YES Middle School

Engineering Landing Pads
Connections to Next Generation Science Standards

NGSS Performance Expectation		In this unit, students:
MS-PS3-2	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.	investigate objects dropped from different heights to compare the amount of kinetic energy they transfer during a collision, and therefore how much potential energy they had.
MS-PS3-5	Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.	perform tests and make observations to explain how kinetic energy is absorbed by landing pad materials and/or transferred back to the falling object.
MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.	determine that their landing pads must absorb the kinetic energy of a falling object and be reusable to minimize waste. Teams tailor their designs to a specific mass of an object and the height from which it is dropped.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	develop tests and measures of success and failure aligned to each of the criteria and constraints in order to evaluate their landing pad designs.
MS-ETS1-3	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.	test how different arrangements of materials absorb the kinetic energy of a falling object. Teams share their findings in a Gallery Walk and combine the methods they learn from each other to inform their landing pad designs.

NGSS Performance Expectation		In this unit, students:
MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	rapidly iterate in two phases, first optimizing for mass, then optimizing for drop height. Teams use the phases of the Engineering Design Process to iterate their designs to a final proof of concept.

Crosscutting Concept

Energy and Matter

In this unit, students track the transfer of kinetic energy within a system. They observe and list evidence for what happens when kinetic energy is absorbed by the landing pad and what happens when kinetic energy is transferred back into the falling object.

Crosscutting Concept

Structure and Function

In this unit, students learn that squishy materials absorb kinetic energy from a falling object by changing shape during the collision. They consider how the properties of materials (squishy vs. firm, thick vs. thin) contribute to their function in a landing pad and select appropriate materials for their designs.

Computer Science Module: *Bounce Height Measurements* Connections to Standards

CSTA K-12 Computer Science Standard		In this module, students:
2-AP-10	Use flowcharts and/or pseudocode to address complex problems as algorithms.	articulate the steps of an algorithm that finds the bounce height of a ping-pong ball from a video.
2-IC-21	Discuss issues of bias and accessibility in the design of existing technologies.	discuss how a computer algorithm and investigation procedure must work together to collect reliable data.

Computer Science Module: *Delivery Notification Systems* Connections to Standards

CSTA K-12 Computer Science Standard		In this module, students:
2-AP-17	Systematically test and refine programs using a range of test cases.	Test and refine their delivery notification system to increase the efficiency of retrieving packages from their landing pads.