Forces and Motion 5E Lesson Plan

Grade Level	Standard(s)
9 - 10	**HS-PS2-1** Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration**.**

Objective

Students will be able to:

- Describe the relationship between the forces acting on a moving object and the force required to stop it.
- Solve for force, mass, or acceleration given a scenario.

* All Gale In Context: Science resources used in this lesson plan and how to locate them are listed on page three.

ENGAGE

1. As a class, watch the **NE@Orion Drop Test** video.
    - As students watch, have them record any factors or forces mentioned by the scientist that are important when conducting this simulation.
2. After watching the video, ask students to share their thoughts on why simulating this landing with so much precision would be important
3. Have students share the factors and forces they heard the scientists mention that play a role in this type of landing and ask if there are any others that may not have been mentioned but they think would be important.
4. Last, ask students to write down three different scenarios that would cause the simulation to not go as planned. Encourage students to be creative and have fun!

EXPLORE

1. Have students choose a partner and share the **DIY - Factors affecting objects falling in air** simulation with them.
2. Students should run the simulation several times changing input variable for each trial. *You may want to prompt students to change only one variable at a time if they are having difficulty interpreting the graphs.
3. Have students record their chosen settings and interpret the graph data on a sheet of paper. *Their interpretation should be with words, not copying down the graphs.
4. After they have run the trial several times, have students answer the following questions:
    - What role did mass play in the simulation?
    - How did an increase in mass affect the acceleration of the skydiver if gravity and air density stay the same?
    - What role does gravity play in this simulation? How is it relevant to Newton's Second Law?
5. As a class, discuss student answers.

EXPLAIN

1. Have students read **"Force, Mass, and Acceleration"**. As they read ask them to use the highlights and notes tool to identify the following information:
    - Acceleration, what causes it, and how it can be negative.
    - Vectors and what their characteristics are.
    - Inertial mass vs. gravitational mass.
2. After students have read the article and identified the requested information, discuss as a class and explain each.
3. Next, have students watch the **Newton's Second Law of Motion** video and draw the given examples in their notebook. This will come in handy for the "elaborate" section.

ELABORATE

1. Using the activity **Seat Belts to Sensors: Car Safety through History,** modify the final assignment to include discussion of Newton's Second Law and the role of force, mass, and acceleration in their argument.
    - The first modification you should make is have all groups write their argument in the affirmative for seatbelts. This way during "evaluate" you can be their opposing argument and bring up prepared points that will prompt students to show their understanding of Newton's Second Law.
    - Another modification you may want to make is have students work with partners instead of larger groups. This way you can be sure each person has a chance to speak and share equally valuable points.
    - You will also need to create a few scenarios to assign to each group. Each scenario should describe two of the three factors needed to solve Newton's Second Law. Students should include the solution and importance of these values in their argument.
        - Ex: Force = 200N Mass = 1000kg Acceleration = ??
    - Last, ensure you students have written down their key points and solutions on a sheet of paper that can be turned in.

*This could be a great opportunity to collaborate with your Social Studies department if they have conducted or are soon going to conduct a debate in their class.

EVALUATE

1. As students are completing the "elaborate" section, circulate the room to ensure the groups are keeping clear notes of their arguments and key points.
2. After completing the debate verbally, have students reflect on the notes and key points they made. Ask them to write down if their mind was changed or if they still agree with each point they wrote.
3. Collect these notes as this will serve as their assessment.

Lesson Sources

Below are the sources used throughout the Forces & Motion 5E Lesson Plan. Utilizing Advanced Search, select the Gale Document Number limiter and search for the below numbers to pull the content for this lesson

GALE IN CONTEXT: SCIENCE

ENGAGE

- "NE@Orion Drop Test" Video
  Document Number: **A271670479**

EXPLORE

- "DIY – factors affecting objects falling in air" Simulation
  Document Number: **OICHIT295424738**

EXPLAIN

- "Force, Mass, and Acceleration" Topic Overview
  Document Number: **CV2434500186**

- "Newton's Second Law of Motion" Video
  Document Number: **PC4295840543**

ELABORATE

- "Seat Belts to Sensors: Car Safety through History" activity
  Document Number: **CX3679900017**