

## Breaking Strength Lab

### Teacher's Guide

**Topic:**

Newton's Laws of Motion

**The following information is provided to the student:**

**Question:**

What is the breaking strength of a light string?

**Purpose:**

To determine the breaking strength of a light string.

A complete lab write-up includes a Title, a Purpose, a Data section, a Conclusion/Discussion of Results. The Data section should include a diagram of your experimental setup and the data for a collection of trials. Trials should be repeated to insure precise results. Observational notes regarding the rate at which the string was pulled should be included with each trial. An average breaking strength value should be reported. The Conclusion/Discussion should respond (as always) to the question raised in the Purpose. Any important information pertinent to your determined value and the manner in which your study was conducted should be discussed.

**Materials Required:**

Spring scale or computer-interfaced force probe; spool of light string or thread.

**Description of Procedure:**

Students obtain several 30-cm (about) lengths of the string. They tie a loop in one of the ends and attach it to the hook of the force scale or force probe. They pull on the other end of the string with a gradually increasing force until it breaks. They record the force at which the string breaks. Trials are repeated to insure accurate results.

**Alternative Materials and Procedure:**

The main role of this lab is to determine the breaking strength of the string so that it can be used in a later lab (VF4-Maximum Load Lab). Otherwise, there is nothing intrinsically interesting about the lab. The lab could easily be postponed until the Maximum Load Lab is performed.

**Safety Concern:**

There is always a higher than usual level of risk associated with working in a science lab. Teachers should be aware of this and take the necessary precautions to insure that the working environment is as safe as possible. Student *horseplay* and off-task behaviors should not be tolerated.

**Suggestions, Precautions, Notes:**

1. The value of the breaking strength of the string will be used in a later lab in the Vectors and Forces unit – VF4-Maximum Load Lab. Be sure to set the role of string aside for later use.
2. Because the value of breaking strength will be used in a later lab, it is important to have an accurate value. It is advisable to pool class results and compute an average value. Demonstrating

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the process of analyzing the data (tossing outliers and conducting an average) is useful; it is a process that students should have an opportunity to observe and even participate in.

3. Use string which breaks at a force value which falls within the range of force values which the measuring tool is capable of measuring.
4. The use of a computer-interfaced force probe provides the most accurate readings. The force applied to the string will drop dramatically the moment the string breaks. The maximum value read from the software is the breaking strength.
5. Students will need to know what is meant by the term **breaking strength**. Here, breaking strength refers to the amount of force which can be applied to a string before it breaks.

### Auxiliary Materials:

None

### Scoring Rubric:

<b>NL10. Breaking Strength Lab</b>	<b>Score</b>
— Included, labeled and organized all parts of the lab report. — Data section includes an informative and labeled diagram. Measured data (with units) are stated clearly. Observational notes are included to provide insight into any irregularities in the data. Disregarded trials are noted and an average value is calculated. Results appear reliable based on precision. — Conclusion/Discussion provides an answer to the question posed in the Purpose and discusses details related to the study and the task of achieving reliable results.	____/____

### Connections to The Physics Classroom Tutorial:

The following readings are a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/Class/newtlaws/u2l1d.cfm>

<http://www.physicsclassroom.com/Class/newtlaws/u2l2b.cfm>

### Connections to Minds on Physics Internet Modules:

This lab is not ideally coordinated with any of the sublevels of the Minds On Physics Internet Modules.