Stability (Item No.: P0999900)

Curricular Relevance

Area of Expertise: Physik
Education Level: Klasse 7-10
Topic: Mechanik
Subtopic: Kräfte, einfache Maschinen
Experiment: Standfestigkeit

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Easy	10 Minutes	10 Minutes	2 Students

Additional Requirements:

- Scissors

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional Information

By pulling a block at a point above its centre of gravity against an obstacle at its base, the students should observe that an object always tips over when the trace of a plumb through its centre of gravity lies outside its supporting base.

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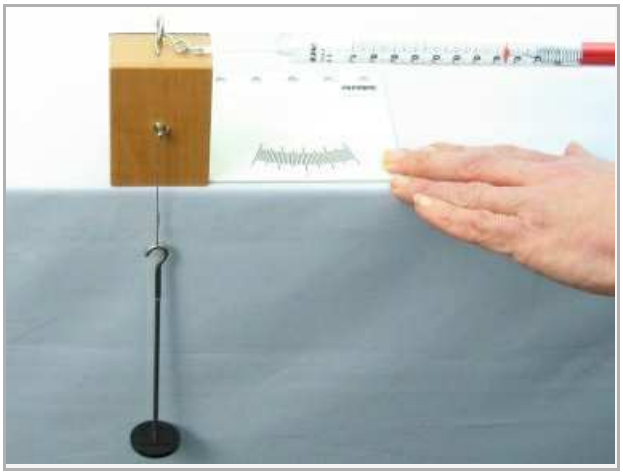
Task and equipment

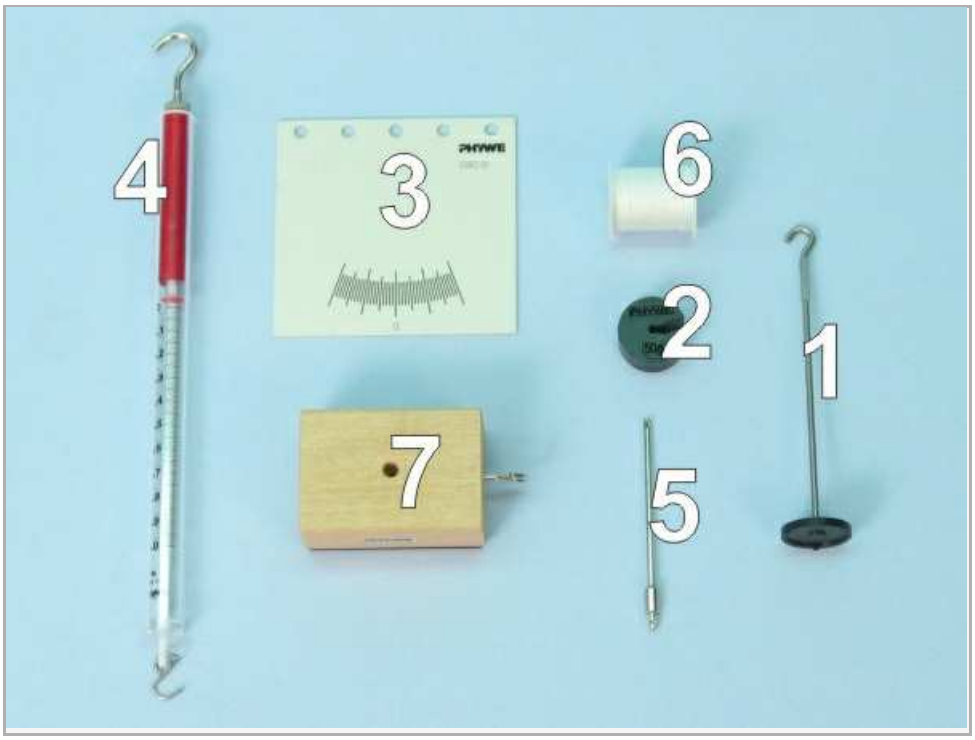
Task

When does a tower tip over?

You will determine experimentally when an object tips over.



Equipment



Position No.	Material	Order No.	Quantity
1	Weight holder for slotted weights	02204-00	1
2	Slotted weight, black, 50 g	02206-01	1
3	Plate with scale	03962-00	1
4	Spring balance,transparent, 1 N	03065-02	1
5	Holding pin	03949-00	1
6	Fishing line, l. 20m	02089-00	1
7	Friction block	02240-01	1
Additional material			
	Scissors		

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Set-up and procedure

Set-up

Set up the experiment according to the following picture (Fig. 1). The friction block should touch the plate with its side.

