Grade 6: Forces and Interactions

Stage 1 Desired Results

ESTABLISHED GOALS:

Competencies:

- **Cause and Effect-** Students will investigate, explain, and evaluate potential causal relationships, using evidence to support claims and predictions about the mechanisms that drive those relationships.
- **Systems and System Models-** Students will investigate and analyze a natural or human designed system in order to develop and justify a model that accurately represents the system or aspects of the system (e.g., boundaries, inputs, outputs, interactions, and behaviors).
- **Stability and Change of Systems-** Students will analyze and evaluate the stability of natural and human designed systems in order to develop evidence-based explanations and predictions of changes over time.
- Students will demonstrate the ability to analyze and summarize text and integrate knowledge to make meaning of discipline-specific materials.
- Students will demonstrate the ability to produce coherent and supported writing in order to communicate effectively for a range of discipline-specific tasks, purposes, and audiences.
- Students will demonstrate the ability to speak purposefully and effectively by strategically making decisions about content, language use, and discourse style.

Content Standards:

- MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
- 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.
- MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
- MS-PS2-4. Construct and present arguments using

Transfer

Students will be able to independently use their learning to ***identify causal relationships in the physical environment.***

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- cause and effect relationships may be used to predict phenomena in natural or designed systems.
- models can be used to represent systems and their interactions—such as inputs,processes and outputs—and energy and matter flows within systems.
- explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales.

ESSENTIAL QUESTIONS

- If Newton's Third Law didn't exist, would it change how we interact with the world?

evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. - MS-PS2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.	***Acquisition***	
	Students will know… - that for any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction. - that the motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. - that the greater the mass of the object, the greater the force needed to achieve the same change in motion. - that for any given object, a larger force causes a larger change in motion. - that electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. that gravitational forces are always attractive. - that there is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. - forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively*).* *<u>vocabulary:</u>* force, mass, gravity, electromagnetic, inertia, field, net force	*Students will be skilled at…* - applying *Newton's Third Law.* - planning and conducting investigations. - asking questions about data. - using evidence to support a claim. - evaluating experimental designs. - constructing and presenting an argument.

Content Area Literacy Standards	***21st Century Skills***
• RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. • RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. • RST.6-8.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*. • RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually. • RST.6-8.8 Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. • RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. • WHST.6-8.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. • WHST.6-8.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. • WHST.6-8.6 Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently. • WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research.	• *think creatively* • *be self-directed learners* • *use and manage information* • *manage goals and time*

Stage 2 - Evidence

Evaluative Criteria	*Assessment Evidence*
	PERFORMANCE TASK(S):
	OTHER EVIDENCE:

Stage 3 – Learning Plan

Summary of Key Learning Events and Instruction

Science and Engineering Practices	*Mathematics Integration*
S&EP 1. Asking questions and defining problems S&EP 3 Planning and carrying out investigations S&EP 6 Constructing explanations and designing solutions S&EP 8 Obtaining, evaluating and communicating information	• MP.2 Reason abstractly and quantitatively. • 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. • 6.EE.A.2 Write, read, and evaluate expressions in which letters stand for numbers. • 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. • 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.
Technology Integration	***District Materials***