

Educational Resources from *Phenomenon Science Education*

Student Proficiency Goals for Performance Expectation 3-PS2-1



Information about Performance Expectation 3-PS2-1

Performance Expectation 3-PS2-1.

Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

Clarification Statement.

Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.

Assessment Limits.

Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.

Science and Engineering Practice (Planning and Carrying Out Investigations)

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.

Disciplinary Core Idea (PS2.A: Forces and Motion)

- Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.)

Disciplinary Core Idea (PS2.B: Types of Interactions)

- Objects in contact exert forces on each other.

Crosscutting Concept (Cause and Effect)

- Cause and effect relationships are routinely identified.

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SEP (Planning and Carrying Out Investigations):

- Students plan investigations, in collaboration with peers, by identifying testable ideas about the effects of balanced and unbalanced forces on the motions of objects.
- Students plan investigations, in collaboration with peers, by considering what evidence they can collect to determine the effects of balanced and unbalanced forces on the motions of objects.
- Students plan investigations, in collaboration with peers, by determining how to use fair tests to collect evidence that supports or disproves their ideas about the effects of balanced and unbalanced forces on the motions of objects.
- Students conduct investigations, in collaboration with peers, to compare the effects of balanced forces on the motions of objects.
- Students conduct investigations, in collaboration with peers, to compare the effects of unbalanced forces on the motions of objects.

DCI (PS2.A Forces and Motion):

- Students know each force acting on an object acts in one direction and has both strength and direction.
- Students know that an object at rest has multiple forces acting on it, but they sum to zero net force on the object.
- Students know that when forces on an object do not sum to zero there are changes in the speed or direction of the object.

DCI (PS2.B Types of Interactions):

- Students know that when objects touch, those objects exert forces on one another.
- Students know that when objects push on one another, those pushes are forces that can change the motion of the objects.

CCC (Cause and Effect):

- Students consider how changes in the forces that act on objects cause changes in the motion of those objects.
- Students identify forces that act on objects and the resulting changes in motion of those objects.
- Students identify cause and effect relationships between applied forces and changes in the motion of objects.