



**Grades 6–8**

**3.2.6-8.H Physical Science:** Forces and Interactions

**Students who demonstrate understanding can** *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.*

**Clarifying 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.

Science and Engineering Practices (SEP)	Disciplinary Core Ideas (DCI)	Crosscutting Concepts (CCC)
<p><b>Planning and Carrying Out Investigations</b>                      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.</p> <ul style="list-style-type: none"> <li>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.</li> </ul> <hr/> <p style="text-align: center;"><b>Connections to Nature of Science</b></p> <p><b>Scientific Knowledge is Based on Empirical Evidence</b></p> <ul style="list-style-type: none"> <li>Science knowledge is based upon logical and conceptual connections between evidence and explanations.</li> </ul>	<p><b>PS2.A: Forces and Motion</b></p> <ul style="list-style-type: none"> <li>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.</li> <li>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.</li> </ul>	<p><b>Stability and Change</b></p> <ul style="list-style-type: none"> <li>Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales.</li> </ul>

**Pennsylvania Context:** N/A

**PA Career Ready Skills:** Identify and evaluate distractors that impact reaching one’s goals.



**Connections to Other Standards Content and Practices**

Standard Source	Possible Connections to Other Standard(s) or Practice(s)
<b>Agriculture (AFNR)</b>	CS.01.02.02.b: Analyze how technology is used in AFNR systems to maximize productivity.
<b>Science, Environmental Literacy and Sustainability (NAAEE)</b>	5.8 Strand 1.B. Designing investigations: Learners design environmental investigations to answer specific questions—often their own questions.
<b>PA Core Standards: ELA</b>	CC.3.5.6-8.C: Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. CC.3.6.6-8.F: 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.
<b>PA Core Standards and Practices: Math</b>	MP.2: Reason abstractly and quantitatively. CC.2.2.7.B.3: Model and solve real-world and mathematical problems by using and connecting numerical, algebraic, and/or graphical representations.
<b>PA Standards: Social Studies</b>	N/A
<b>Educational Technology (ISTE)</b>	1.4. Innovative Designer: Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.
<b>Technology and Engineering (ITEEA)</b>	STEL-1L: Explain how technology and engineering are closely linked to creativity, which can result in both intended and unintended innovations.