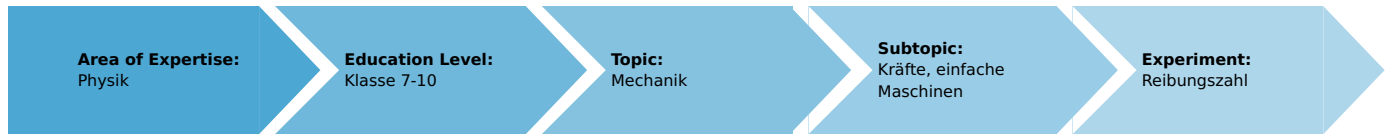


Coefficient of friction (Item No.: P1000400)

Curricular Relevance



Difficulty



Intermediate

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional Information

- Using a friction block, the students should establish that the frictional force is independent of the surface area.
- For a constant surface area the students should vary the mass of the friction block and measure the frictional force F_f in each case.
A graph of these results should then be investigated, showing clearly the proportionality between frictional force and weight (force). Finally, the students should also calculate the coefficient of friction, μ , from the slope of the straight line.

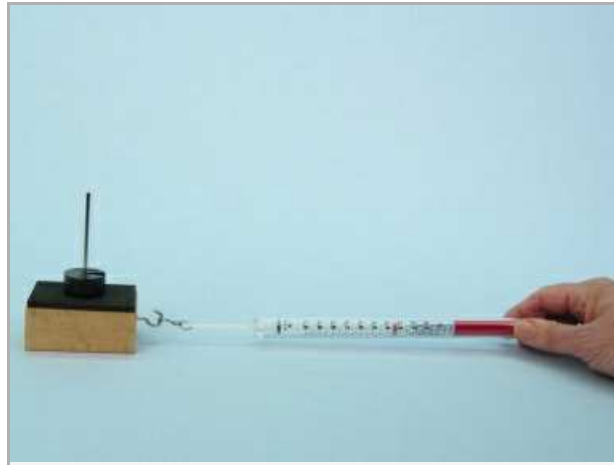
Coefficient of friction (Item No.: P1000400)

Task and equipment

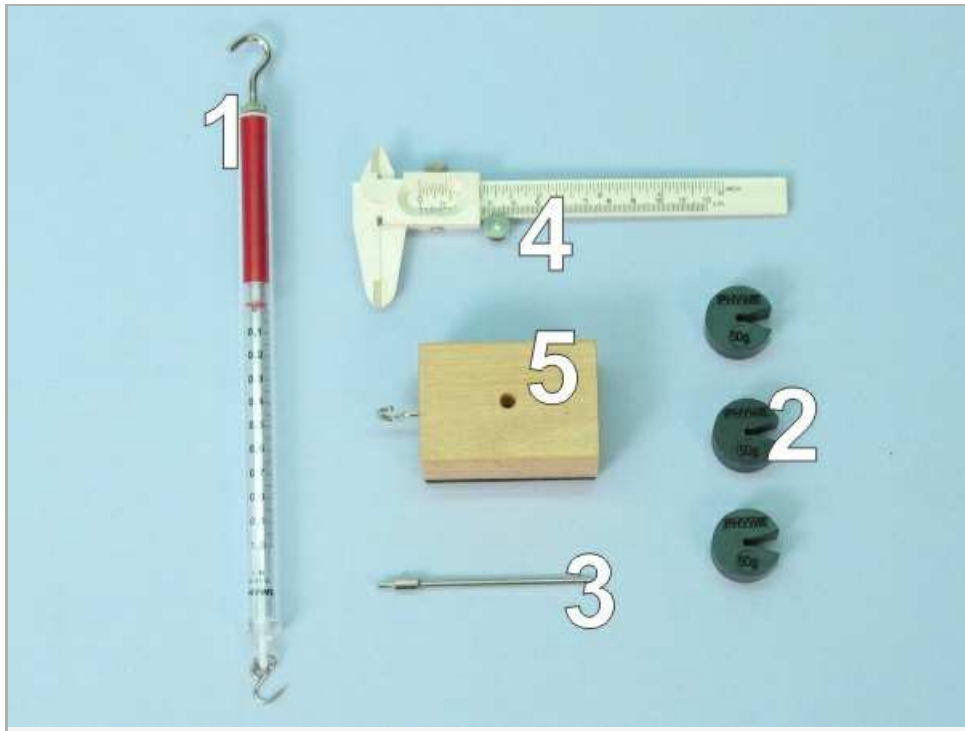
Task

Does friction change under load?

