PASTA TOWER CHALLENGE

ENTRIES OPEN MARCH 14, 2019- JULY 11, 2019

BRAINSTORM & DESIGN LESSON

PASTA TOWER BRAINSTORM

It's brainstorm time! Explore the properties of spaghetti and marshmallows to supersize your free-standing tower.

FOR THE CLASSROOM

POSSIBLE APPROACH FOR THE CLASSROOM

LESSON LENGTH

10-15 MINUTES

OBJECTIVE

LEARN ABOUT THE PROPERTIES OF SPAGHETTI AND MARSHMALLOWS

MATERIALS

PEN, PAPER, SPAGHETTI AND MARSHMALLOWS

VOCABULARY:

- Brainstorm
- Static
- Dynamic
- Equilibrium
- Load

PROCEDURE

1) DOWNLOAD AND TEACH THE PASTA TOWER BRAINSTORM POWER POINT: We have provided a Future Engineers PPT. Feel free to customize it to suit your teaching needs.

2) ACTVITY ONE: BRAINSTORM

Put your students in groups. Give them a few pieces of pasta and a few marshmallows. Encourage them to manipulate (bend, squeeze, snap etc.) their materials while they brainstorm the following categories.

- Spaghetti Properties: What properties does pasta have that could be useful in your build? What makes it buckle, flex or snap? If you hold the spaghetti vertical, how does it deal with a load above it? If you place it horizontal, how does it deal with a load above it? How can you make it stronger?
- Marshmallow Properties: What properties do marshmallows have that could be useful in your build? Will you use your marshmallows as structural nodes? Do you want to split them? Mush them? Stretch them?

3) ACTVITY TWO: SKETCH YOUR PASTA TOWER (DESIGN)

Have your students use the information they gathered from the brainstorming session to sketch out a design of their pasta tower build. Remember to review the contest rules and design guidelines.

LESSON PLAN CONTINUED

PASTA TOWER BRAINSTORM

BACKGROUND INFORMATION

BRAINSTORM

Here are some basic rules to follow when conducting a brainstorm in the classroom with a small or whole group of students:

- There are no wrong answers
- Try to get as many ideas as possible
- Record all ideas
- Do not express your evaluation on any idea presented

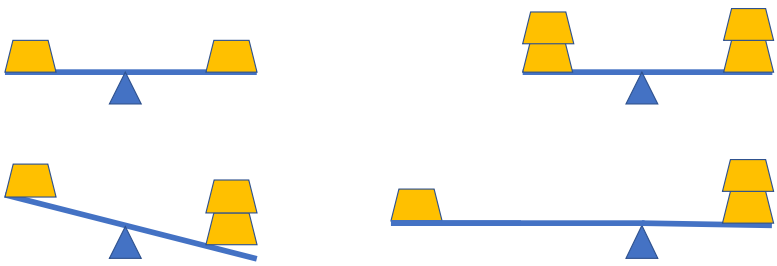
FORCES and LOAD

When building a structure, you need to think about the 'load' acting on the structure, which in this case is the structure's own weight due to gravity. For example, how will your tower support the load above it? How are the pieces of spaghetti positioned to best transfer and/or dissipate the load? How will you avoid having one section supporting too much load? How will you balance the forces to keep your structure from shifting or collapsing? These are the types of questions that structural engineers ask every day!

STATIC, DYNAMIC, and EQUILIBRIUM

When an object is moving, it is dynamic, which means the forces acting upon it are not balanced. A structure, on the other hand, is an object that is engineered to be static. It doesn't move because the forces acting on it are balanced, or in equilibrium. When the forces acting on a structure are balanced, the structure will remain at rest according to Newton's First Law. (This is a good thing because no one wants to be in a wobbly building.)

A great example of equilibrium and balanced forces is a see-saw. In the example below equal weight is applied at equal distances from the center of the see-saw, so the see-saw is balanced. If we double the weight on one side of the see-saw, it will move because the forces are unbalanced. To balance the system, we can double the weight on the other side, OR keep the same weight and double the distance. Structural engineers make lots of design decisions like these to make sure forces are balanced so that the structure is static or stable and doesn't move.



LESSON PLAN CONTINUED

PASTA TOWER BRAINSTORM

ADDITIONAL TEACHING RESOURCES:

- What is Structural Engineering? https://www.youtube.com/watch?v=oqpp8L4J4ek

NEXT GENERATION SCIENCE STANDARDS

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.

MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

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.

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.

MS-PS2-2 Motion & Stability: Plan an investigation to provide evidence that the change of an object's motion depends on the sum of the forces on the object and the mass of the object. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.]

BRAINSTORM WORKSHEET

WHAT WILL YOU BUILD?

It's brainstorm time! Explore the properties of spaghetti and marshmallows to supersize your free-standing tower.

Brainstorming Categories:

Below are two brainstorming topics to dive into.

SPAGHETTI PROPERTIES

What properties does pasta have that could be useful in your build? What makes it buckle, flex or snap? If you hold the spaghetti vertical, how does it deal with a load above it? If you place it horizontal, how does it deal with a load above it? How can you make it stronger?

MINI MARSHMALLOW PROPERTIES

What properties do marshmallows have that could be useful in your build? Will you use your marshmallows as structural nodes? Do you want to split them? Mush them? Stretch them?

Sketch Your Design:

Use the space below to sketch a design of your pasta tower.