MS-PS2-3 Motion and Stability: Forces and Interactions

Students who demonstrate understanding can:

MS-PS2-3. **Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.** [Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.] [*Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Asking Questions and Defining Problems
Asking questions and defining problems in grades 6–8 builds from grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.

- Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.

Disciplinary Core Ideas

PS2.B: Types of Interactions

- 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.

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Observable features of the student performance by the end of the course:

1	Addressing phenomena of the natural world or scientific theories	
	a	Students formulate questions that arise from examining given data of objects (which can include particles) interacting through electric and magnetic forces, the answers to which would clarify:
		i. The cause-and-effect relationships that affect magnetic forces due to:
		1. The magnitude of any electric current present in the interaction, or other factors related to the effect of the electric current (e.g., number of turns of wire in a coil).
		2. The distance between the interacting objects.
		3. The relative orientation of the interacting objects.
		4. The magnitude of the magnetic strength of the interacting objects.
		ii. The cause-and-effect relationship that affect electric forces due to:
		1. The magnitude and signs of the electric charges on the interacting objects.
		2. The distances between the interacting objects.
		3. Magnetic forces.
	b	Based on scientific principles and given data, students frame hypotheses that:
		i. Can be used to predict the strength of electric and magnetic forces due to cause-and-effect relationships.
		ii. Can be used to distinguish between possible outcomes, based on an understanding of the cause-and-effect relationships driving the system.
2	Identifying the scientific nature of the question	
	a	Students' questions can be investigated scientifically within the scope of a classroom, outdoor environment, museum, or other public facility.