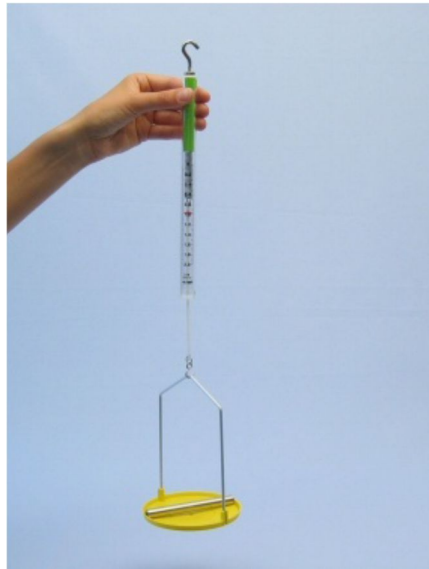


2.1 Measurement of force

Task

How is force measured?

In this experiment you become acquainted with the dependence of the reading of spring balances on their orientation and with their adjustment. With the spring balance adjusted for use in the normal vertical position, the weight of different objects is determined.



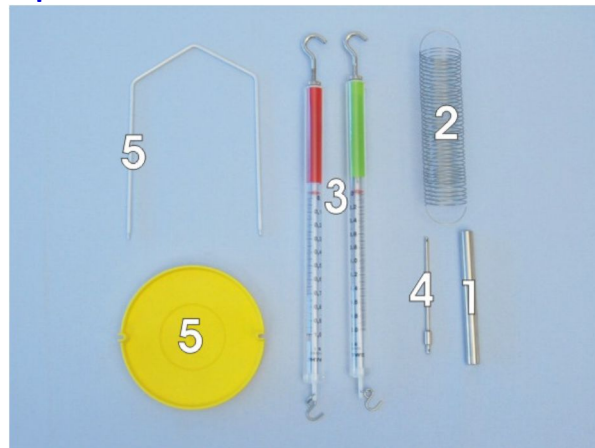
Use the space below for your own notes.

Material

Material from "TESS advanced Physics Set Mechanics 1, ME-1" (Order No. 15271-88)

Position No.	Material	Order No.	Quantity
1	Support rod with hole, stainless steel, 100 mm	02036-01	1
2	Helical spring 3 N/m	02220-00	1
3	Spring balance, transparent, 1 N	03065-02	1
3	Spring balance, transparent, 2 N	03065-03	1
4	Holding pin	03949-00	1
5	Balance pan, plastic	03951-00	1

Material required for the experiment



Setup

Assemble the balance pan as shown in Fig. 1.

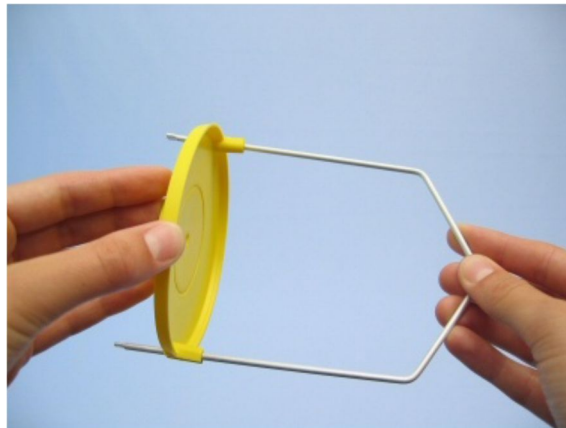


Fig. 1

Action

Hold the 2 N spring balance: first vertically (Fig. 2), then horizontally (Fig. 3) and finally upside down (Fig. 4). Observe the spring balance's indicator scale carefully in each position.



Fig. 2



Fig. 3



Fig. 4

-
- Hold the 2 N spring balance vertically upside down and adjust its indicator by loosening the screw at the top and turning the hook until the indicator points exactly to the zero mark. Then retighten the screw (Fig. 5).
 - Now hold the spring balance vertically, then horizontally. Read the scale each time and record the values in Table 1 on the Results page.



Fig. 5

Adjust the 2 N spring balance which is being held vertically to zero (Fig. 6).



Fig. 6

Hang the balance pan on the hook and place the helical spring, the holding pin and the support rod one after another on it (Fig. 7 and Fig. 8). Record the measured values in Table 2 on the Results page.

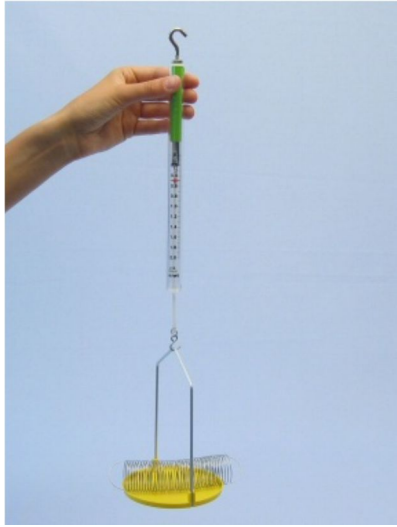


Fig. 7

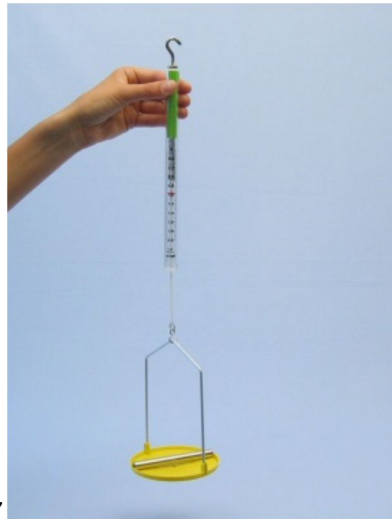


Fig. 8

Results

Table 1

Position of spring balance	Reading F in N
upside down	
horizontal	
vertical	

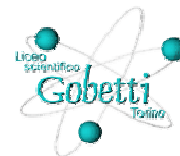
Table 2

	Weight (force) F in N			
	with balance pan		without balance pan	
Spring balance	2 N	1 N	2 N	1 N
Balance pan				
Helical spring				
Holding pin				
Support rod				

Evaluation

Question 1:

Does the reading of the spring balance change in the 3 positions?



Question 2:

Explain the variations which occur in the 3 different positions of the spring balance.

Question 3:

What does one division on the face of the 1 N spring balance indicate? On the 2 N balance?

Question 4:

Use the measured values in Table 2 (Results page) to calculate the weight of the 3 objects - without the balance pan - and record the results in Table 2.