Forces and work
Force-transforming apparatus

Forces and paths at a fixed pulley - Stand setup

Objects of the experiment
1. Investigating the relation between load and force
2. Investigating the relation between the load path and the force path

Setup

Apparatus

1 Pulley, 100 mm diam., plug-in, pair, set of 2	340 921ET2
1 Weight, 0.5 kg	315 38
1 Weight, 0.2 kg	683 11
1 Weight, 0.1 kg	683 10
1 Precision dynamometer, 5 N	314 161
1 Metal rule, 0.5 m	460 97
2 Pointer, pair	301 29
3 Stand bases MF	301 21
1 Stand tube, 1000 mm, 10 mm diam.	608 052
1 Stand tube 750 mm, 10 mm diam.	608 051
1 Stand tube 450 mm, 10 mm diam., set of 2	666 609ET2
1 Stand rod, 250 mm, 10 mm diam.	301 26
2 Support block	301 25
1 Support clip, for plugging in	314 04ET5
1 Demonstration cord	309 50

Carrying out the experiment

1. Relation between load and force:
- Using the dynamometer, measure the gravitational forces of the three weights one after another, and enter them into the table as load F_1.
- Then assemble the experimental setup as shown in the illustration.
- Make the zero adjustment at the unloaded dynamometer.
- Suspend the weight 0.5 kg.
- Read the force F_2 at the dynamometer.
- Then suspend the other two weights one after another and read the corresponding forces.

2. Relation between the load path and the force path:
- Set the load path s_1 with the pointers at the left stand rod to a fixed value of 10 cm.
- Align the load so that its lower edge is at the height of the lower pointer.
- Mark the position of the dynamometer with the upper pointer at the stand rod in the middle.
- Loosen the screw at the support block and lower the dynamometer until the load has passed the fixed path s_1.
- Fasten the screw at the support block.
- Mark the new position of the dynamometer at the stand rod in the middle with the lower pointer.
- Measure the distance between the upper and the lower pointer at the stand rod in the middle, and enter it into the table as force path s_2.
- Repeat the experiment with other load paths.

Measuring example

Body	*Load F_1 in N	*Force F_2 in N
weight 0.5 kg	5	5
weight 0.2 kg	2	2
weight 0.1 kg	1	1

*rounded values

Load path s_1 in cm	Force path s_2 in cm
10	10
15	15
20	20

Evaluation
1. At the fixed pulley, the load and the force are equal: $F_1 = F_2$. Only the direction of the force is changed.
2. The load path and the force path are equal: $s_1 = s_2$.

Remark:

The measured values can be used to calculate the mechanical work performed at the fixed pulley:
$$W = F_1 \cdot s_1 = F_2 \cdot s_2$$