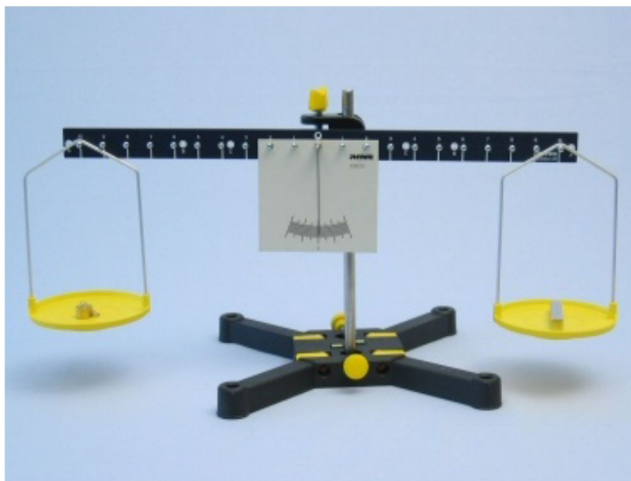## 1.5 Determination of the density of solid bodies

Task

In which properties do bodies with the same volumes but different weights differ?

Mass and volume of a wood column, of an iron column, of an aluminium column and of a weight from the weight set are determined. The density of these objects is calculated.

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	Beaker, plastic, short form, 100 ml	36011-01	1
2	Wood column	05938-00	1
2	Aluminium column	03903-00	1
2	Iron column, nickel-plated	03913-00	1
3	Graduated cylinder, 50 ml, plastic	36628-01	1
3	Pipette, with rubber bulb	64701-00	1
4	Vernier caliper, plastic	03011-00	1
5	Fish line, in reel, d = 0.7 mm, 20 m	02089-00	
6	Balance pan, plastic	03951-00	2
6	Plate with scale	03962-00	1
6	Pointer for lever	03961-00	1
7	Support base, variable	02001-00	1

8	Support rod, stainless steel 18/8, l = 250 mm, d = 10 mm	02031-00	1
9	Bosshead	02043-00	1
10	Holding pin	03949-00	1
11	Set of precision weights, 1g…50g, in case	44017-00	1
12	Lever	03960-00	1
Additional Material			
	Scissors		1

Material required for the experiment
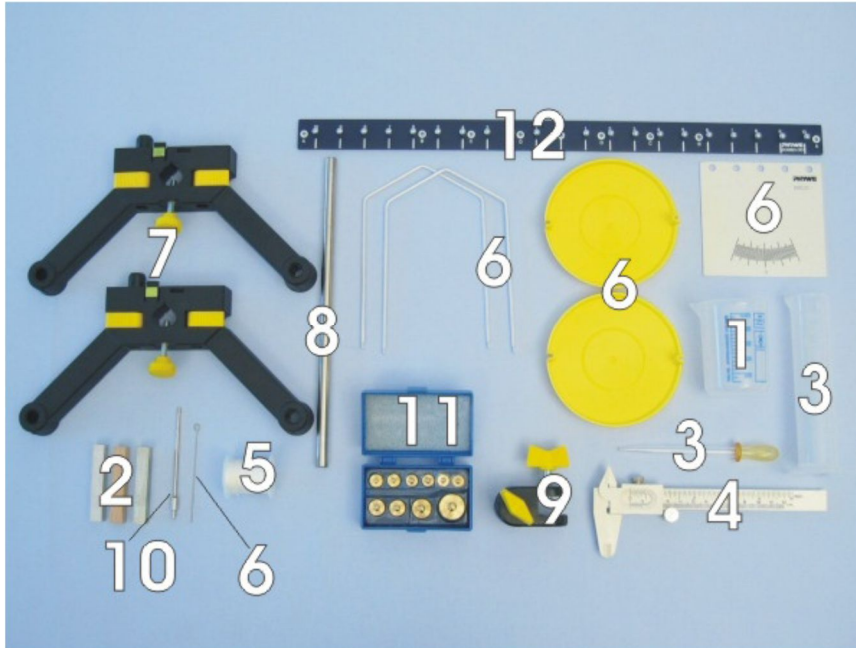
Setup
Set up a stand with the support base and the support rod as you can see in Fig. 1 and Fig. 2.
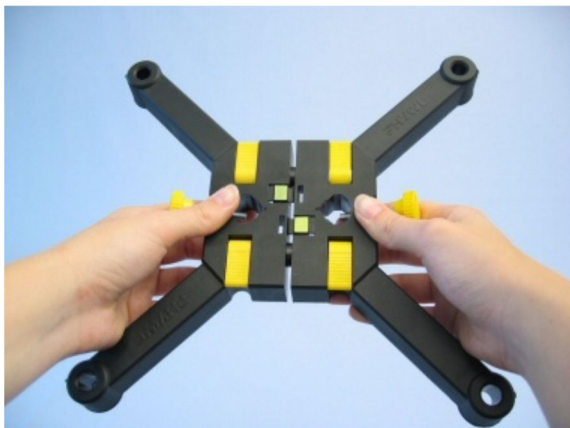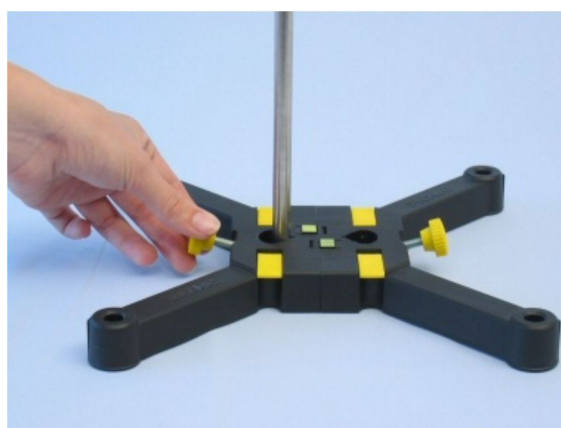

