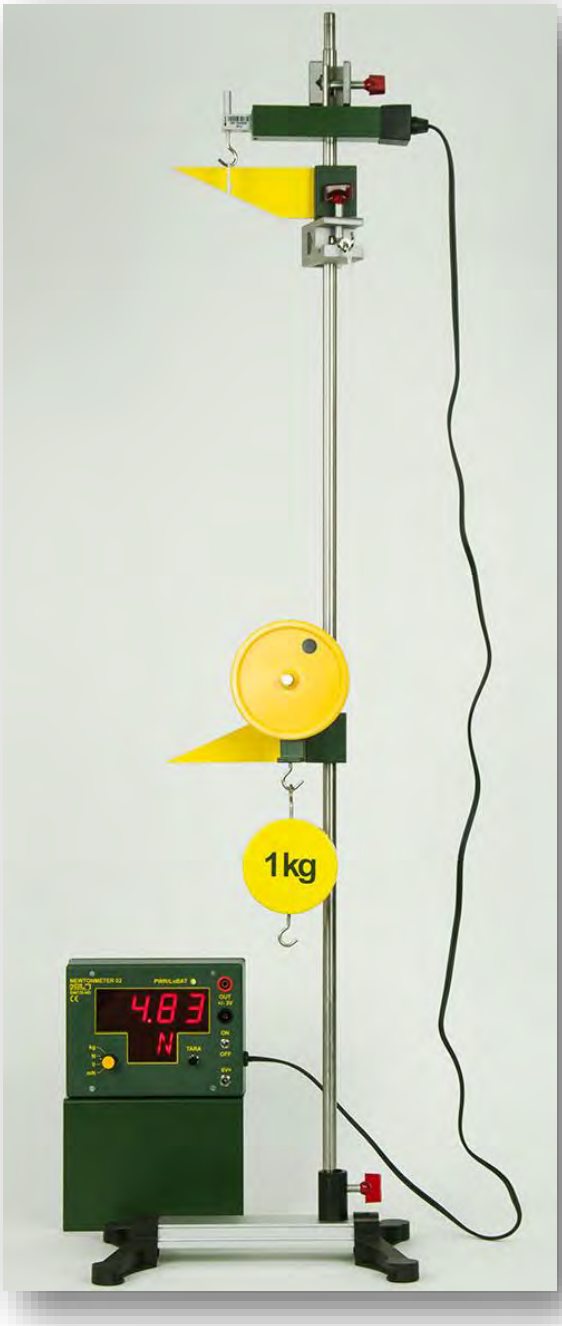
PULLEY

MED 11.02



Material

Item-no.	Qty.	Description
DS090-3K	1	Claw base "Sepp", 260 x 220 mm
DS201-00	1	Support rod round, L=1000 mm, D=12 mm
DS095-3K	2	Bosshead cross-pattern, demo 03
DS204-2L	1	Bearing pin with clamp insert
DS203-1S	1	Support with hook
DG110-1G	1	Pointers for rods, pair
DM210-2L	1	Pulley, movable, with hook, D=100 mm
DG200-1S	1	Cord, D=1.7 mm, L=5 m
DM121-7A	1	Weight on hook 1 kg, profi
DM121-6A	1	Weight on hook 500 g, profi
DM725-ND	1	Newtonmeter "inno" 20 N / 2000 g
P3120-5B	1	S-shaped assembly platform

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Purpose
To demonstrate the condition for equilibrium on a pulley.

