Physics 20

Equilibrium of Forces

Equilibrium happens when a set of vectors "cancel" each other out resulting in zero net force. In the case of forces several basic examples exist, such as a book resting on a table. In that situation you could say that the force of gravity and the normal force are in a state of equilibrium.

It is also correct to say that if one vector cancels out the effect of other vectors, that one vector is an ***equilibrant***. An equilibrant is the exact opposite of a resultant.

Purpose

The goal of this lab is to determine if a state of equilibrium that exists in a two dimensional force-vector system agrees with theoretical predictions.

Procedure & Equipment

You will be using three spring scales calibrated to show force in Newtons. You will be pulling them in three different directions while they are attached to each other, making a "Y" shape. You will be doing this over a sheet of paper so that you can draw vectors for each scale showing their directions and magnitudes of forces.

In your analysis you will take **two** of the vectors and determine (by calculating their total x and y components of force) what the equilibrant ***should*** be. You will then compare this to the ***actual*** x and y components of the **third** vector. You are hoping that the components will be the same. You must calculate a percent error for both the x and y components (two calculations).

Nota Bene

You will need to set up a reference line to be able to do your measurements from, This can be done by simply laying a metre stick across the page and drawing a line. Measure all your vectors angles from this reference line.

A spreadsheet can certainly be used for the analysis of this lab, but keep in mind that careful attention must be paid to how spreadsheets handle trig calculations (DEG vs RAD). If you choose to use a spreadsheet it must also be emailed with your lab.

Post-Lab Question

Why is performing two calculations for error possibly a problem for coming to a conclusion as to the overall error?