

2.11 Finding the center of gravity

Task

How can an object's center of gravity be determined?

The center of gravity of different flat objects is determined by balancing them on the point of a pencil. The results are confirmed by a plumb method for finding the center of gravity.



Use the space below for your own notes.

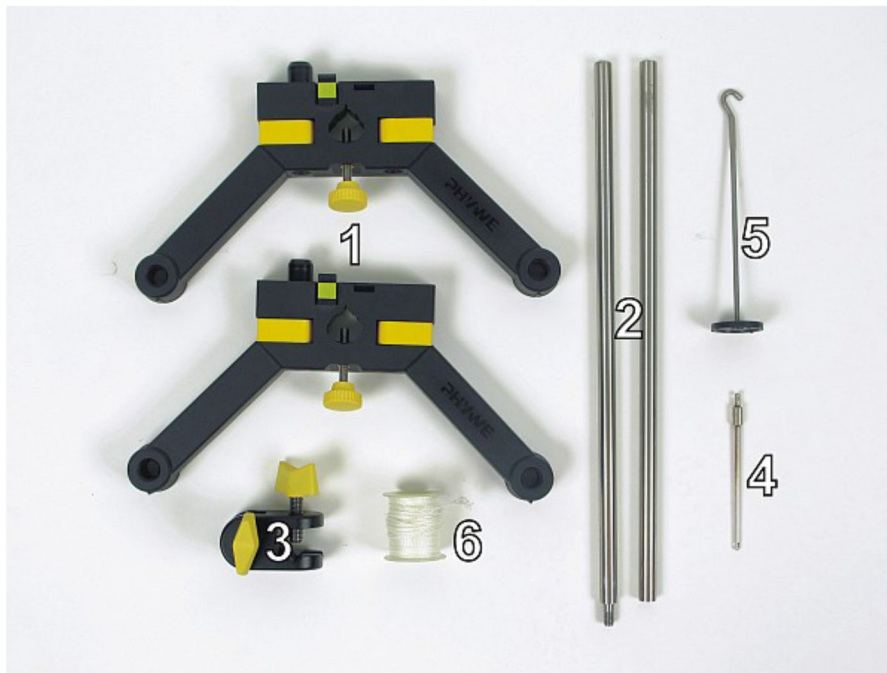
Material

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

Position No.	Material	Order No.	Quantity
1	Support base, variable	02001-00	1
2	Support rod, split in 2 rods, $l = 600$ mm	02035-00	1
3	Bosshead	02043-00	1
4	Holding pin	03049-00	1
5	Weight holder for slotted weights, 10 g	02204-00	1
6	Fish line, in reel, $d = 0.7$ mm, 20 m	02089-00	50 cm

Additional Material			
	Paper with drawn objects		1
	Drawing cardboard (approx. DIN A4)		1
	Scissors		1
	Pencil		1

Material required for the experiment



Setup

- Download the template for the objects by clicking this link.
- Print the paper with objects, glue the paper to the cardboard and cut the objects (no. 1 - 6) out. With your pencil punch small holes in the objects at the indicated points so that the holding pin can pass through them.
- Screw the two splitted support rods together to get a long one (Fig.1).
- Setup a stand with the support base and the 60 cm support rod (Fig. 2 and Fig. 3).



Fig. 1

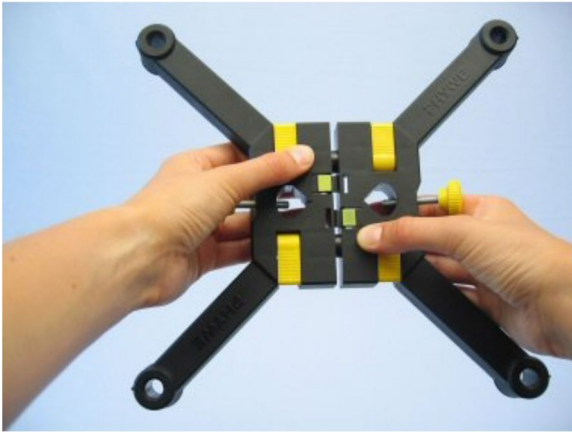


Fig. 2



Fig. 3

Hang one object in the holding pin, clamp the holding pin in the bosshead and hang the weight holder on the holding pin with a piece of fish line (Fig. 4).

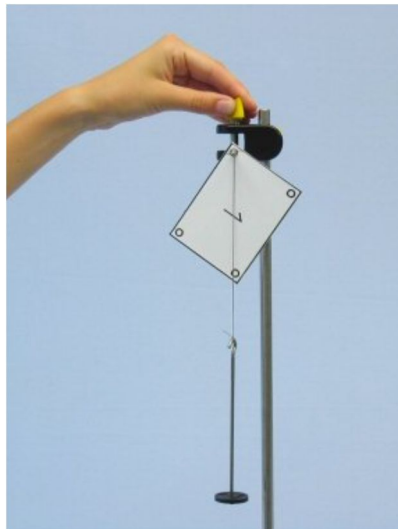


Fig. 4

In order to disassemble the support base you should press the yellow buttons (Fig. 5).

