

Anatomy and Architecture of a NGSS Performance Expectation

Scientific and Engineering Practices

The 8 scientific and engineering practices are the major practices that scientists employ as they investigate and build models and theories about the world, and that engineers use as they design and build systems

Crosscutting Concepts

The 7 crosscutting concepts are concepts that bridge disciplinary boundaries, thus have explanatory value throughout much of science and engineering

Disciplinary Core Ideas

The disciplinary core ideas have broad importance across multiple sciences or engineering disciplines or are a key organizing concept of a single discipline. There are 44 of these core ideas across the areas of Life Sciences, Physical Science, Earth and Space Sciences, and Engineering, Technology, and Applications of Science

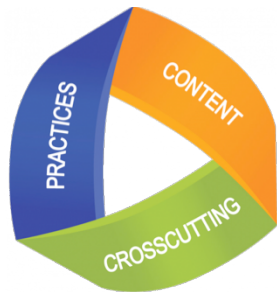
MS-PS2-2.

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. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] [Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.]

Title and Code

Performance Expectations

Performance expectations specify what students should know, understand, and be able to do. They also illustrate how students engage in scientific practices to develop a better understanding of the essential knowledge. These expectations support targeted instruction and assessment by providing tasks that are measurable and observable.



Dimensions of Learning

Scientific and Engineering Practices

Disciplinary Core Ideas

Crosscutting Concepts

Connections Boxes

Connections to Other DCIs in grade-band

Articulation of DCIs across grade-level

Common Core State Standard Connections

MS-PS2-2 Motion and Stability: Forces and Interactions		
Students who demonstrate understanding can: 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. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] [Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.]		
The performance expectation above was developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i> :		
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions. <ul style="list-style-type: none"> Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. 	PS2.A: Forces and Motion <ul style="list-style-type: none"> 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. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. 	Stability and Change <ul style="list-style-type: none"> Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales.
Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence <ul style="list-style-type: none"> Science knowledge is based upon logical and conceptual connections between evidence and explanations. 		
Connections to other DCIs in this grade-band: MS.PS3.A ; MS.PS3.B ; MS.ESS2.C		
Articulation of DCIs across grade-bands: 3.PS2.A ; HS.PS2.A ; HS.PS3.B ; HS.ESS1.B		
Common Core State Standards Connections:		
ELA/Literacy - RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS2-2) WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS2-2)		
Mathematics - MP.2 Reason abstractly and quantitatively. (MS-PS2-2) 6.EE.A.2 Write, read, and evaluate expressions in which letters stand for numbers. (MS-PS2-2) 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. (MS-PS2-2) 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. (MS-PS2-2)		