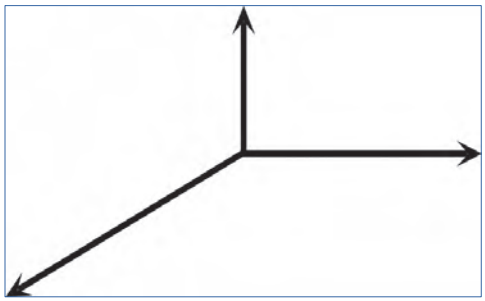
19380 Vector Board, Class Set



Purpose:
Three (or more) randomly placed force vectors in equilibrium are quickly analyzed and compared with theoretical
notions using this alternative to the usual force table or force board.

Procedure:
Select one set of materials from the bulk package. Position the Soft Board on a suitable work surface and set one sheet of white paper on it. The three springs are quite alike, but measure and record the length of each from hook to hook. Connect the three springs from a common place using the hooks already formed on the ends. These can be connected and disconnected without tools. Pushing the push pins through the paper and into the Soft Board, stake out the free ends of the springs in some interesting way. Try to make as large a figure as is convenient, so the springs are stretched a noticeable amount. Mark the paper where the three springs share a common point.

The force exerted by each spring is proportional to the amount by which it is stretched, and the three forces are in equilibrium. Any one force can be regarded as the equilibrant for the sum of the other two. This provides a rich source of data for comparing the results with theoretical predictions by graphical analysis, or resolution into components, or by other trigonometric means.

The first need is to properly represent the forces involved. When the holes made by the push pins have been identified and labeled, and the common point has been labeled, then the pins can be removed and the materials used by another student or returned to the storage container. Next, draw a separate line from the common point to the hole made by each push pin. This line is in the direction of each component force. Then, using the “length of spring” data, measure back from the push pin hole toward the common point, an amount that is equal to the length of that spring. The remaining distance is the amount by which the spring was stretched and is therefore proportional to the size of the force exerted by that spring. Since the spring constant is the same for all the springs, these remaining segments can be labeled as relative force vectors emanating from the common point with arrowheads at the other end. The sum of any two of these vectors is the negative of the third vector. In a similar way, four or more forces can be investigated by using springs from the other sets. An example is illustrated, reduced from an actual experiment.

Time Allocation:
No prior assembly is required for this product. Individual experiment times will vary depending on needs of students and methods of instruction, but gathering and analyzing the data will normally not exceed one class period.

Feedback:
If you have a question, a comment, or a suggestion that would improve this product, you may call our toll free number.