Fig. 1

Fig. 2

Put the plate with scale in the middle of the lever, then, put the holding pin in the hole of the pointer and in the hole of the lever (Fig. 3). Fix the holding pin in the bosshead (Fig. 4).
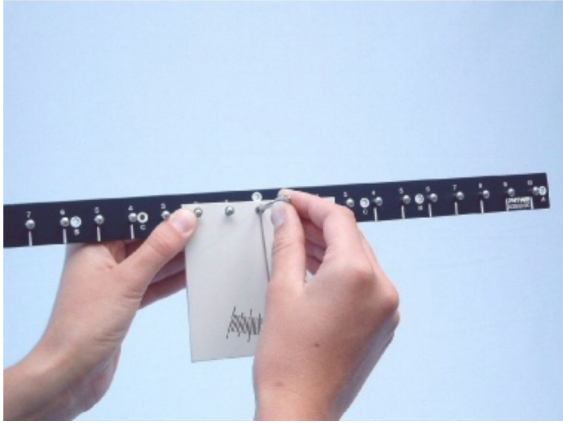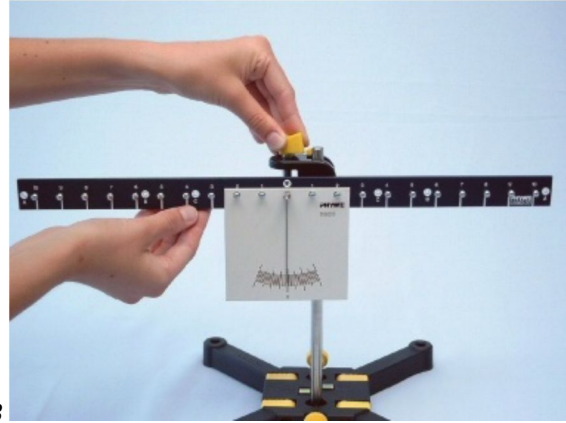
Fig. 3

Fig. 4

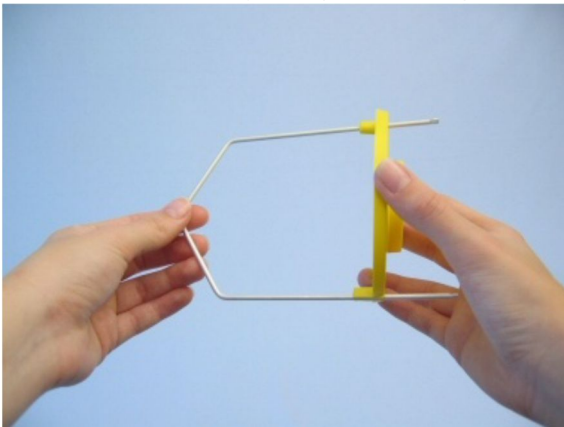Assemble the balance pan (Fig. 5) and hang each of them up at the end of the lever (Fig. 6).
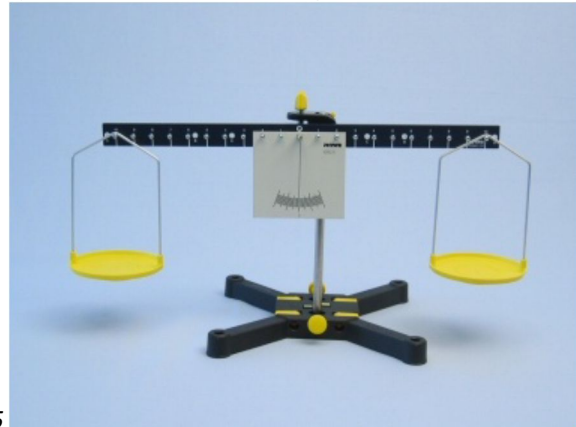

Fig. 5

Fig. 6

Place the pointer in such a way, that it points exactly to the zero mark (Fig. 7).

