STRESS AND STRAIN

Purpose

To show the relationship of stress and strain.

Stress is the force acting on a unit area of a rock and strain is the amount of deformation that the stress causes as a proportion of the original size. In this experiment we shall use sponge because rocks need very high pressures to deform them. The sponge acts like a rock which is confined so that it cannot spread sideways.

Geological Relevance

It is important to be able to estimate the amount of compression that the rocks under large buildings such as dams will undergo. Knowing the amount of strain rocks show geologists can calculate how deeply they have been buried or how much tectonic pressure they were subjected to.

Instructions

1. ***Choose one of the sponges and measure its thickness t_0***

2. ***Remove the pan from the scales and put the larger piece of plywood on top.***

3. ***Place the other plywood pieces on the top and bottom of the sponge and then place the sponge and the plywood pieces onto the balance.***

4. ***Set the scales to zero.***

5. ***Press down lightly on the top piece of wood so that the sponge is compressed equally all over and the scale reads 1kg.***

6. ***Record the reading on the balance, 1kg, this is the force you are exerting on the sponge. This is the same as the stress if the area of the sponge is taken as one unit. At the same time use the ruler to measure the new thickness of the sponge t_1.***

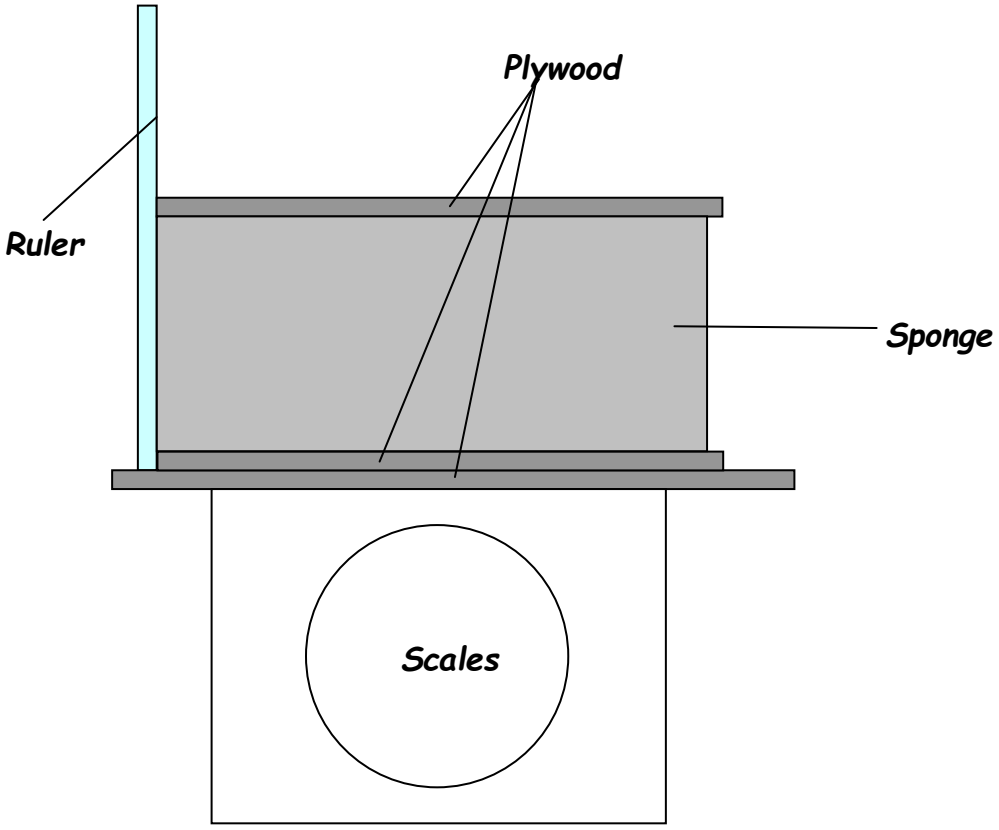
7. ***Increase the force to 2kg and again record the thickness.***

8. *Repeat these instructions until you have measurements for 5 different forces.*

9. *Now choose a different sponge and repeat the instructions.*

10. *For each reading calculate the strain* $(t_0 - t_1)/t_0$.

11. *Plot stress against strain.*



Teacher's Section

Requirements

Pieces of different types of sponge each about 5 cm by 10cm by 10cm.
Kitchen scales or any scales or balance reading up to about 5kg.
2 pieces of plywood 10cm by 10cm and one piece slightly larger say 11cm by 11cm.
Ruler whose length below zero is equal to the thickness of the plywood.

Sponges can be bought in chemists and cut to size using a hot wire or can be obtained from the specialist companies who supply sponge for furniture.

Notes

This can be done with weights on top instead of scales but it is difficult to get the pressure even all round and so the sponge varies in thickness.

Checks

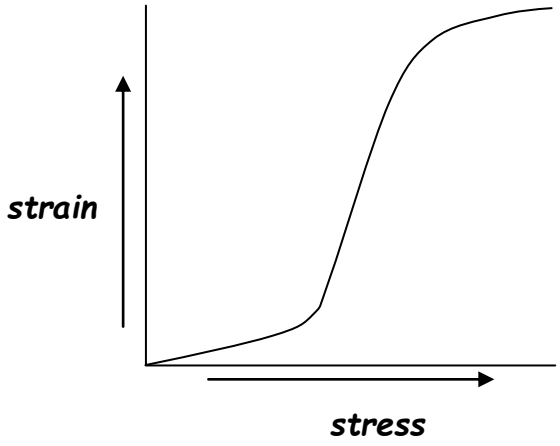
Make sure the students are pressing evenly so that the sponge is the same thickness all round.

Time

15 minutes for 2 sponges

Results

Ideally each sponge should give a sigmoidal curve but you may only get part of it. This is because sponge, like rock is not a truly elastic material.



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