Lesson

Do Materials Get Tired? Do Rubber Bands Get Longer During Use?

Suggested Grade Level

9-12

Run Time

Approximately 60 - 90 minutes; spread out over the course of 2 days

PDE Standards

- 3.1.12 C: Assess and apply recurring patterns in science and technology
- 3.6.10 C: Apply physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research and design to real world problems
- 3.8.10 B: Analyze how human ingenuity and technological resources satisfy specific human needs and improve the quality of life.

Content Objectives

1. Students will conduct an experiment mimicking a creep test.
2. Students will determine the strain on a rubber band.
3. Students will infer reasons for the quantitative strain values for various rubber band and forces applied.

Process Objectives

1. Students will calculate the strain on various rubber bands with various forces applied.
2. Students will compare the strain on various rubber bands with various forces applied.

Assessment Strategies

1. Completion of the “Do Materials Get Tired-Do Rubber Bands Get Longer During Use?” Lab

Materials

- Computer with Internet access
- Video clips (online)
    1. "Do Materials Get Tired? Introduction" (2 minutes 21 seconds)
    2. "Do Materials Get Tired? Creep" (1 minute 21 sec)
- Two sizes of rubber bands (2 of each)
- A hook or nail attached to a wall (i.e. a coat hook or wall tack)
- A set of mass objects of known mass
- A metric ruler

Procedure

DAY 1 (20 – 25 minutes):

1. Students should view the video clip "Do Materials Get Tired? Introduction" (2 minutes 21 seconds) (if they have not viewed it already) and the video clip "Do Materials Get Tired? Creep" (1 minute 21 sec).
2. Teacher should lead a discussion on how to test the creep of various objects. What are some products students would want to make sure were tested for fatigue via creep? Have any students ever had a product just suddenly break due to the creep of the object?
3. Teacher should inform the students that they will test the creep of rubber bands.
4. Students should create the three hypotheses listed in the lab.
5. Students should collect the initial data. This can be done with groups of students testing just one variable (two groups can test the same rubber band, but each group would change the force applied) and then share the data between the groups, or each group can test all of the variables including type of rubber band and force applied.
6. Students should also add the larger weight and measure the new length of the rubber band.
7. The band should then be left hanging with the larger weight for at least 24 hours. If the length of the rubber band can be recorded throughout the 24 hours time period, data would yield more accurate results.

DAY 2 (45 – 60 minutes):

1. Students should calculate the strain (ε) for each set of data recorded.
2. Students should graph the number of amount of creep (strain ε) vs the number of hours left hanging. Multiple graphs may need to be completed, one for each type of rubber band or force applied.
3. Students should complete the analysis questions.
4. Teacher should readdress the discussion around various objects that may have failed under strain forces. Teacher should also discuss the various careers in which the experiment pertains and the importance of such careers to society and today's lifestyles.

Extension

1. Groups of students can test only one type of rubber band. After the tests have been conducted, the various data can be recorded and averaged.

2. Some of the rubber bands can be frozen and same experiment conducted. This can show how changes in temperature can affect the strength of materials.