

Lesson

Breaking Things on Purpose

Suggested Grade Level

9-12

Run Time

Approximately 45-50 minutes

PDE Standards

- 3.1.10 B: Describe concepts of models as a way to predict and understand science and technology
- 3.1.10 C: Apply patterns as repeated processes or recurring elements in science and technology
- 3.1.10 E: Describe patterns of change in nature, physical and man made systems
- 3.2.10 B: Apply process knowledge and organize scientific and technological phenomena in varied ways
- 3.2.10 C: Apply the elements of scientific inquiry to solve problems
- 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
- 3.7.10 B: Apply appropriate instruments and apparatus to examine a variety of objects and processes

Content Objectives

1. Students will determine the amount of stress required to break various candy bars.
2. Students will examine how a various substances break and infer a cause for the type of break.
3. Students will relate the candy bar experiment to the importance of nanotech laboratory work and how it is commercially and economically beneficial.

Process Objectives

1. Students will predict the required stress to break a candy bar.
2. Students will compare the amount stress required to break various candy bars.
3. Students will determine the amount of stress required to break various candy bars.

Assessment Strategies

1. Completion of the “Breaking Stuff: lab

Materials

- Video clips
 1. "Bend Twist & Break, the Bridge"
 2. "Bend Twist & Break, Breaking Glass"
 3. "Bend Twist & Break, Fracture Surfaces"
- Computer with Internet access
- 4 different Hershey's chocolate bars, for example:
 1. Regular milk chocolate (1.55 oz.)
 2. Dark chocolate (1.45 oz.)
 3. Hershey's Mr. Goodbar (1.75 oz.)
 4. Nestle Crunch bar (1.55 oz.)
- Plastic or Styrofoam cups (12 oz size)
- Pennies (approximately 350 per group)
- String/twine
- Scissors
- Ruler or tape measure.
- Two desks that can be placed approximately 3 – 4 inches apart (approximately the length of the chocolate bars)
- Mass balance

Procedure

PART 1:

1. Students should view video clip "Bend Twist & Break, the Bridge".
2. Teacher should ask some of the students about a device that broke and they were not expecting it. The teacher can also discuss molecular frequency of objects and how matching the frequency can cause the object to break (such as a singer shattering a wine glass, or the wind effects on the Tacoma Narrows Bridge).

PART 2:

1. Students should view video clip "Bend Twist & Break, Breaking Glass".
2. Students should complete the laboratory activity

Extension

1. Students can watch video clip "Bend Twist & Break, Fracture Surfaces" and discuss various mechanical experimental designs that would test different physical properties of the chocolate bars.
2. Using the Virtual Microscope (<http://virtual.itg.uiuc.edu/>), students can view the candy bar samples under an electron microscope.
3. Students can compare results and average the data.
4. Some of the candy bars can be frozen and the same experiment conducted. One major source of error here would be heating of the bar while the experiment is being conducted.

