

Physics: Momentum and Impulse

Car Safety Engineering (the Egg Drop)

The following learning activities were backwards planned to facilitate the development of students' knowledge and skills for mastery of this NGSS Performance Expectation. Not all of the dimensions and CCSS are covered in the following activities and teachers are encouraged to address them where possible.

HS-PS2-3 Motion and Stability: Forces and Interactions		
<p>Students who demonstrate understanding can:</p> <p>HS-PS2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.* [Clarification Statement: Examples of evaluation and refinement could include determining the success of the device at protecting an object from damage and modifying the design to improve it. Examples of a device could include a football helmet or a parachute.] [Assessment Boundary: Assessment is limited to qualitative evaluations and/or algebraic manipulations.]</p>		
<p>The performance expectation above was developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i>:</p>		
<p>Constructing Explanations and Designing Solutions</p> <p>Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.</p> <ul style="list-style-type: none"> Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects. 	<p>PS2.A: Forces and Motion</p> <ul style="list-style-type: none"> If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. <p>ETS1.A: Defining and Delimiting an Engineering Problem</p> <ul style="list-style-type: none"> Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. <i>(secondary)</i> <p>ETS1.C: Optimizing the Design Solution</p> <ul style="list-style-type: none"> Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. <i>(secondary)</i> 	<p>Cause and Effect</p> <ul style="list-style-type: none"> Systems can be designed to cause a desired effect.
<p><i>Connections to other DCIs in this grade-level: N/A</i></p>		
<p><i>Articulation of DCIs across grade-bands:</i></p> <p>MS.PS2.A ; MS.PS3.C</p>		
<p><i>Common Core State Standards Connections:</i></p> <p>ELA/Literacy -</p> <p>WHST.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS2-3)</p>		