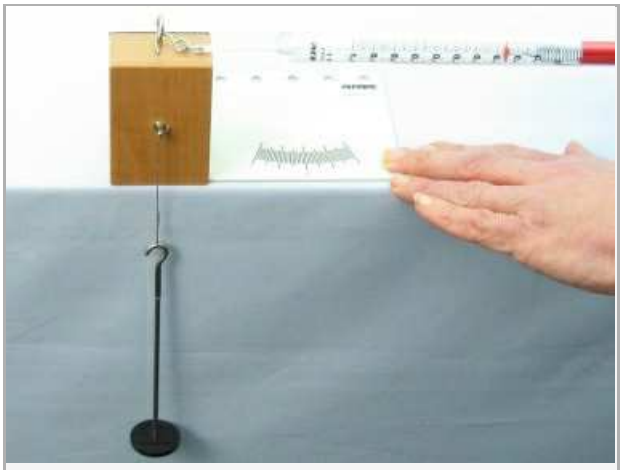


Fig. 1

Procedure

- Hang the spring balance on the hook of the friction block. Hold the plate in position with one hand (Fig. 2).
- Pull the spring balance parallel to the table top.
- Observe the object and the plumb line in all three positions (Fig. 2, Fig. 3, Fig. 4).
- Record the acting force in each position in the report.

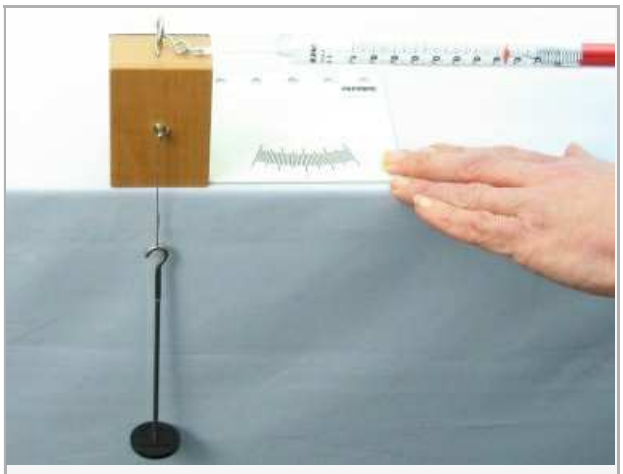


Fig. 2

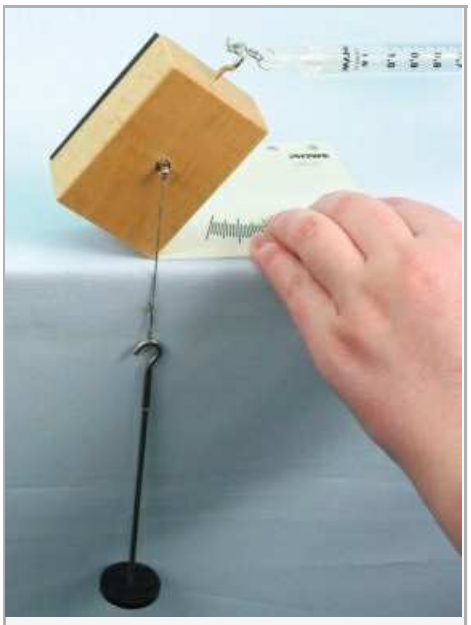


Fig. 3

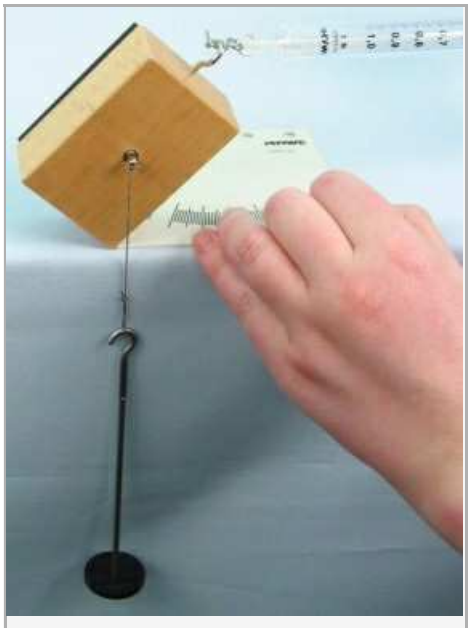


Fig. 4

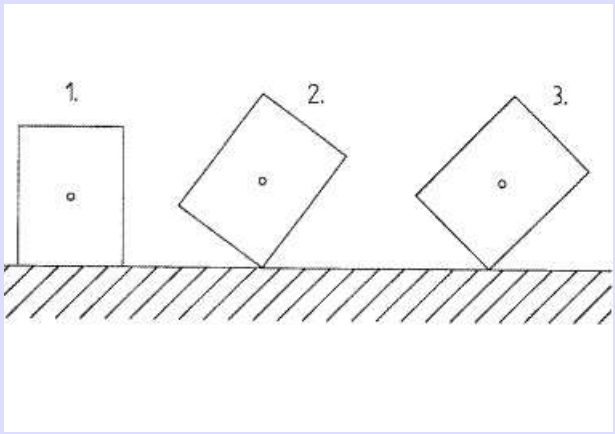
Report: Stability

Results – Observation

Position 1: tractive force = ... N, object .....