In this experiment you will investigate whether the frictional force depends on the surface size, and whether it depends on the load (i.e. the mass).



Equipment



Position No.	Material	Order No.	Quantity
1	Spring balance,transparent, 1 N	03065-02	1
2	Slotted weight, black, 50 g	02206-01	3
3	Holding pin	03949-00	1
4	Vernier calliper, plastic	03011-00	1
5	Friction block	02240-01	1

Set-up and procedure

- Determine the length a and the width b of the friction block with the vernier caliper (Fig. 1). Record these values in Table 1.

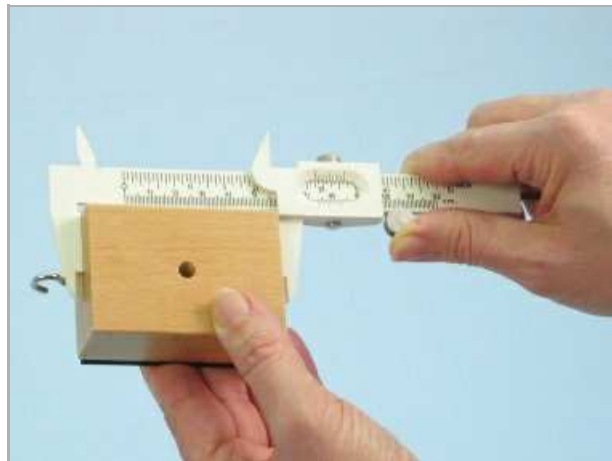


Fig. 1

- Place the friction block with its broad side on the table and its rubber surface facing upwards.
- Pull the friction block using the spring balance (Fig. 2) and read off the frictional force F_f during uniform motion (sliding friction).
- Now, determine the friction block's height c , turn it on its side and repeat the measurement of the frictional force (Fig. 3).
- Record all measured values in Table 1.



Fig. 2

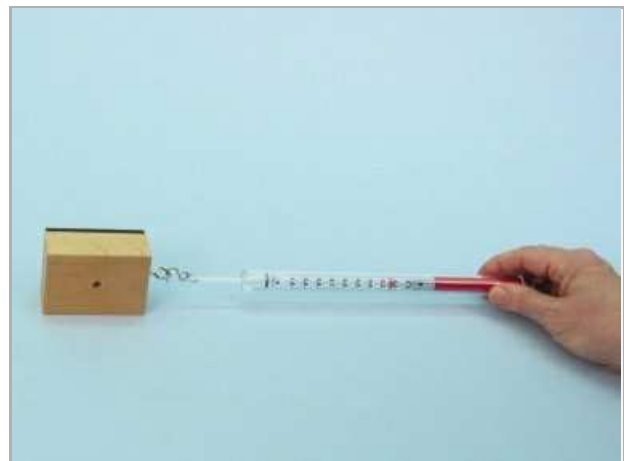


Fig. 3

- Determine the weight (force) F_g of the friction block (including the holding pin) using the spring balance (Fig. 4), and record the value in Table 2.



Fig. 4

- Place the friction block on the table, with the rubber surface and the holding pin facing upwards.
- Pull the friction block using the spring balance, and read off the frictional force F_f during uniform motion (sliding friction). Record the value in Table 2.
- Load the friction block with 50 g (slip the mass piece onto the holding pin) and read off the frictional force F_f again (Fig. 5). Record the value in Table 2.
- Repeat the experiment with 2 and then 3 mass pieces (50 g each) on the friction block (Fig. 6). In each case, record the value in Table 2.

