



Grade 7 Science - Unit 5 - Engineering and Design

Unit Focus

Student will apply their understanding of the functionality of simple machines, that they gained during several inquiry-based experiments, to devise a chain reaction machine. The Engineering Design Process that students have utilized in prior grades will guide their planning and design through several iterations as they work to devise a machine that will complete a given task. At the conclusion of the unit, students will present their machine to the class and explain the physics behind each of the simple machines utilized in their design. This unit is completed if there is additional time available at the end of the school year as it is a supplemental unit to Grade 8: Forces in Motion.

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
<p>Next Generation Science Standards Performance Expectations: Middle School Engineering</p> <ul style="list-style-type: none"> Design Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. (MS-ETS1-3) <p>Next Generation Science Standards (DCI) Science: 7</p> <ul style="list-style-type: none"> A solution needs to be tested, and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem. (ETS1.6.B3) The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (ETS1.6.C2) 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. (PS2.6.A2) A system of objects may also contain stored (potential) energy, depending on their relative positions. (PS3.6.A4) When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (PS3.6.B1) When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (PS3.6.C1) <p>Madison Public Schools Profile of a Graduate</p>	<p><i>Students will be able to independently use their learning to...</i></p> <p>T1 Create models to explore complex systems, show mastery of key science concepts, and/or develop solutions through creation of a product open to testing and redesign.</p> <p>T2 Make observations and ask questions to define a problem based on prior knowledge and curiosity that stimulates further exploration, analysis, and discovery.</p>	
	Meaning	
	Understanding(s)	Essential Question(s)
	<p><i>Students will understand that...</i></p> <p>U1 Engineers work to solve a problem through the Engineering Design Process which involves making a plan, testing, collaborating and redesigning.</p> <p>U2 Energy, in everyday life, typically refers to the conversion of stored energy into a desired form for practical use.</p>	<p><i>Students will keep considering...</i></p> <p>Q1 How can I use simple machines and the laws of motion to create a product according to specific design criteria?</p> <p>Q2 How do I explain my results? What questions do I wonder about now?</p>
	Acquisition of Knowledge and Skill	
	Knowledge	Skill(s)
	<p><i>Students will know...</i></p> <p>K1 Six basic categories of simple machines include: lever, inclined plane, wheel and axle, pulley, wedge, and screw.</p> <p>K2 Simple machines can be used to move objects.</p>	<p><i>Students will be skilled at...</i></p> <p>S1 Determine ways to modify a simple machine (inclined plane, pulley and lever) to improve its mechanical advantage.</p>

Stage 1: Desired Results - Key Understandings

- Design: Engaging in a process to refine a product for an intended audience and purpose. (POG.2.2)

K3 Simple machines are not used to change the amount of work to move or lift an object; rather, simple machines change the amount of effort force, direction or distance needed to move the object.

K4 Kinetic energy (motion energy) is proportional to the mass of the object and the square of its velocity.

K5 Potential energy depends on the mass and relative position of the object.

S2 Use the Engineering Design Process to build a functional Rube-Goldberg machine to perform a specified task.