The force of friction is proportional to the weight force of a body and independent of the size of the supporting surface.

Material

2	Slotted weight, black, 50 g	02206.01
2	Slotted weight, silver bronze, 50 g	02206.02
1	Friction block, large	02240.02
1	Spring balance 2.5 N	03060.02
1	Spring balance 5.0 N	03060.05
1	Holding pin	03949.00

Setup and implementation

Experiment 1

- Adjust the spring balance 5 N in vertical position to zero
- Hang the spring balance on the hook, determine the weight force F_W of the block, calculate F_W with 100 g and with 200 g additional weight (Table 1)
- Place the friction block with the rubber surface facing down on the table
- Adjust the spring balance in horizontal position to zero
- Hang the spring balance onto the friction block (Fig. 1)
- Exert horizontal force and slowly increase until it begins to slide
- Determine the kinetic force of friction F_K (Table 1)
- Load the block at first with two and then with four 50 g slotted weights, use holding pins for this and determine the F_K each time.

Experiment 2

- Place block at first with the wood side facing down on the table, then position on the side surfaces (Fig. 2)
- Hang the spring balance 2.5 N onto the friction block
- Determine the kinetic force of friction F_K for each (Table 2)

Observation and measurement results

The greater the body is loaded with weights, the greater the kinetic force of friction.

Table 1

$\frac{F_W}{N}$	$\frac{F_K}{N}$
3.8	1.5
4.8	2.1
5.8	2.5

Fig. 1

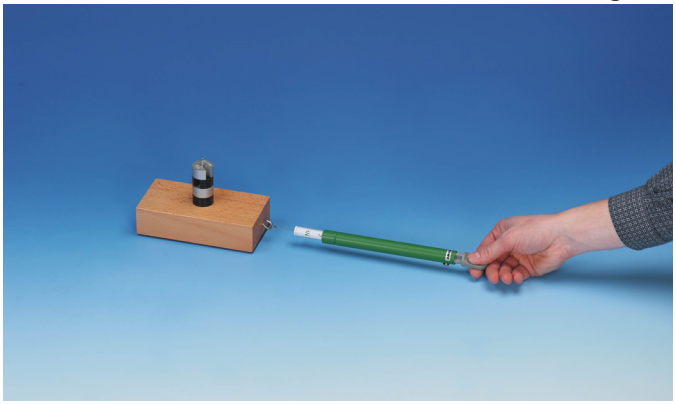

Fig. 2

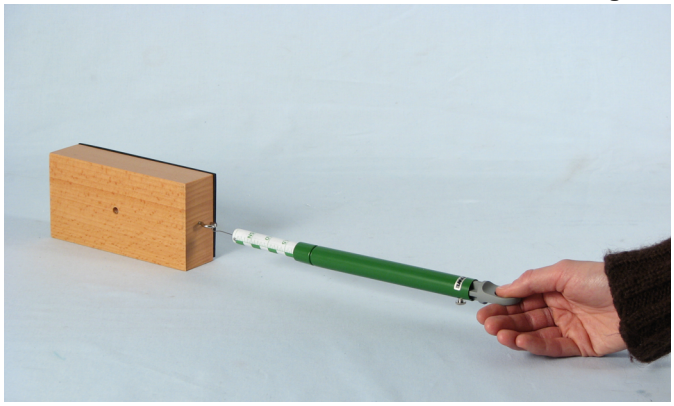

Table 2

Supporting surface	$\frac{F_K}{N}$
large	0.75
small	0.70

The kinetic force equal to both supporting surfaces.

Evaluation
If the force of friction is entered in a diagram based on the weight force, then this makes a straight line. The kinetic force is proportional to the weight force.

$$F_K \sim F_W$$

or

$$F_K = \mu \cdot F_W$$

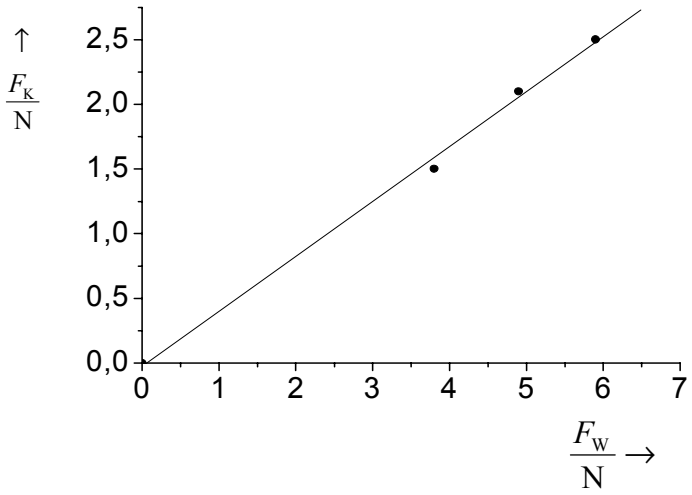

Fig. 3

The proportionality factor can be determined from the slope of the straight line. It equates to:

$$\mu = 0.42.$$

and is called the friction factor or coefficient of friction.

Different combinations of materials have different friction factors.

Examples:
- Steel on steel: 0.15
- Wood to wood: 0.2 to 0.4
- Ice skate on ice: 0.01
- Rubber on the street: 0.3

The shorter the friction factor, the lower the friction. The force of friction can be calculated from the friction factor and the weight force of a body:

$$F_K = \mu \cdot F_W$$

The kinetic force of friction does not depend on the size of the rubbing surfaces.

Remarks

1. Depending on the surface of the table the values for the forces of friction can deviate from those indicated.

2. There is also a friction factor for static friction force. This is larger than the friction factor for kinetic friction.

3. The friction factor only slightly depends on the speed with which the body slides.

Room for notes