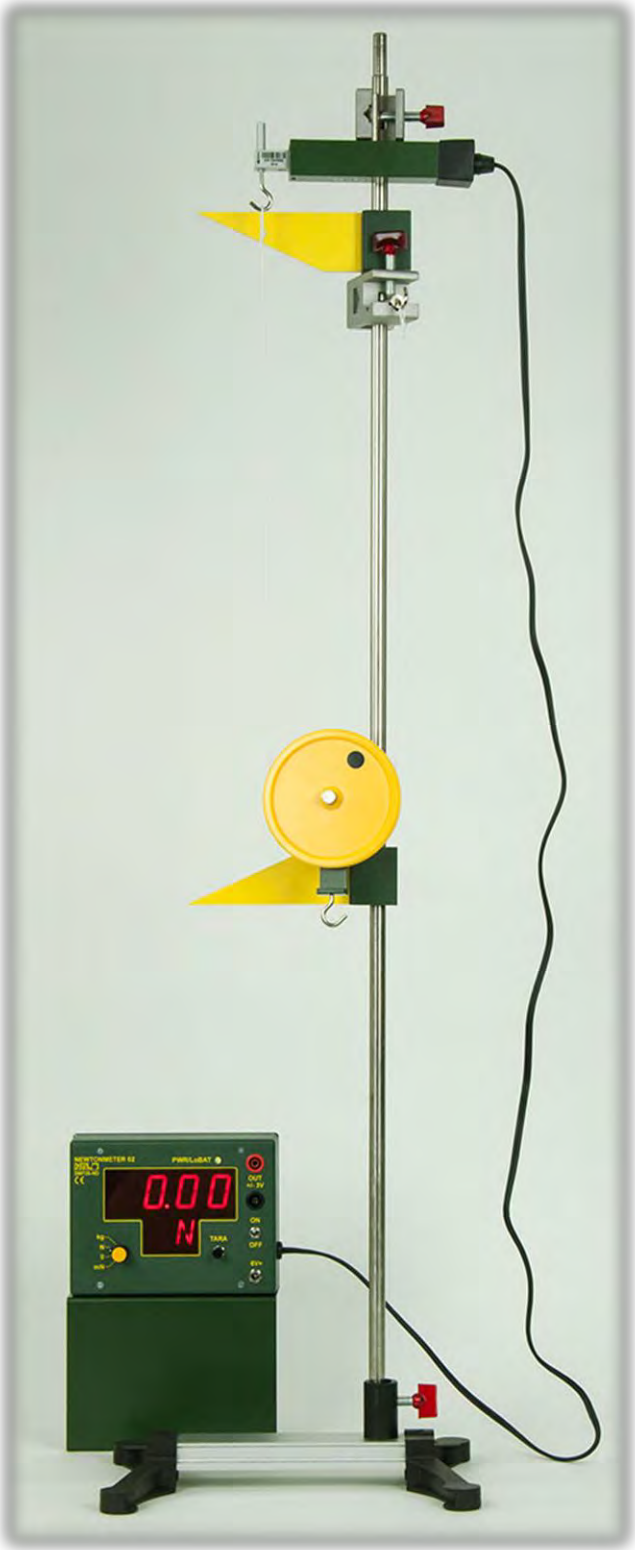
Preparation
Insert the 1000 mm support rod into the sliding saddle of the claw base; afterwards mount the two bossheads at a height of 75 cm and 90 cm on the support rod.

Mount the weighing bar in the upper bosshead and the support with hook in the lower bosshead.

Cut off a 100 cm piece of the cord and make loops at both ends of the cord; the remaining length after making the loops should be 90 cm approximately.

Mount the cord between hook of the weighing bar and the support with hook as shown on the image to the left and "hang" the pulley into the cord.

Place the Newtonmeter on the S-shaped assembly platform for better visibility, set the measuring range of the Newtonmeter to „N" (Newton), turn it on afterwards and tare if required (set to 0).



The pointers are positioned as shown on the image; the upper pointer marks the height of the hook of the weighing bar while the lower pointer marks the bottom end of the pulley.

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Experiment 1
Hang a weight of 1 kg on the cord and read off the force of weight.

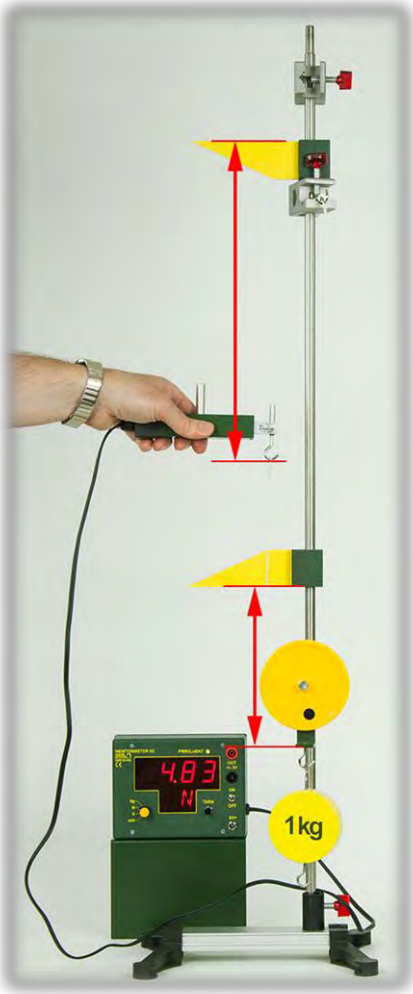
Result
To hold the mass we need about half the weight.
The "second half" of the weight is carried by the hook of the support.

The friction of the pulley causes a small loss of force, thus the force of weight will be a little less than the half.

Experiment 2
Adjust the lower pointer so that it marks the bottom end of the pulley.

Loosen the screw on the sliding saddle and lower the weighing bar, thus the weight moves further down too.

Measure the two paths with a ruler or tape measure and compare them.



Result
The path of the weighing bar is twice as much as the path of the weight.

When comparing the work (force x path) the result is

$$F \times s = \frac{F}{2} \times 2s$$

The (loose) pulley can be seen as a one-sided lever where the force arm is twice as big as the load arm.

Note
The direction of force is not arbitrary in this experiment; this can be achieved with an additional fixed pulley.

The loose pulley is not only serving to raise and lower but also to increase the force generally (for example at a sailing boat).

When pulling on a loose pulley only half the force is available at the loose end of the cord; owever when starting a model aircraft for example twice the speed is available.

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