



Young's modulus worksheet

The Young's modulus is a property of a material that determines how much an object made from this material will compress or stretch in response to applied forces. For a block of material, the **stress** (force per unit area) applied is proportional to the **strain** (fractional change in length), and the Young's modulus is the proportionality constant:

$$(F/A) = Y (\Delta L/L)$$

To get familiar with this, you will now measure the Young's modulus of a marshmallow.

You have: a marshmallow, empty styrofoam cups, a cup with 100ml of water, and a ruler (above).

1) Design an experiment to measure Y: describe what you will do and what you will measure:

2) Write a formula for the Young's modulus in terms of the quantities you are going to measure. Don't plug in numbers yet.

3) Write your measurement results below. We're just going for an order of magnitude here, so they don't have to be super-accurate. If it's within 25%, that's fine.

4) Calculate Y using your formula from question 2.

5) Do you expect that this is larger or smaller than the Young's modulus for steel?

6) Suppose we did the same experiment, but with two marshmallows placed side by side, and a bigger cup with twice as much water. Which quantities in your formula from question 2 would change? Would your Young's modulus be the same or different?

7) Now suppose we did the experiment with two marshmallows placed on top of one another, with the original amount of water. Compared to the original experiment, which quantities in your formula from question 2 would change? Would your Young's modulus be the same or different as for the single marshmallow?

8) Compared to a regular marshmallow, would you expect that the Young's modulus for a mini-marshmallow to be significantly larger, significantly smaller, or about the same? Why?