'Let's get Practical'
– How Science Works

OCR

Stress and Strain

Apparatus

Retort stand and clamp
A selection of rubber bands
Aqueous bromine
1N weights
Metre ruler

Gateway Science Suite Chem C2 *[Chemical Resources] testing for flexibility and strength*

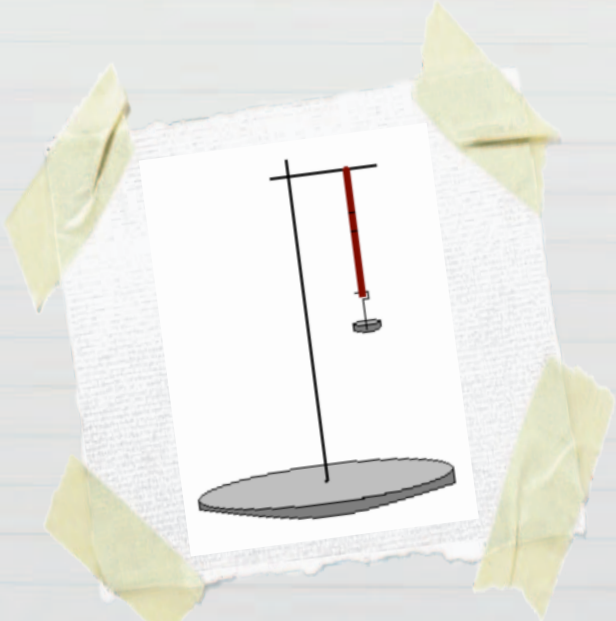
Twenty First Century Science Suite C2 *[material choices] particularly C2.1*

Gateway Science Suite Chem C6g *contains references to use of bromine water to test for unsaturation in fats and oils*

Stretching rubber bands

Your task is to find out how the stretching of a rubber band depends on the soaking time in bromine water.

You will be using rubber bands, weights and a metre ruler, and dilute aqueous bromine.



Procedure Part 1:

1 Select a rubber band. Make two marks on the band, one close to each end.

2 Hang the rubber band from a clamp. Attach a 1 N weight holder at the lower end so that the band hangs vertically.

3 Measure the distance between the two marks.

4 Increase the load in 1 N steps. Measure the new distance between the two marks.

5 Calculate the extension of the band (the increase in the distance between the two marks).

6 Plot the data: stress [or extension] on the y axis and strain [or load] on the x axis. Is the graph linear?

Procedure Part 2:

1 Select an identical rubber band to that used in part 1, and place it in a boiling tube containing bromine water so that the whole band is immersed. Place a bung in the tube and store it in the fume cupboard over-night.

2 After soaking, was there any difference to the appearance of the bromine water?

3 Remove the band and rinse it under the tap. Was there any difference in texture or feel to the band?

4 Repeat part 1 with the soaked band.

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Extensions and questions

1 Repeat the experiment once again with the same band. Is the graph the same shape as the first?

2 Record the stretching of the rubber band and then record the shrinking of the band as the weights are removed from the hook. Plot both sets of data on the same axis. What do you notice?

3 Leave a band under tension over night or until the next lesson. Remove the weights and then repeat the original extension experiment, plotting data as before. Does the band behave in the same way as before?

4 Suspend a new band and load it with weights to give about a third of the maximum extension and then heat the rubber with a hair-dryer. What was noted?

5 Fishermen often use nylon lines marked with different breaking loads. Investigate the load bearing capacity of rubber bands as a function of unstressed cross-sectional area.