

# Marshmallow Towers

Grade Level: 3rd-8th grade

Duration: 30-50 minutes

Classification: Classroom, STEM Spark

Subject(s): Geometry, Physics, Statics

Categories (STEM): Engineering, Mathematics

Keywords: Design, Compression, Tension, Build, Support, Marshmallows

## Introduction

- Summary: Students will learn about the concepts of compression and tension and how they are applied in building
- Description: Work as a team to build the tallest standing tower out of marshmallows and spaghetti. For an additional challenge, students can compete to build the tower that will hold the most weight as well.

## Online Resource:

<https://www.common sense.org/education/lesson-plans/the-marshmallow-challenge>

## Materials

Materials	Quantity	Reusable?
Spaghetti*	15 per Group of 4	No
Mini Marshmallows*	10 per Group of 4	No
Yard Stick	1 per Classroom	Yes
Weights <ul style="list-style-type: none"><li>● Pennies &amp; a folder</li><li>● OR medium size book</li></ul>	1 per Classroom	Yes
Copy Paper	1 sheet per group of 4	No

\*If there are extra marshmallows and spaghetti leftover, you can let them try the activity again.

## Directions

- Divide students into groups of 4. Explain the rules of the competition:
  - You will have 15 minutes to complete this activity
  - **Do not** eat the marshmallows
  - Tower must be free standing
  - You don't get extra materials (even if you break your spaghetti!)
  - You can't use the spaghetti box when building
- Have students take a few minutes to discuss the design of their tower.
- Pass out 15 noodles and 10 marshmallows per group.
- When the time is up measure the towers.

## Activity Extension

- Have groups re-design and try for a second time
- Have students talk through what types of 2D and 3D shapes they have made within their towers. Have students practice drawing 3D shapes on paper.
- Test to see which tower can hold the most weight
- Compression/Tension Activity
  - Have students work in pairs to experience compression for themselves. Tell student pairs to stand face to face and gently press their palms together at about shoulder height (as in a "high five"). Then tell them to slowly lean into each other.
  - Next, have students experience tension. While standing and facing each other, have student pairs grab hands and gently lean away from each other.
  - Ask them to describe what they feel, where they feel it, and what they think is causing the feeling.

## Discussion Questions

- How did limited resources impact building a tower?
- What engineering factors are used to build a tower?
- What shapes have more structural integrity? (triangles are the strongest shape)
- What part of your design is most susceptible to destruction? What is the most stable?
- What would you change if you could re-build your tower?

## What is happening?

- Gravity (and the weights, if used) are acting down on the tower. The pasta noodles are bearing the weight to hold the tower up.
- Some noodles have more force acting on them than others, and may break if the weight is greater than the strength of the noodle. (This is why symmetry is important!)
- Noodles in a triangular shape are better able to distribute the force equally.

## Applications:

- Majors
  - General Engineering: Engineering process to design, develop, test and renovate
  - Physics: How gravity impacts the tower standing up
- Jobs
  - Civil Engineer – bridges and buildings
  - Construction Engineer
- Hobbies – Legos

