CRISP Kit Teacher Module

Title of Module:

Mousetrap Catapult

Subject(s) or Unit of Study:

Engineering, Measurement, Mechanics

Grade Level(s):

6 – 8

Est. Length of Activity:

5 hr.

Student Objectives:

Students will:

- Design and construct a catapult built to design specifications using limited materials provided.
- Go through the engineering design process to refine and improve their catapult design

Vocabulary:

Force, Measurement, Potential and Kinetic Energy

Materials:

Duct tape
Plastic Spoon
Wooden Spoon
Metal Spoon
2 Plastic Knives
8 Erasers (1”x2”)
Mousetrap
Hot glue Gun
Marshmallows (Small)

Learner Background:

Students should have an understanding and be able to convert measurements, determine angles and should have knowledge of potential and kinetic energy.

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Learning Activity or Procedure:

Students will be given the materials the catapult and design requirements (i.e., marshmallow must travel 3 meters and land within a 10 cm square)

Students will sketch a design, build their catapult to their design specifications, test and then refine their design

Assessment:

Students should record their measurements and steps taken as they go

Additional Resources:

http://www.instructables.com/id/MouseTrap

Teacher Notes:

Describe any tips/tricks or suggestions for implementing this lesson/demonstration that might be helpful to future educators. Provide answer keys if applicable

Safety:

Wear safety goggles

STEM Careers:

Field Artillery Officer
Mechanical Engineer
Mathematical
Scientist
Civil Engineer

Standards:

Next Generation Science Standards:

NGSS Performance Tasks	**MS-PS3-2 Energy** • 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. **MS-ETS1-1 Engineering Design** • 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.
NGSS - (DCI) Disciplinary Core Ideas	**PS3.A: Definitions of Energy** • A system of objects may also contain stored (potential) energy, depending on their relative positions. **PS3.C: Relationship between Energy and Forces** • When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. **MS - ETS1.A: Defining and Delimiting Engineering Problems** • The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. **MS - ETS1.B: Developing Possible Solutions** • 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. • 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.
NGSS - (CC) CrossCutting Concepts	**Systems and System Models** • Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy and matter flows within systems. **Interdependence of Science, Engineering, and Technology** • All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS) • The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS) • New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS)
NGSS - (SEP) Science and Engineering Practices	**SEP 2 – Developing and Using Models** • Develop a model to describe unobservable mechanisms.

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Common Core Standards:

CC ELA/Literacy Standards	**SL.8.5** • Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-PS3-2)
CC Math	**MP.2** • Reason abstractly and quantitatively. (MS-ETS1-1) (HS-ETS1-1) **MP.4** • Model with mathematics. (HS-ETS1-1)