

BREAK A BEAM

Video to support this activity: https://youtu.be/hi5jl2QH_KQ

Materials Science and Engineering is a fascinating field in which scientists and engineers study the materials that things are made of, and learn how to use them for various applications. Things like making car batteries more energy efficient, making things last longer or more easily recyclable.

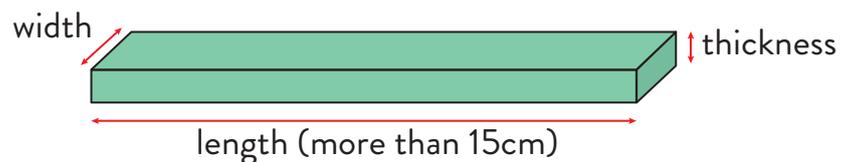
One of the ways that scientists test materials is to break them using a bend test. In this experiment you will make a beam out of a material and try to break it. The first attempt will be known as the **reference beam**. After this first beam we want you to create two further beams with the aim of at least one beam breaking and one beam not breaking when the same weight is applied. This will show you how important the design of your beam is in terms of how much weight it can support.

You can then repeat the steps in this worksheet by changing the material that you use to find out which material is the strongest.

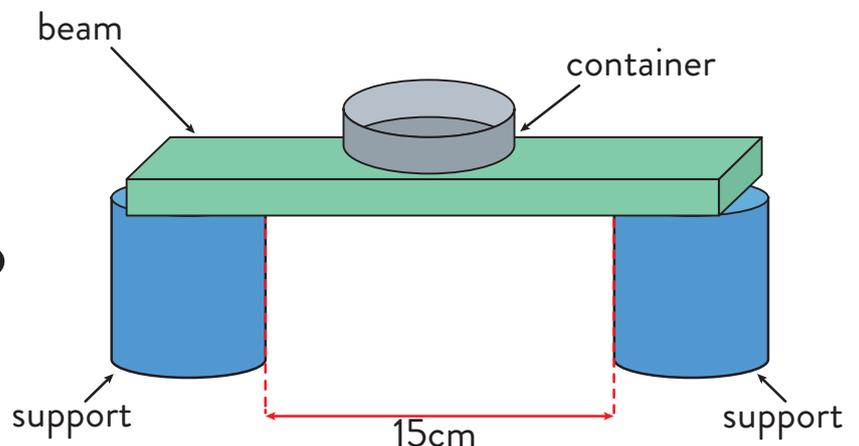
YOU WILL NEED:

- Kitchen Scales
- A plastic cup or container
- Weights to add into the cup (such as coins or pebbles)
- Two supports of the same height (food cans work well)
- Something to make the beam out of (e.g. Spaghetti, Lego bricks)

BEAM DESIGN



BEND TEST SET UP





Design and make your first beam (reference beam)

Design a beam to make a bridge between two supports, it must be more than 15 cm long.

Think about what materials you will make the beam out of, the number of layers of material and both the width and thickness of the beam.

Material used (e.g. spaghetti)	
Number of layers	
Width of beam (cm)	
Thickness of beam (cm)	

Draw a diagram or photograph your beam design

Make your beam

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Testing

Place two objects of the same height (food cans are great) 15 cm apart and place your beam on both supports to form a bridge.

Place a container and place in the middle of the beam and gradually place more and more things into it (coins and small pebbles work well) into it until the beam breaks.

Weigh your container and everything that was in it to make the beam break.

Then calculate the force (units: N) required to break your beam by multiplying the mass that broke the beam (units; kg) by 9.8 (which is the force per unit mass exerted by gravity).



Did your beam break?

If Yes	Reference beam supported _____g before it broke	The force required to break reference beam was: _____N
If No	The maximum mass that the beam supported was _____g	

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Beam redesign

The reason that we test materials to destruction is to find out how much force it takes to break a sample (in this case a beam). We then redesign the sample and retest to find out if our new design can withstand more force than the first sample or not.



Think about how you might design two new beams, only changing one variable (a variable is something you can change about your design for example the thickness of your beam). This will help you to understand how important that particular variable is in terms of the strength of the beam.

Design two more beams made from the same materials as the reference. Try to design one that will break and one that will not break.

Beam 2		Beam 3	
Number of layers		Number of layers	
Width of beam (cm)		Width of beam (cm)	
Thickness of beam (cm)		Thickness of beam (cm)	

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Retest

Test your beams using the same method that you used for the reference beam (see Step 2) and try to slowly add mass until the same mass

Did beam 2 break?

If Yes	Beam 2 supported _____g before it broke	The force required to break Beam 2 was: _____N
If No	The maximum mass that the beam supported was _____g	

Did beam 3 break?

If Yes	Beam 3 supported _____g before it broke	The force required to break Beam 3 was: _____N
If No	The maximum mass that the beam supported was _____g	

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Results and discussion

Summarise the force required to break your beam or the maximum mass your beam did not break

Material used:					
	Thickness	Width	Number of layers	Did it break?	What force did it take to break the beam?
Reference beam					
Beam 2					
Beam 3					



What did you find had the most influence on the strength of your beam?



Repeat the experiment using different material but the same beam design. You could change number of layers or beam dimensions.

Share your findings

It would be great if you could share photos / videos of your beams and how much weight they could hold by the following ways:

Twitter: @DiscoverMaterials #DiscoMaterBeam

Please post your results on Padlet where see what other people have done:

<https://padlet.com/DiscoverMaterials/nsszy5ckgv6h57sg>

