CRISP Kit Teacher Module

Title of Module:

Making More Stuff: Safer

Subject(s) or Unit of Study:

Technology and Society, Mechanics, Engineering

Grade Level(s):

5 – 12

Est. Length of Activity:

Est. length of activity

Student Objectives:

Students will… explore how to build and test the strength of different shapes and then use those shapes to design and build strong structures.

Vocabulary:

Engineering,

Materials:

Activity 1:

- Toothpicks
- Gumdrops candy

Activity 2: Design challenge include (for groups)

- Pencil and paper
- Gumdrops candy
- Toothpicks
- Small weights (not included)
- 4”x4” piece of cardboard

Learner Background:

Students should have a discussion prior to the activities. Some questions can include:

- Why do you think buildings come in different shapes and sizes?
- Do certain kinds of buildings tend to come in similar shapes?
- How do you think different shapes provide different amounts of support or strength for buildings?

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Learning Activity or Procedure:

Activity 1:

Students will build structures of different shapes and test them for structural integrity, rebuild and test again.

Activity 2:

In groups or 4 or 5 students will design, build and test a miniature building using their experience and knowledge from the first activity.

Both activities are provided in a separate document

Assessment:

None provided at this time

Additional Resources:

https://www.youtube.com/watch?v=bELc-hZ6nmE

Teacher Notes:

There are several suggestions for assisting students with limitations or disabilities.
Students with physical or visual impairments may struggle with using gum drops to connect toothpicks together. The following approaches could be used to help make this activity more accessible:

- Instead of toothpicks and gumdrops, use k'nex, legos or erector set pieces so triangular and square structures can be built and tested (See Tools E8,K1,L1 in Tools Table in Appendix).
- Instead of toothpicks and gumdrops, which might be too small for some students to easily handle, use popsicle sticks/craft sticks and connect them together with double sided tape (See Tools A1,C5 in Tools Table in Appendix).

Safety:

N/A

STEM Careers:

Structural Engineer
Civil Engineer
Mechanical Engineer
Physicist
Materials Scientist
Mechanical Engineering Technologists
Marine Engineers and Naval Architects
Industrial Engineer
Health and Safety Engineers
Engineering Managers

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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
NGSS - (SEP) Science and Engineering Practices	**SEP 2 – Developing and Using Models** • Develop a model to describe unobservable mechanisms. **MS SEP 8 - Obtaining, Evaluating, and Communicating Information** • Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence.

	HS SEP 3 – Planning and Carrying out an investigation • Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

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)