Determining the principle of moments – transcript

One of the effects of a force acting on an object is rotation. An object may start turning around a point by applying some force. Similarly, an already rotating object could be made to rotate faster or slower; or even to stop rotating.

An object is in rotational equilibrium, if it is not rotating or is rotating at a constant speed. In this experiment, an object that is in rotational equilibrium will be studied.

The principle of moments states that if an object is in equilibrium around a pivot point then the sum of clockwise moments must be equal to the sum of anti-clockwise moments:

This is the condition for rotational equilibrium.

First, the nail is carefully pushed through both corks to make tight-fitting holes.

The first cork and nail is then clamped in the stand. Then the metre rule is balanced on the pivot and secured in place with the second cork.

It is very likely that the ruler will not be perfectly balanced. It is acceptable that the ruler will almost balance.

Now 100 g is added to the left-hand side of the metre rule 10 cm away from the pivot.

And 100 g is added to the right-hand side. The right-hand side weight is moved gently either away or towards the pivot point until the metre rule is balanced again.

The data is recorded in a table like this.

The applied force on the metre rule is assumed to equal the number of 100 g masses used.

Another 100 g weight is added to the length hand hanger and a new position of the right hand hanger is found to achieve balance.

Different arrangements of weights and distances can be placed on both sides of the pivot to maintain balance.

Five different combinations have now been added to the table.

Remember the moment equals the force times the perpendicular distance from the pivot

From the results in the table the anti-clockwise and clockwise moments can be calculated using the values in the data table.

The values of the clockwise and anti-clockwise moments are almost equal to each other for each balanced metre rule. This is an example of the principle of moments in action.

If the sum of clockwise moments is equal to the sum of anti-clockwise moments, the object is in rotational equilibrium.

Different sets of masses at different distances on the left-hand side can create more than one anti-clockwise moment. Similarly, more than one clockwise moment can be created by adding additional sets of masses to the right-hand side of the metre rule.