Fig. 7

Action

Determine the mass *m* of the wood, the iron and the aluminum columns as well as that of the 50 g weight from the weight set with the balance (Fig. 8) and record the values in Table 1 on the Results page.
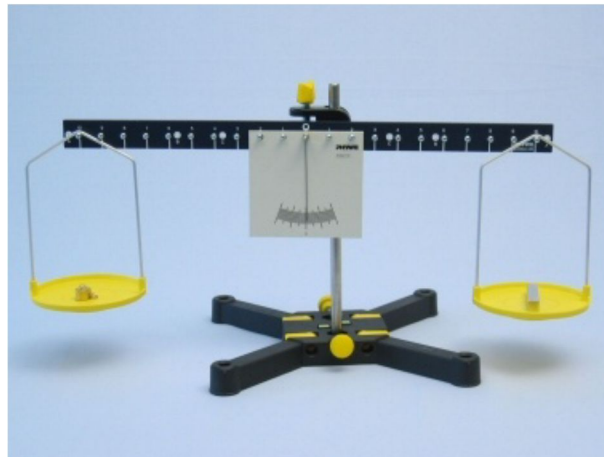
Fig. 8

Measure the length, width and height of the 3 regular bodies (Fig. 9) and calculate their volume $V = l \times w \times h$ using the measured values. Record these values in Table 1, too.
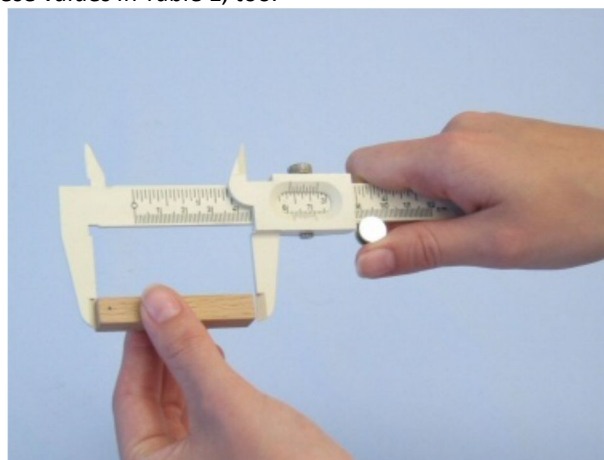

Fig. 9

Determine the volume of the weight using the immersion method:
- Fill the graduated cylinder with 30 ml water (V_0) and read the water level.
- Attach a piece of fish line to the weight and lower it into the graduated cylinder so that it is completely covered with water (Fig. 10). Read the new water level (V_1).
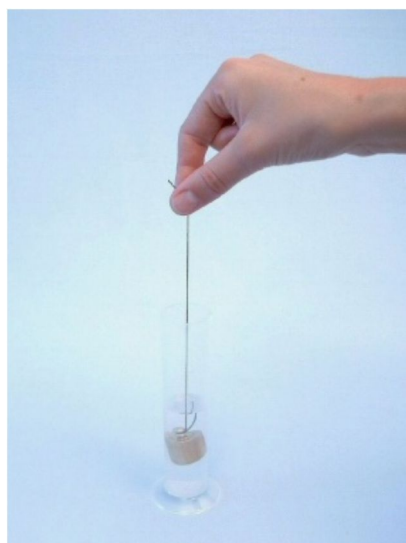- Calculate the volume of the weight and record all the values in Table 1 on the Results page.

Fig. 10

In order to disassemble the support base you should press the yellow buttons (Fig. 11).
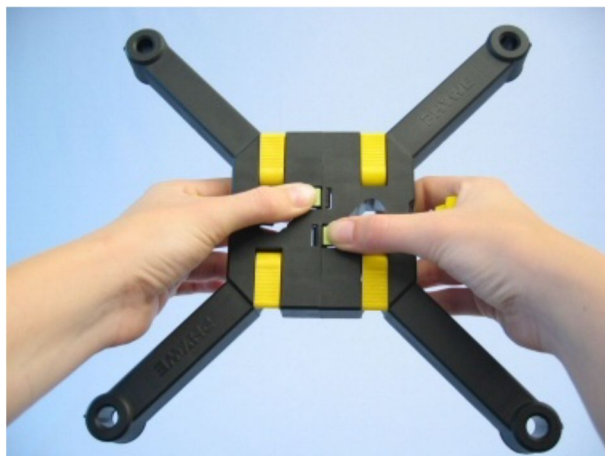

Fig. 11

Results

Table 1

Object	m in g	l in cm	w in cm	h in cm	V in cm^3	ρ in g/cm^3
wood column						
aluminium column						
iron column						

	m in g	V_0 in cm^3	V_1 in cm^3	V in cm^3	ρ in g/ cm^3
mass piece					

Evaluation

Question 1:
Calculate the density of the 4 objects in g$/$cm$_3$ from the values for mass m and volume V according to the formula $\rho = m/V$. Enter your results in Table 1 (Results page).

Question 2:
What have you noticed about the density of wood?

Question 3:
Compare the density of the mass piece with that of the metal columns. Arrange the objects in sequence according to their densities.

Question 4:

Can you state the densities of other materials? Are there substances which are more dense than iron?