NGSS Standards:
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.

HS-PS2-2. Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.

HS-PS2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

HS-PS2-4. Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

HS-PS2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

HS-PS3-5. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

ELA/LITERACY:
RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS2-1) (HS-PS2-6)

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-PS2-1)

WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS2-6)

WHST.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS2-3) (HS-PS2-5)

WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS2-5)

WHST.11-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS2-1) (HS-PS2-5)

MATHEMATICS:
MP.2 Reason abstractly and quantitatively. (HS-PS2-1),(HS-PS2-2),(HS-PS2-4)
a. decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols.
b. reflect during the manipulation process in order to probe into the meanings for the symbols involved
c. create a coherent representation of the problem
d. make sense of quantities and their relationships in problem situations
e. attend to the meanings of quantities
f. use flexibility with different properties of operations and objects
g. translate an algebraic problem to a real-world context
h. explain the relationship between the symbolic abstraction and the context of the problem
i. compute using different properties
j. consider the quantitative values, including units, for the numbers in a problem

MP.4 Model with mathematics. (HS-PS2-1),(HS-PS2-2),(HS-PS2-4)
a. apply mathematics to solve problems in everyday life, society, and workplace
b. identify important quantities in a practical situation and map the relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas
c. consistently interpret mathematical results in the context of the situation and reflect on whether the results make sense
d. apply knowledge, making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later
e. make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised
f. identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas
g. analyze quantitative relationships to draw conclusions
h. improve the model if it has not served its purpose

HSN.Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS2-1) (HS-PS2-2) (HS-PS2-4) (HS-PS2-5) (HS-PS2-6)

HSN.Q.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS2-1), (HS-PS2-2), (HS-PS2-4), (HS-PS2-5), (HS-PS2-6)

HSN.Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS2-1) (HS-PS2-2) (HS-PS2-4) (HS-PS2-5) (HS-PS2-6)

HSA.SSE.1 Interpret expressions that represent a quantity in terms of its context. (HS-PS2-1) (HS-PS2-4)

HSA.SSE.1 Interpret expressions that represent a quantity in terms of its context. (HS-PS2-1) (HS-PS2-4)

HSA.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. (HS-PS2-1) (HS-PS2-4)

HSA.CED.1 Create equations and inequalities in one variable and use them to solve problems. (HS-PS2-1) (HS-PS2-2)

HSA.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (HS-PS2-1) (HS-PS2-2)

HSA.CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (HS-PS2-1) (HS-PS2-2)

HSF-IF.7 Graph functions expressed symbolically and show key features of the graph, by in hand in simple cases and using technology for more complicated cases. (HS-PS2-1)

HSS-IS.1 Represent data with plots on the real number line (dot plots, histograms, and box plots). (HS-PS2-1)

ESSENTIAL QUESTIONS:
1. What causes motion?
2. How would you test each of Newton's Laws?
3. Distinguish between the different types of forces.
4. Can you elaborate on the reason motion is relative?
5. Elaborate on velocity versus acceleration.
6. How is momentum conserved in different situations?
7. How would you describe a falling body and how does horizontal speed affect the rate of a falling body?
8. Describe the motion of a ball dropped vertically and one simultaneously thrown horizontal?

BIG IDEAS:
1. Different forces

2. Vector versus scalar quantities

3. Friction can be friend or foe.

4. Causes of motion

5. Newton's laws and forces in everyday life

6. Types of collisions

7. One dimensional versus two dimensional motion

Vocabulary: Force, Friction, Speed, Velocity , Acceleration, Newton's Laws, Vector, Momentum, Motion, Inertia, Impulse, Weight, Inverse square law, Equilibrium, Net force, Terminal velocity, Gravity, Projectile motion, Collision, Projectile motion