

The Effect of Temperature on the Elasticity of Rubber Bands

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Research Question: Does temperature affect the elasticity of rubber bands?

Objectives: To investigate if there is an effect of temperature on the elasticity of rubber bands, by measuring the maximum stretch lengths of rubber bands before and after different temperature treatments. This study aims to find the optimal temperature for achieving desired levels of elasticity for rubber bands. The results of this study will have many practical applications in fields such as engineering, material sciences, biomechanics, physics, and much much more.

Research Design:

Explanatory Variable - Temperature at 2 levels: left in the freezer for an hour or room temperature for an hour.

Treatments - cold (freezer), control (room)

Response Variable - Difference in the maximum stretch length before and after treatment is applied, measured in millimeters.

Observations - The experimental unit is 1 rubber band. The number of replicates is 25 per treatment making for a total n of 50.

Materials and Tools/Inclusion Criteria:

50 Alliance Rubber 26649 Advantage Rubber Bands. These rubber bands should all be new and unused. Should also have a standard freezer set at around 0° F and room temperature should be set to around 70° F.

Steps:

1. Get your 50 Alliance Rubber 26649 Advantage Rubber Bands.

2. Write a number 1-50 on 50 small pieces of paper. Evens will be assigned to the freezer and odds will be assigned to the control. Flip the papers over and randomly assign them to each rubber band. Mark the rubber band with its number.
3. Stretch the rubber bands over a large piece of paper. Using a pen mark the starting point, stretch the rubber band fully, and mark the furthest point reached by the fully stretched rubber band. (May need two people) I define a fully stretched rubber band as a rubber band that is stretched until I cannot comfortably stretch the rubber band any notable amount.
4. Using the measure app on your phone, measure the distance between the two points in millimeters. The measure app works by using your camera and measuring the distances between two points of your choosing.
5. Repeat steps 2 and 3 for each of the 50 rubber bands, recording the maximum length reached for that numbered rubber band.
6. Apply each treatment for all 50 rubber bands, leaving 25 at room temperature for the control group and putting the other 25 rubber bands in the freezer for the cold group.
7. Set a timer for an hour.
8. After 1 hour, repeat steps 2 and 3 once again and record the final maximum length reached. Due to the time that it takes to measure the rubber bands and the fact that the temperature might be lost, keep the individual cold rubber bands in the freezer until it is time to measure each one.
9. Calculate the difference in millimeters between the final maximum stretched length and the initial length. (final - initial)

Notes:

The measure app does not necessarily have to be used. If the researcher owns a ruler, meter stick, or some other sort of measuring device, they can use that instead. I chose to use 50 rubber bands as I feel 25 replicates will be a sufficient amount to find any statistical significance if it exists.

The statistical analysis method I plan on using for finding statistical significance is a t-test. Some limitations of this study include: 1) can only be generalized to Alliance Rubber 26649 Advantage Rubber Bands. 2) temperature values will not be directly measured, possibly leading to increased unexplained variation and decreased reproducibility. 3) Maximum stretch is dependent on the opinion/strength of the researcher.