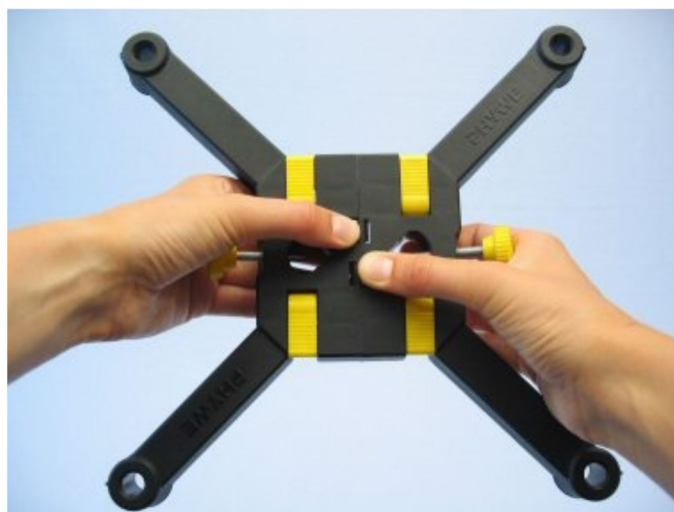


Fig. 5

Action

- Balance the objects 1 - 4 on the point of a sharp pencil and try to determine their center of gravity as exactly as possible (Fig. 6).

- Mark the determined center of gravity as exactly as possible with your pencil.
- Hang each of these objects on the holding pin which is fixed in the bosshead and check whether your marked point lies on the line indicated by the weighted fish line for all of each object's holes (Fig. 7).

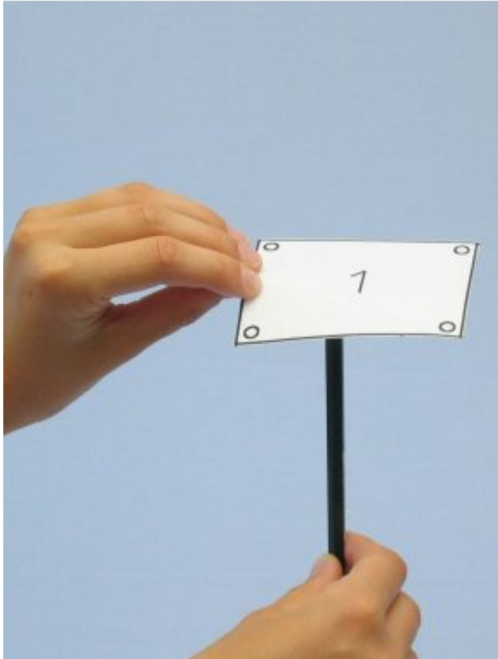


Fig. 6



Fig. 7

- Now, hang the irregularly-shaped plate (no. 6) with one of its holes on the holding pin, mark the fish line's path on the plate (Fig. 8); repeat this by rehanging the plate on several of its other holes.
- Check to see whether the lines intersect in one point.
- See whether the plate is in equilibrium when you hold your pencil under the point of intersection.

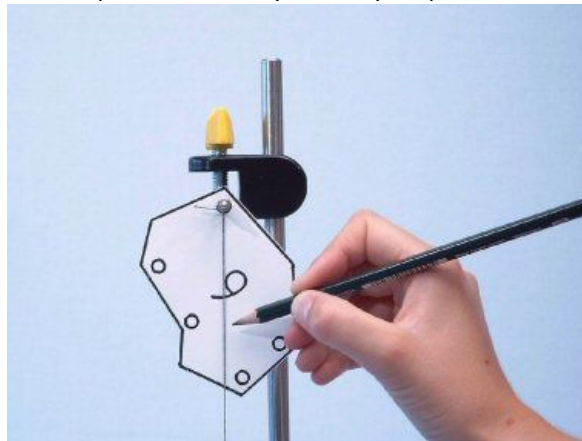


Fig. 8

Evaluation

Question 1:

Do the marked centers of gravity of objects 1 - 4 lie on the line indicated by the fish line?



Question 2:

What do you conclude from this?

Question 3:

Do you get the same center of gravity with both procedures?

Question 4:

Which method is surely more accurate?

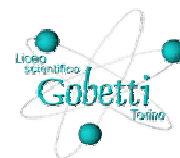
Additional Tasks

Question 1:

How is the center of gravity of object 5 determined?

Question 2:

Where is the center of gravity in this case?



Question 3:

Can you explain how the center of gravity of object 1 is determined using only a pencil and a ruler?
