Unless otherwise specified, "descriptions" referenced in the evidence statements could include but are not limited to written, oral, pictorial, and kinesthetic descriptions.

MS-PS2-1 Motion and Stability: Forces and Interactions

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.*]

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

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.

Disciplinary Core Ideas

PS2.A: Forces and Motion

- 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 (Newton's third law).

Crosscutting Concepts

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.

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Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

- The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions.

Observable features of the student performance by the end of the course:		
1	Using scientific knowledge to generate design solutions	
	a	Given a problem to solve involving a collision of two objects, students design a solution (e.g., an object, tool, process, or system). In their designs, students identify and describe*:
		i. The components within the system that are involved in the collision.
		ii. The force that will be exerted by the first object on the second object.
		iii. How Newton's third law will be applied to design the solution to the problem.
		iv. The technologies (i.e., any human-made material or device) that will be used in the solution.
2	Describing* criteria and constraints, including quantification when appropriate	
	a	Students describe* the given criteria and constraints, including how they will be taken into account when designing the solution.
		i. Students describe* how the criteria are appropriate to solve the given problem.
		ii. Students describe* the constraints, which may include:
		1. Cost.
		2. Mass and speed of objects.
		3. Time.
		4. Materials.
3	Evaluating potential solutions	
	a	Students use their knowledge of Newton's third law to systematically determine how well the design solution meets the criteria and constraints.
	b	Students identify the value of the device for society.
	c	Students determine how the choice of technologies that are used in the design is affected by the constraints of the problem and the limits of technological advances.