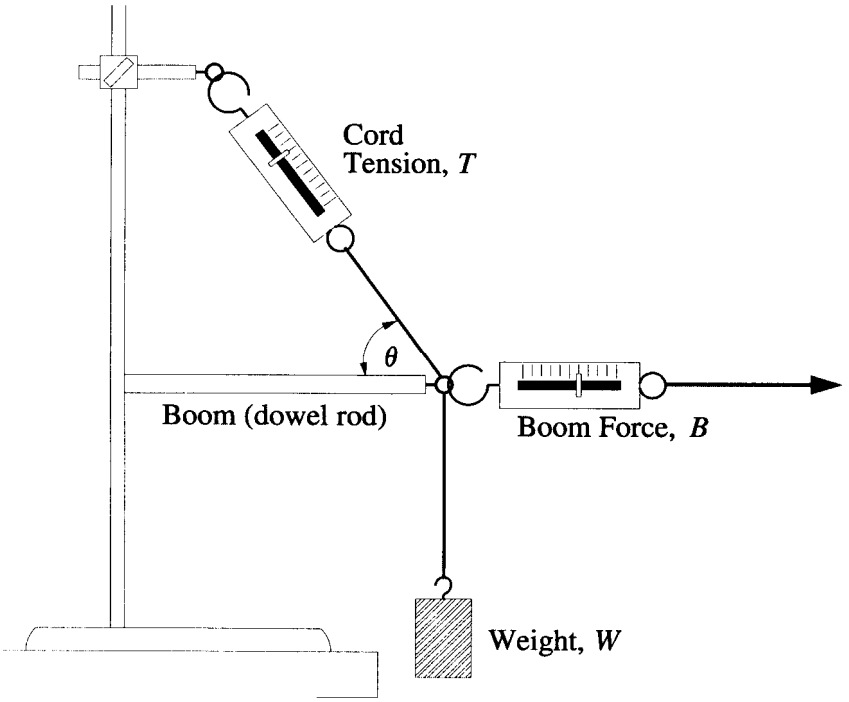
Name Section #

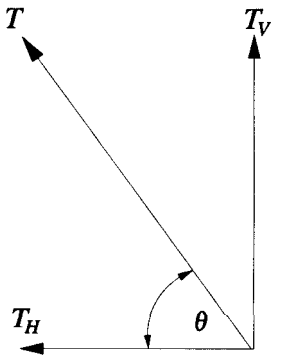
Determining the Components of a Force

Purpose

The last lab exercise demonstrated that two forces could be combined by vector addition to obtain a resultant force. In this experiment you will determine whether it is reasonable to resolve a single force into two mutually perpendicular components.

The diagram below shows a boom apparatus with a spring balance measuring the tension force T in the cord. This force will be resolved into a vertical component T_V, and horizontal component T_H. Notice that the ring at the end of the dowel rod is in equilibrium under the action of the three forces T, B (the boom's push), and W (the hanging weight). It would appear that the horizontal component of the cord's tension, T_H $(=T\cos\theta)$ should be equal and opposite to B, while its vertical component, T_V $(=T\sin\theta)$ provides the lift to offset W.





Procedure

Set up the boom as in the diagram above making sure that it is horizontal and then measure the angle θ it makes with the supporting cord. Hang a 500 gram mass ($W = 4.9$ N) from the right-hand end of the boom. While someone holds their finger a few millimeters below the middle of the dowel rod, have someone else pull horizontally on the spring balance measuring B. When the boom loses contact with the pole and rests on the person's finger, a third person should take readings of the spring scales indicating the value of the boom's force B, and the cord's tension T.

Enter the values for θ, T, B, and W along with the calculated values for the components of T in the table below. The horizontal and vertical components can be calculated as follows: $T_H = T \cos\theta$, and $T_V = T \sin\theta$. These should be compared with B and W, respectively, by determining the percent differences and entering them in the table.

Perform a second trial by substituting a 1 kilogram mass ($W = 9.8$ N) for the hanging weight. Afterwards, change the angle θ and perform a third trial with the 500 gram mass, and then, with the same new angle, a fourth trial with the 1 kilogram mass.

Questions

Data & Analysis of Force Resolution Experiment

Trial #	T (N)	θ (degrees)	T_V (N)	W (N)	Percent Difference	T_H (N)	B (N)	Percent Difference
1								
2								
3								
4								

- Based on your data, what conclusion do you arrive at?

- What problems in the design or execution of this experiment might lead to an erroneous conclusion?

- How has the weight of the boom been taken into account in this experiment?

- What happens to the tension T in the cord as angle θ is made smaller?