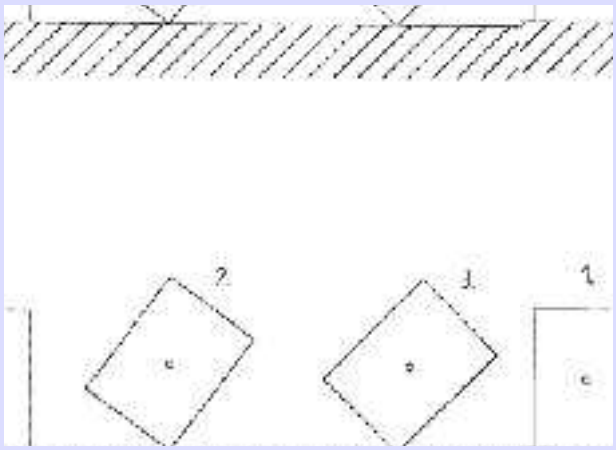
Position 2: retention force = ... N, object .....

Position 3: force = ... N, object .....



Evaluation – Question 1

Draw the plumb line for each position of the block.



Evaluation – Question 2

How are the tracing of the plumb and the supporting base of the block related to each other

a) in position 1?

b) in position 2?

c) in position 3?

Evaluation – Question 3

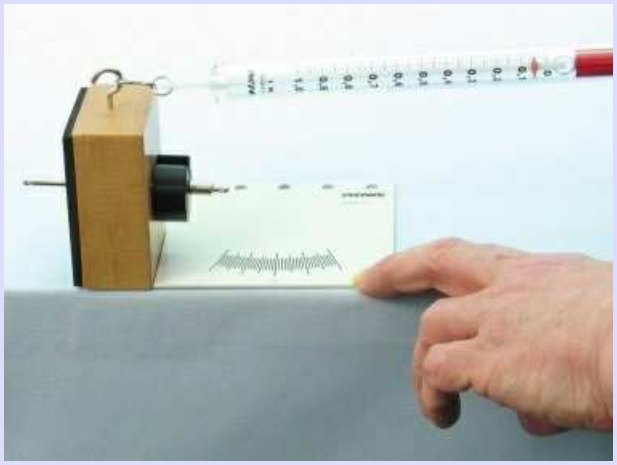
What condition must be met so that an object (e.g. a tower) does not tip over?

Evaluation – Additional Task 1

Push the holding pin into the mass piece and then push the free end of the pin through the hole in the wooden side of the friction block.

- Place the friction block in such a way that the mass piece points in the direction of pull, i.e. toward the plate (Fig. 6).
- Measure the tractive force with the spring balance and record it.

Mass in the direction of pull: tractive force F_1 = ... N.

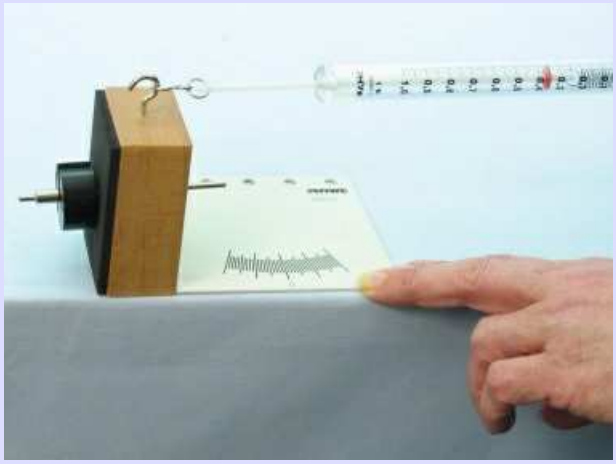


Evaluation – Additional Task 2

Remove the holding pin with the mass piece and insert the weighted pin into the rubber side of the friction block.

- Place the friction block in such a way that the mass piece points in the opposite direction of the pull, i.e. away from the plate (Fig. 7).
- Remeasure the tractive force and record it.

Mass against the direction of pull: tractive force F_2 = ... N.



Evaluation – Additional Task 3

Compare the measuring results. How can you explain them?

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