

It's a Breeze Lab

Teacher's Guide

Topic:

Vectors and Forces

The following information is provided to the student:

Question:

What is the mathematical relationship between the effective force exerted by a fan upon a fan cart and the angle between the fan cart and the fan's blowing direction?

Purpose:

To determine the mathematical relationship between the effective force exerted by a fan upon a fan cart and the angle between the fan cart and the fan's blowing direction.

A complete lab write-up includes a Title, a Purpose, a Data section, a Conclusion and a Discussion of Results. The Data section should include a diagram of the experimental setup with the angle θ clearly defined on the diagram. Collected data should be organized using a table format. Calculations or a graph or some other method of data analysis should be used to determine the mathematical equation; the method of analysis should be documented. The Conclusion should respond to the question raised in the Purpose. The Discussion of Results should explain the logic which leads from the data to the conclusion.

Materials Required:

Fan cart; track; computer interfaced force probe.

Description of Procedure:

A fan cart is placed on a track or table and turned on. The force probe is used to determine the force required to hold the fan cart at rest. Measurements are repeated for various angles. The data are analyzed to determine a relationship between the force and the angle which the thrust air makes with the direction which the cart is pointed.

Alternative Materials and Procedure:

Alternative materials and procedures are not recommended.

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. A fan cart with an exposed blade can produce considerable damage (a large F_{hurt}) to a finger or any other body part placed in the path of the fan blade.

Suggestions, Precautions, Notes:

1. [Pasco Scientific](#) sells a Fan Cart (ME-9485) and a Super Fan Cart (ME-6977), both of which have the capability of adjusting the angle of the thrust.

The Laboratory

2. The rotating fan blades of many fan carts can cause damage. Exercise great caution with such fan carts (or avoid using them altogether).
3. The development of an equation from the data can be a difficult task for even the best students. Guidance may need to be given or the entire process can be demonstrated as a useful lesson in data analysis.

Auxiliary Materials:

None

Scoring Rubric:

VF1. It's a Breeze Lab	Score
<p>___ Included, labeled and organized all parts of the lab report.</p> <p>___ Data section includes a diagram; the angle Q is defined. Force and Q measurements are recorded in a table format; units are identified. Analysis of the data is clearly documented (methods may vary); an equation is derived from the analysis. Data and associated equation are accurate.</p> <p>___ Conclusion answers the <i>question</i> posed in the Purpose.</p> <p>___ Discussion of Results explains the logic which leads from the data to the conclusion.</p>	___/___

Connections to The Physics Classroom Tutorial:

The following readings are a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/Class/vectors/u311d.cfm>

<http://www.physicsclassroom.com/Class/vectors/u313b.cfm>

Connections to Minds on Physics Internet Modules:

Sublevels 1 and 2 of the Forces in Two Dimensions module are a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/mop/module.cfm>