

BUILDING GREAT STRUCTURES

A STEM activity guide
provided by SDAN



Straw Towers to the Moon

Activity Description: Students use the engineering design process to research and evaluate the best tower designs based on the constraints of the challenge. Students act as civil engineers to build the highest tower possible with the materials and tools available to them.

Time: 3 hours for complete lesson or 1 hour for Design Challenge

Grade: K - 5

Introduction Video: [Straw Towers to the Moon - YouTube](#)

Lesson URL: [Straw Towers to the Moon - Activity - TeachEngineering](#)

Materials Needed:

For Each Group

- 50 non-bendable drinking straws
- 2 meters masking tape
- Scissors

For Entire Class

- Measuring Tape
- Timer or Clock

Handouts are included within the Lesson URL



This activity aligns with the following South Dakota Science Standards:

2-PS1-2 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.* (SEP: 4; DCI: PS1.A; CCC: Cause/Effect, Technology)

Next Gen Science Standards:

K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. (Grades K - 2)

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. (Grades 3 - 5)

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. (Grades 3 - 5)

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Extensions:

- Many variations of this design challenge exist. Consider trying a variation such as one which uses spaghetti and marshmallows as materials. Discuss the limitations and advantages of using different materials.

The Squeeze is On - Design Challenge

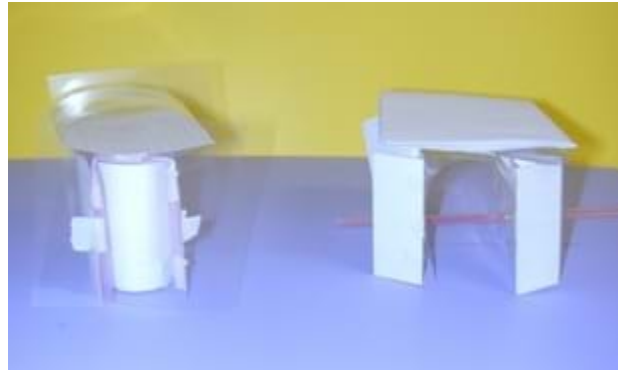
Activity Description: Students act as civil engineers in this design challenge. Using common materials they create a building that has maximum load bearing capacity. To do so students explore concepts such as compressive forces and weight distribution as they complete their model structures.

Time: 1 - 2 hours (Suggestion: Introduce and begin build on day 1. Test and redesign on day 2.)

Grade: 3 - 8

Introduction Video: [Tension and Compression Forces in Buildings. - YouTube](#)

Lesson URL: [The Squeeze Is On - Informal Learning Activity - TeachEngineering](#)



Materials Needed:

Each group needs:

- 10 3" x 5" (7.6 cm x 12.7 cm) index cards
- 1 sheet of paper
- 1 transparency sheet
- 12" (30.5 cm) masking tape
- 15 toothpicks
- 2 straws
- ruler
- scissors

For the class to share:

- 5 hard-covered text books to use as weight
- 1 wooden board, ~12" x 8" (30.5 cm x 20.3 cm)

This activity aligns with the following South Dakota Science Standards:

3-PS2-1 Plan and carry out an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. (SEP: 3; DCI: PS2.A, PS2.B; CCC: Cause/Effect)

4-PS3-4 Design, test, and refine a device that converts energy from one form to another.* (SEP: 6; DCI: PS3.B, PS3.D, ETS1.A ; CCC: Energy/Matter)

NGSS:

3-5-ETS1 -1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Extensions:

- Have students share their designs and their reasoning for placement of the vertical and horizontal components of the design. Discuss the strengths and weaknesses of the design in an effort to improve them.
- Instruct students that they will be creating a multi level building with the same constraints for each level (increase materials allowed but equal for each story of the building). Discuss how the compressive forces on the structure act differently when the building has multiple levels.

Building a Ski Jump

Activity Description: Students explore physics concepts such as trajectory, friction, and the effects of launch angle as they build a model ski jump. Design challenges related to this activity can extend the lesson and incorporate the engineering mindset.

Time: 1 - 2 Hours

Grade: 3 - 8

Introduction Video: [Science of the Winter Olympics - Ski Jumping - YouTube](#)

Lesson URL: [Balls and Tracks Activity \(ed.gov\)](#)



Materials Needed:

For each team:

- 6 feet of foam insulation tubing (E.G. - one pool noodle)
- Glass Marbles
- 1 popsicle stick
- Masking tape and string
- Empty cans, such as coffee cans or baby formula containers
- Yardstick or measuring tape
- 1 empty cardboard box, such as a shoe box

For the site leader:

- Craft knife or similar tool for cutting foam insulation

This activity aligns with the following South Dakota Science Standards:

3-PS2-2 Make observations and/or measurements of an object's motion to provide evidence for how a pattern can be used to predict future motion. (SEP: 3; DCI: PS2.A; CCC: Patterns)

MS-PS2-2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. (SEP: 3; DCI: PS2.A; CCC: Stability/Change)

Extensions:

- Have students participate in a design challenge where teams of students compete to create model ski jumps that can:
 - Launch their marbles the highest

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- Launch their marbles the farthest
- Launch their marbles into a target (coffee can or similar container)

*Students should compare their models and discuss the factors that are most important to achieve the desired outcome