Graphic Organizer to Develop NGSS Aligned Lessons

Selected Performance Expectation:
Students who demonstrate understanding can:

MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.*
[Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.] [Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.]

Describe what you want to see on the final product.

- Students will design/construct a car that is able to complete the designed track(or course)that includes one large hill and a subsequent smaller hill to evaluate the effectiveness of their car (including speed, forces acting on car, etc.)
- After conducting all investigations leading up to the culminating task, students will create a final presentation in the form of a pamphlet, poster, or lab report, that explains the benefits and short comings of their vehicle.

Directions
What should an "A" work look like?

- **Students will have work together in groups of 2 to design their vehicles and run through each of the investigations**
- **Each student will have their own independent data, graphs, tables etc. that are accurate and neatly organized.**
- **The collected data from each investigation is attached to their pamphlet, poster, or lab report.**
- **In their write up students address the following:**
  - Explanation as to why their car performed the way it did
  - Explanation is supported by their data
  - What materials were used to build their car
  - Possible problems/ challenges and solutions
  - Considerations and implications for the future
  - Reflection on the design process

Which **Common Core State Standard**(s) is (are) addressed in student's final work? Explain.
What would the student response look like to show you that the student met this criteria?

ELA/Literacy –

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (MS-PS2-1),(MSPS2-3)

RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS2-1),(MS-PS2-2),(MS-PS2-5)

WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS2-1),(MS-PS2-2),(MS-PS2-5)

Mathematics –

MP.2	Reason abstractly and quantitatively. (MS-PS2-1),(MS-PS2-2),(MS-PS2-3)
6.NS.C.5	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values; use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-PS2-1)
6.EE.A.2	Write, read, and evaluate expressions in which letters stand for numbers. (MS-PS2-1),(MS-PS2-2)
7.EE.B.3	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-PS2-1),(MS-PS2-2)
7.EE.B.4	Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-PS2-1),(MS-PS2-2)

In going through this unit, students will satisfy many of the common core standards that are addressed for both math and English. Students will be conducting their own research projects, building with partners and sharing data with the entire class. This requires students to utilize many different communication strategies, including reading, writing, and speaking with one another. At the end of the unit, students will be expected to report the statistics of their vehicles, citing their data, and providing evidence for the claims that they have made. While conducting the 8 investigations, students will be required to use mathematical equations and reasoning in order to support their ideas, make conclusions, and make predictions.

Which **Crosscutting Concept** is addressed in student's final work? Explain
What would the student response look like to show you that the student understood the underlying crosscutting concept?

Systems and System Models

Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. (MS-PS2-1),(MS-PS2-4),

Students will be designing a Balloon car that will allow them to measure speed, graph it, and analyze data. Students will be drawing conclusions on how the input of force impacts the output in terms of speed, kinetic energy, and potential energy, showing how energy is transformed from one type to another.

Which **Scientific Practice(s)** and **Engineering Practice(s)** are addressed in student's final work? Explain.
What would the student response look like to show you that the student thinks like an engineer and a scientist?

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. Apply scientific ideas or principles to design an object, tool, process or system. (MS-PS2-1)

Students will be building cars based on the basic engineering cycle of design, built, test, and revise. Students will be designing solutions to meet the challenges of mass transit engineering and constructing explanations based on data collected from their investigations.

Sequence of lesson to be field tested including estimated instructional time

Lesson 1: Zip-line Activity
Lesson2: Design: Car Building
Lesson 3: Investigation: Speed (Flat Surface)
Lesson 4: Investigation: Varying Mass
Lesson 5: Investigation: Varying Force
Lesson 6: Down Hill (Kinetic Energy and Gravity)
Lesson 7: Uphill Investigation (Potential Energy)
Lesson 8: Car Collisions
Lesson 9: Race Course