Investigating coplanar forces

Transcript

Objects are in equilibrium when all of the forces acting on the object are balanced.

In this experiment, a vertical force of weight, a horizontal force of tension and a diagonal force measured by a newtonmeter all act on an object to produce equilibrium.

Two clamp stands are used to support the horizontal and diagonal forces.

The newtonmeter will measure the diagonal force. The mass will provide a vertical force of weight.

The string providing the horizontal tension must be checked.

There are a number of methods to check this. Consider which is the best.

The angle of the diagonal string can be measured with a protractor. Using a lamp to produce a shadow on a screen may make it easier to make this measurement.

Take a reading from the newtonmeter.

Note down the reading from the newtonmeter and the mass of the hanger in a table with headings ‘angle’, ‘degrees’, ‘force’, ‘Newtons’ and ‘mass’.

Mass is now added to the mass hanger.

The horizontal string will have to be adjusted for the new mass so it remains horizontal.

For each new value of mass on the hanger, measurements of the angle and force are taken.

These values, as well as the value of the mass, are written in the table.

The value for the gravitational field strength of the Earth is known so calculations of the weight of the mass can be made.

The values for weight are added to the table.

A graph is plotted of weight against force. A line of best fit is drawn. The gradient is equal to sine of the angle.

Can you prove this relationship using your understanding of vector triangles and equilibrium? Refer to the free body force diagram shown.

Although this experiment should give reliable data allowing a good straight-line graph to be plotted, what do you think the largest source of error is?