

OCR A Physics A-Level

PAG 2.3

Investigating a property of plastic



Equipment

- Plastic bag
- Guillotine
- 100 g masses
- Holepunch
- Ruler
- Stand and clamp

Method

1. Using the guillotine slice the plastic bag both lengthways and widthways to test its properties in each plane (separate these sections so that they don't get muddled up).
2. Holepunch one end of each strip to create a hole to hang the masses from.
3. Attach the strip to a clamp stand and measure its original length (while taut) from where it is attached to the clamp stand to the hole where masses will be attached.
4. Attach a 100 g mass to the strip of plastic and measure its new length.
5. Repeat this process the above step, measuring the new length until you have taken at least 10 readings of extension for a given mass.
6. Apply this method to the other strips, recording whether they are width ways or length ways strips. For the strips that do not break, rather than beginning a new strip, remove the masses one by one recording the new length after each removal. This unloading will allow an unloading line to be plotted on the force-extension graph.

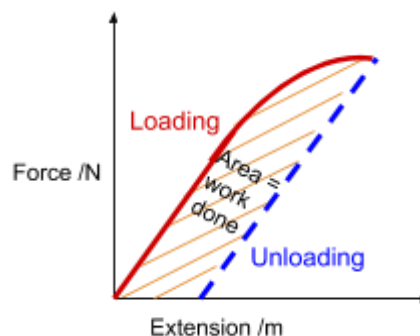
Calculations

- The table that the results are recorded in and calculations are carried out in, has the headers illustrated below.

Mass /kg	Force /N	Original Length /m	New Length /m	Extension /m
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Extension is found by the difference between the new length and original length. Force applied is calculated using the product of mass and g (acceleration due to gravity).

- Plot a graph of force against extension. This graph will show properties of the plastic, for instance:
 - **Limit of proportionality** - the point after which Hooke's law is no longer obeyed (force is no longer proportional to extension)
 - **Elastic limit** - if you increase the force applied beyond this, the material will deform plastically (be permanently stretched).
 - Breaking stress is the value of stress at which the material will break apart, this value will depend on the conditions of the material e.g its temperature.
 - The area between the loading and unloading line represents the work done to permanently deform the material



Notes

- Using a holepunch means the force isn't evenly distributed through the strip but concentrated by the hole - using a bulldog clip wound around the bag allows more even distribution of the weight of the masses.
- Using a computer and spreadsheet software for the table can save time as extension and force can be calculated immediately and without error.
- Read the ruler at eye level to avoid parallax error.

Safety

- Cushion the floor below the masses and be wary of them falling.
- Be careful when using the guillotine.

