - Construct a data table.
    - Place a distance marker by pressing the mouse scroll wheel from the point of origin to the location where the ball stopped.
    - Compute the average distance the ball travels for each parameter.
    - Graph the data to use as evidence for the conclusion.

NOTE: Balls may continue to move in Fortnite until they hit an object and may only seem to "stop". Students should look for that moment when the ball "stops."

EXPLAIN

Students will explain the physics by submitting a lab report and video of their research. The student's explanation will be noted in the Claim, Evidence, Reasoning (CER) section of their report.

EVALUATE

The teacher will assess student understanding based on mastery of rubric, a lab report, and a video submission. The teacher should feel free to have students show evidence of learning in whatever way they deem appropriate; other methods to show evidence of learning can include a blog post or website.

EXTEND

Have students design an experiment similar to the Fortnite experiment (using the same data table) to examine how collisions behave with marbles and/or steel bearings. Students should reflect on and document differences noted between the fortnite experiment and the physical experiment.

EXTERNAL RESOURCES

NGSS Report Template
Collision Decision Slides

Video 1: Snow Collision
Video 2: EYC funny snow tube collision
Video 3: Keansburg, New Jersey's Bumper Car Psychos
Video 4*: BUMPER CARS For LOOT in Fortnite!

ASSESSMENT

ASSESSMENTS

Completed lab report, including:

- Guiding question
- Hypotheses
- Procedure
- Data table and results
- Conclusion / reflection

Sample lab report template: NGSS Report Template

RUBRIC

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.

COLLISION DECISION RUBRIC

DOK 1 DEVELOPING	TASK
Student identifies the phenomena and purpose of the investigation as well as components of the model including: applied forces, friction, mass, and acceleration.	Sketch and model of their collision device with labeled components.
DOK 2 PROGRESSING	**TASK**
Student explains or describes the relationship between force, mass, and acceleration. Evidence is cited to defend claims.	Explanation of relationships is provided in summary media (video, blog, and so on) and/or research report.
DOK 3 EXTENDING	**TASK**
Student connects their experiment to Newton's Laws of Motion. Conclusions are justified by the student and based on evidence from their designed experiment.	Claim, Evidence, and Justification / Reasoning are thought out, and reflect an understanding of Newton's Laws of Motion and how they apply to a collision.

STANDARDS MAPPING

NGSS

MS-PS2-2 Motion and Stability: Forces and Interactions

Students who demonstrate understanding can:

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

ISTE STANDARDS

3 Knowledge Constructor
Students build knowledge by actively exploring real-world issues and problems, developing ideas and theories, and pursuing answers and solutions.

4 Innovative Designer

4a Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.

4c Students develop, test and refine prototypes as part of a cyclical design process.

4d Students exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.

5 Computational Thinker

5a Students formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models, and algorithmic thinking in exploring and finding solutions.

5b Students collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.

5c Students break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving.

5d Students understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.

6 Creative Communicator

6a Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models, or simulations.

7 Global Collaborator

7a Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.

INTERDISCIPLINARY AND 21ST CENTURY CONNECTIONS

This lesson covers areas related to engineering, science, and multimedia design. This lesson integrates all areas of STEM / STEAM.

21st Century Connections:

1. Critical thinking
2. Creativity
3. Collaboration
4. Communication
5. Technology literacy
6. Flexibility
7. Leadership
8. Initiative
9. Social skills

MODIFICATIONS AND ACCOMMODATIONS

Provide students with the option to use a different tool (digital or physical to complete the activities.

Incorporate adaptive controller / game controller if necessary.

ADDITIONAL TEACHING MATERIALS:

Include other teaching materials as separate documents (handouts, etc.)

NGSS Report Template

Collision Decision Slides

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