

DIRECTION OF FORCE AND POINT OF IMPACT

MED 03.08



Material:

Item-no.	Qty.	Description
DS101-1G	1	Support base, large, L=500 mm
DS093-04	1	Sliding saddle "Sepp", H=40 mm
DS300-75	1	Support rod, squared, L=750 mm, 12x12 mm
DS400-3K	2	Bosshead cross-pattern, Demo, green
DS204-2L	1	Bearing pin with clamp insert
DM221-1H	1	Lever rod, metal, L=1000 mm
DS402-2G	1	Clamp on support
DG101-00	1	Ruler, metal, L=1000 mm
DM132-1F	1	Torsion dynamometer 10 N
DM121-1A	2	Weight on hook 5 g, profi
DM121-7A	1	Weight on hook, 1 kg, profi
	1	Cord, 50 cm
	1	Self-adhesive sticky note

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Purpose

The decisive factor for the rotational effect of a force on the lever rod is not the distance of the point of application of the force from the axis of rotation, but the distance of the line of action from the axis of rotation.

Preparation

Place the sliding saddle in the centre of the large support base and insert the 750 mm support rod into the sliding saddle; afterwards mount one bosshead at a height of 25 cm and the other bosshead 10 cm below the top end of the support rod.

Fix the clamp on support to the bottom bosshead and mount the metal ruler in this clamp.

Remove the bearing pin from the clamp insert and put the bearing pin through the central hole of the lever rod.

Now put the bearing pin back into the clamp insert and mount the clamp insert at the upper bosshead.

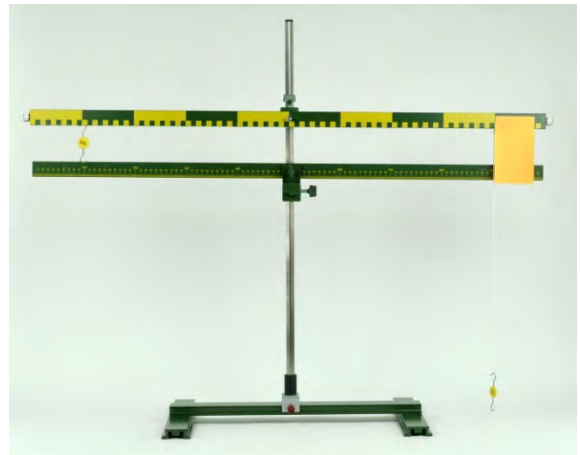
Cut off a 60 cm piece of a cord and make a loop at one end. The other end of the cord is tied 40 cm from the centre to the holes in the lever rod.

A self-adhesive sticky note is attached to the right leg at 40 cm at a right angle.

In the loop of the cord and at a distance of 40 cm on the left leg (from the centre) 5 g weights are attached.

The lever bar is now held horizontally; afterwards the load hook of the 10 N torsion dynamometer is attached to the right leg at a distance of 40 cm from the centre.

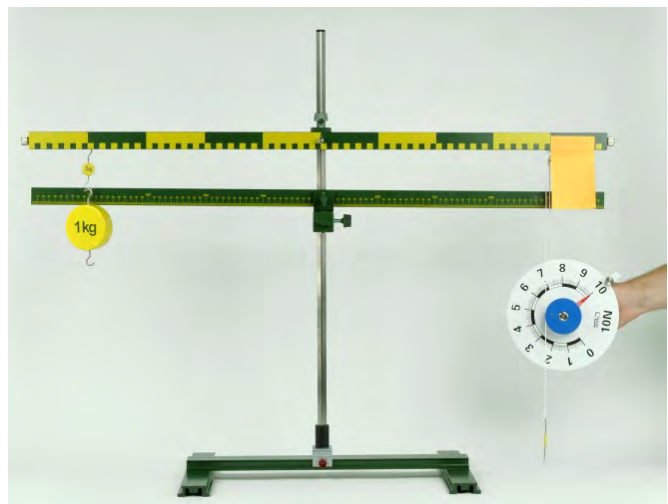
A 1 kg weight is attached to the left leg.



Experiment

Bring the lever bar into a horizontal position by pulling the torsion dynamometer vertically downwards.

The distance to the center is 40 cm.
The value is read and entered in the table.



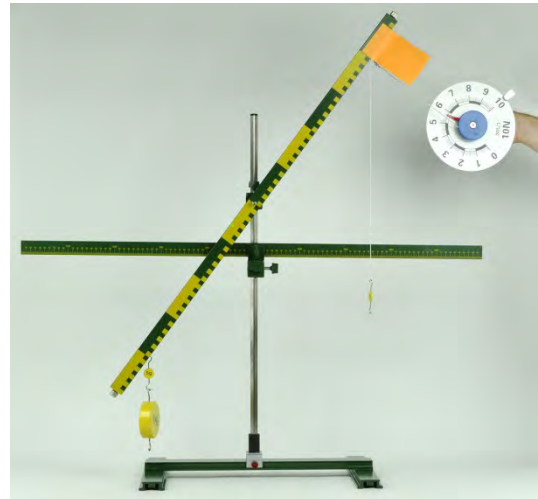
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We now let the lever turn slightly to the left by slowly moving the torsion dynamometer upwards. After the lever is no longer horizontal we read the distance to the axis of rotation on the drop cord (line of action).

The measured force is noted in 5 cm steps in the chart.

Please note that the pull of the dynamometer must always be normal to the lever rod (for this we have attached the sticky note)!



Force (N)	Force arm (m)	
	0,40	
	0,35	
	0,30	
	0,25	
	0,20	

Determination and comparison of the products force x power arm (torques) during rotation.

$$8\text{N} \times 0.30\text{m} = 9.81\text{N} \times 0.245\text{m} \quad (0.245\text{m} = 0.30\text{m} \times \cos 35.4^\circ)$$

Extreme case: vertical lever bar - zero torque

Note

This experiment is a good opportunity to make the term torque understandable.