Activity 1: Squashing sweets

In this activity, students investigate the change in height of a marshmallow under different loads.

Credit: IOP

Equipment:

Each group of four students will need:

- Copy of experiment role cards (see page 12)
- Scissors
- A marshmallow (giant ones work best – note that vegan options are available, and may be more appropriate for your class)
- Two plastic drinks cups (ideally transparent)
- Six 100 g masses
- Ruler

Procedure

To develop experimental planning skills, you could ask students to plan the investigation from scratch. Alternatively, provide partial or complete instructions, such as the ones below.

1. Cut out role cards, place them face down, shuffle and pick one each.
2. Place the marshmallow inside a plastic cup and then place the second cup inside the first, resting on the marshmallow.
3. Measure the distance between the rims of the two cups to find the initial height of the marshmallow in millimetres.
4. Add a mass to the second cup and then measure the new distance between the rims of the cups.
5. Repeat to collect data for different heights (mm) and masses added (g).
6. Calculate compression force (100 g is equivalent to 1 N) and change in height (original height – new height)
7. Plot a graph of compression force against change in height and work out the gradient including its units.
8. Think-pair-share: Who would need to understand compression forces in their job?

Inclusive science teaching	Implementation
Give students opportunities to make links between their learning and their lives and interests	Compress objects that students will be familiar with (marshmallows). Think-pair-share STEM careers linked to compression forces
Enable all students to participate	Use role cards to assign responsibilities for practical work
Make time for maths	Discuss units for gradients of graphs
Build scientific vocabulary	Discuss other names that students may see online or in books for compression forces (reaction, support, normal contact or push off table/ground)

Teaching notes

Marshmallows deform plastically. They won't return to their original shape. If students want to repeat the investigation, provide fresh ones.

We used a giant marshmallow to get the results below. You may want to test your marshmallows to see if they also give (approximately) linear results. If not, reduce the number of masses you provide.

Mass added (g)	0	100	200	300	400	500	600
Height (mm)	50	48	46	44	42	40	38
Force (N)	0	1.0	2.0	3.0	4.0	5.0	6.0
Change in height (mm)	0	2	4	6	8	10	12

The gradient of a force against change in height graph has units of Newtons per millimetre (N/mm). Discuss the meaning of the word 'per'. The gradient tells us how many Newtons are needed for every millimetre change in height. It is a measure of the stiffness of a material.

Credit: Mecmesin

Careers info...

Compressing marshmallows to check their stiffness is part of a real-world quality control process. The machine in the picture enables engineers to test for texture (find out more at **textureanalyzers.com**). As well as 'sweet tester', other fields that may require an understanding of compression forces include vehicle safety, sports equipment manufacture and furniture design. Examples can be found at **neonfutures.org.uk/case-study**