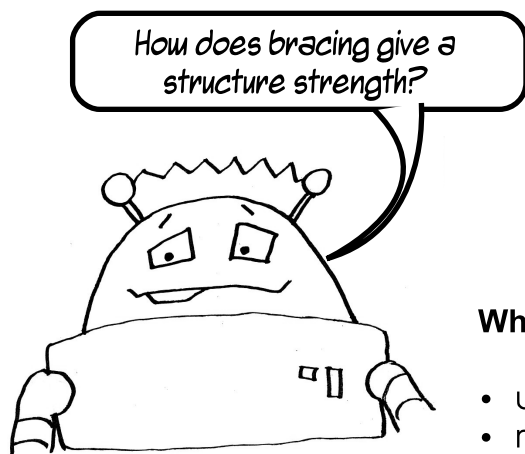




AN EXPERIMENT ABOUT ENGINEERING

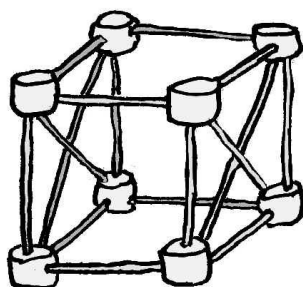
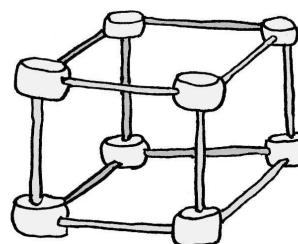
DIAGONAL BRACING

What you will need:

- uncooked dry spaghetti
- marshmallows
- books

What you will do:

1. Build a cube by joining half lengths of spaghetti to marshmallows as shown in the picture. Just push the ends of the spaghetti into the marshmallows, but be careful - the spaghetti snaps easily!
2. Test it's stability - can you collapse the cube? How difficult is it?
3. Now apply diagonal bracing to two sides, making sure the sides are opposite each other, as in the picture. You will need to break the spaghetti at about 2/3 it's length.
4. Test it again - push it in both directions: from the front and from the side. How strong is it? Is there a difference between the two?
5. Now put diagonal bracing on the front and back. Test it again. Has it improved?
6. Test the cube's strength by placing books on top of it. How many books can it hold?



What should happen:

Strong materials make strong buildings, but there is still a limit to what you can build relying on the strength of the materials alone. Some of the most amazing engineering discoveries have been about ways to use materials to increase their strength. Some shapes are stronger than others and you should discover that diagonal bracing is one of the simplest methods for increasing the strength and stability of a structure.

Monster Challenges:

- Build a tower as tall as you can by adding extra cubes with diagonal bracing to the top of the one before. Then test it's strength.
- How could you modify your structure to make it even stronger?
- Try building other shapes, for example pyramids. Can you join them together? What other shapes can you make?
- Do some research into the invention of skyscrapers. What was the engineering discovery that allowed them to be built?

TEACHING NOTES:

Monster Sciences Experiment: Engineering EN05

Key Concepts:

- Some shapes are stronger than others

Resources:

- Experiment description Engineering EN05 - one copy per student.
- uncooked dry spaghetti, marshmallows, books

Lesson Notes:

Begin the lesson by reviewing the experiment process with the students. Students can work individually or in small groups.

At the conclusion of the lesson I bring the class back together to discuss their discoveries and to allow students to show any Monster Challenges they have completed.

What should happen in this experiment and why?

This is a great hands-on lesson that involves building and testing and enables students to draw their own conclusions about how the diagonal bracing improves the strength and stability of their structure.