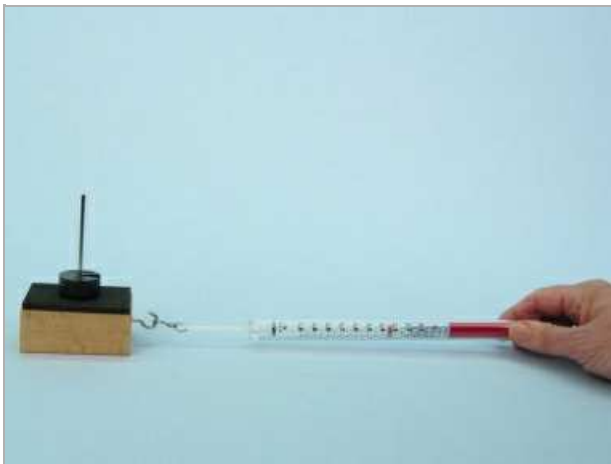


Fig. 5

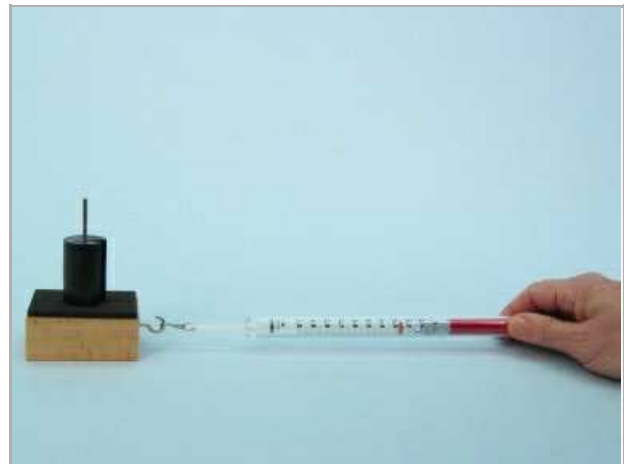


Fig. 6

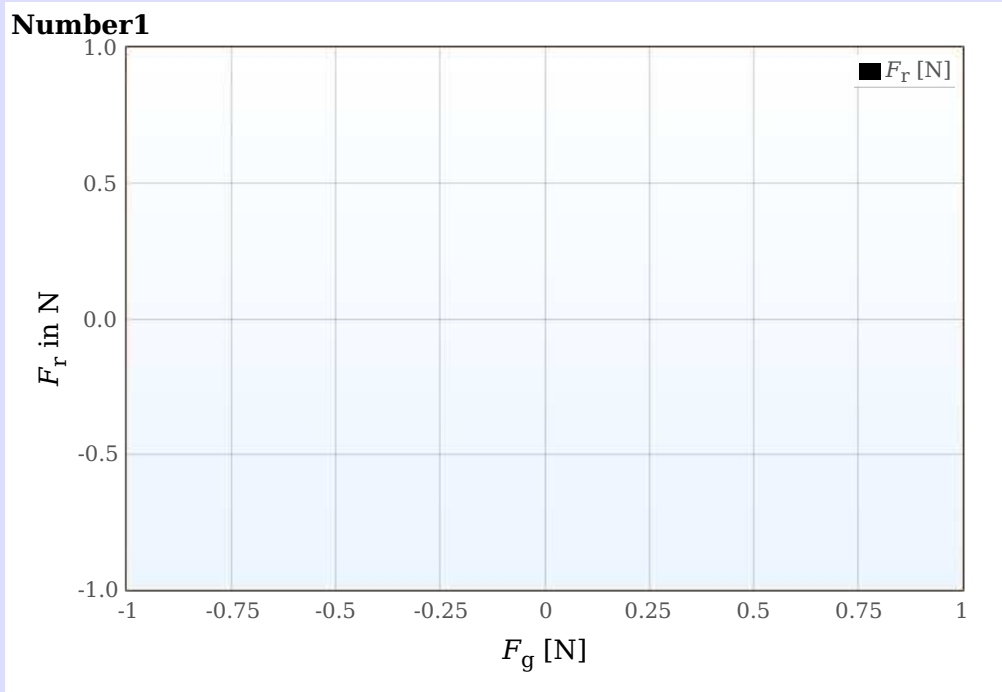
Report: Coefficient of friction

Results - Table 2

Frictional force and mass:

Calculate the weight (force) F_g of the friction block with mass pieces; record these values in Table 2.

	F_g in N	F_r in N
Block with holding pin	0	0
+ 50 g	0	0
+ 100 g	0	0
+ 150 g	0	0



Results - Table 1

Frictional force and area:

Calculate the frictional area A from a and b and then from a and c ; complete Table 1.

Friction block on the table	a in cm	b in cm	c in cm	A in cm^2	F_f in N
with the broad side	0	0	-	0	0
with the small side	0	-	0	0	0

Evaluation - Question 1

Does the force F_f change when the area A becomes smaller?

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Evaluation - Question 2

What can you conclude from this?

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Evaluation - Question 3

Does the frictional force F_r depend on the load of the friction block?

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Evaluation - Question 4

Look at the graph on the Results page, generated from the data in Table 2. What shape is the curve?

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Evaluation - Question 5

Determine the slope of the line: $\Delta F_r / \Delta F_g = \dots\dots\dots$

Evaluation - Question 6

This quantity is called the coefficient of friction, μ . Is μ dependent on the character of the rubbing surface?

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