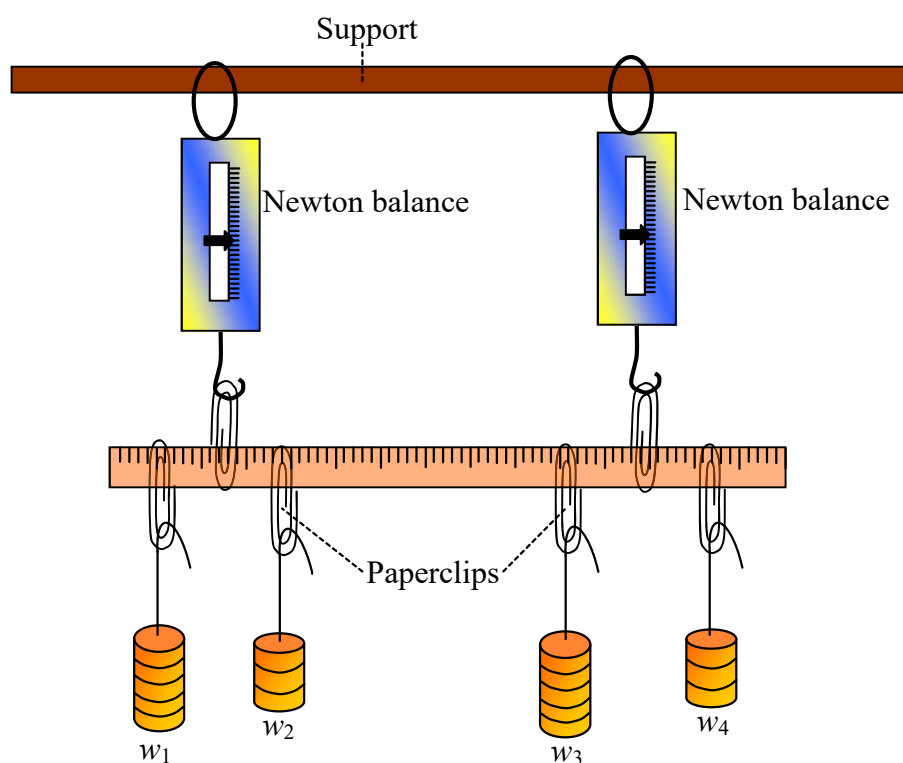


INVESTIGATION OF THE LAWS OF EQUILIBRIUM FOR A SET OF CO-PLANAR FORCES

Apparatus

Two newton balances (0-50 N), metre stick, weights, paperclips.



Procedure

1. Use a balance to find the centre of gravity of the metre stick and its weight.
2. Hang the balances from a support or two retort stands; hang the metre stick horizontally from the balances.
3. Hang a number of weights from the metre stick and move them around until the stick is horizontal and in equilibrium.
4. Record the reading on each newton balance.
5. Find the sum of the weights on the metre stick and add the weight of the stick.
6. Record the positions on the metre stick of each weight, each newton balance and the centre of gravity of the metre stick.
7. Find the moment of each force about the 0 cm mark by multiplying the force, in newtons, by its distance, in metres, from the 0 cm mark.
8. Find the sum of the clockwise moments about an axis through the 0 cm mark.
9. Find the sum of the anticlockwise moments about an axis through the 0 cm mark.
10. Repeat steps 7, 8 and 9 for at least two other points along the metre stick.
11. Repeat for a different set of weights.

Results

For each situation

- (1) Forces up = Forces down
i.e. the sum of the readings on the balances should be equal to the sum of the weights plus the weight of the metre stick.
- (2) The sum of the clockwise moments about an axis through any of the chosen points should be equal to the sum of the anticlockwise moments about the same axis.

Notes

Giant paperclips [50 mm] can be used to support the slotted weights, thereby eliminating the problem students encounter when thread is used. The paperclips can also be used as support points for hanging the metre stick from the newton balances.

The paperclips may be treated as part of the weights and so their weight is added to that of the other weights.

Fixing the paper clips in position with cellotape or bluetack may be an easier alternative approach. The paperclips may then be treated as part of the metre stick. In this case, find the centre of gravity and weight of metre stick and paperclips using one of the balances.

Open out the paperclips for ease of use, especially if it's planned to slide the weights to different positions.