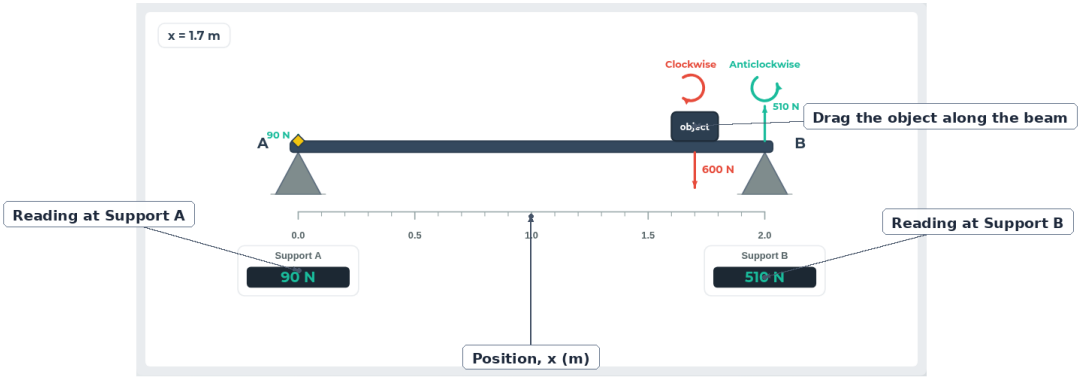
Investigating the Upward Forces on a Beam

Load Position and Support Forces

Aim:

You are investigating how the position of a load along a beam affects the upward force at each of its two supports.



Prediction:

The object starts directly above Support A. What do you predict Support A and Support B will each read?

Support A: ..... N Support B: ..... N

Move the object to that position in the simulation and test your prediction.

Method:

1. Set the object's weight using the Object's weight (N) slider and keep it fixed for your first set of readings.
2. Drag the object to a position along the beam.
3. Read the value on the Support A scale and the Support B scale. Record the position x, both readings, and their total A + B in your results table.
4. Move the object to a new position and repeat.
5. Repeat for at least seven more positions, chosen over a wide and evenly spaced range from Support A to Support B.

Results:

position x (m)	reading at A (N)	reading at B (N)	A + B (N)

Analysis:

What happens to the reading at Support A as the object moves towards Support B? What happens to the reading at Support B?

Look at your two readings at each position together with the object’s weight. Is there a relationship between them? Does it hold at every position you tried?

Is there a position where the two readings are equal? Is there more than one?

Plot the position x (m) on the horizontal axis and the force reading (N) on the vertical axis. Plot both Support A and Support B readings on the same axes. Describe how each line changes as the object moves from A to B — is the change steady, or does it speed up and slow down?

Explaining why:

moment (N m) = force (N) × perpendicular distance from the pivot (m)

Open the Turning effects view and choose Support A as the pivot. With the object somewhere between the supports, which way does the object's weight try to turn the beam about A — clockwise or anticlockwise? Which force turns it the other way?

The beam stays still. What must be true about these two turning effects for that to happen?

Use this idea to explain why moving the object closer to B makes the reading at B larger. Refer to the turning effect of the object's weight about A, and name its direction.

Now switch the pivot to Support B and explain, in the same way, why the reading at A behaves as it does.

Put it together: an object starts at Support A, then moves all the way to Support B. Using turning effects about a pivot, explain how and why the force at each support changes as it moves. Name the direction of each turning effect you mention.