5.7 Compound pendulum (physical pendulum)

Task

What property characterizes a reversion pendulum?

Measure the time required for 10 oscillations of a reversion pendulum at different suspension points. From this data determine the respective oscillation periods.
Measure the time required for 10 oscillations of a thread pendulum with a pendulum length which equals the "reduced pendulum length" of the rod pendulum.

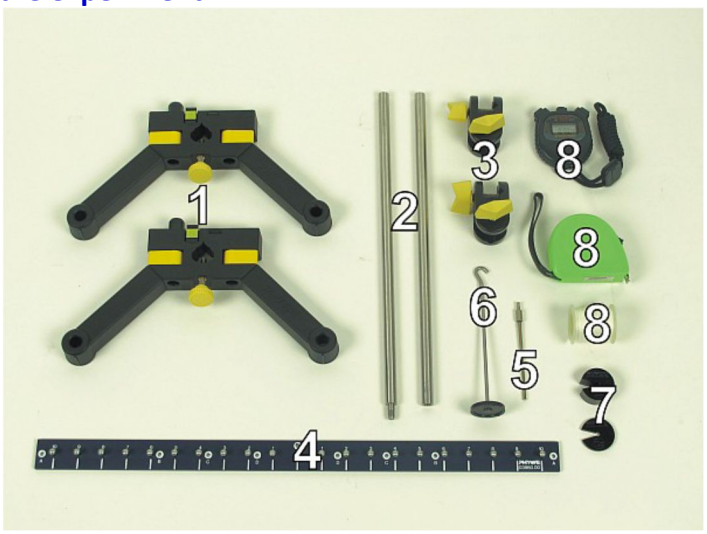
Use the space below for your own notes.

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	2
4	Lever	03960-00	1
5	Holding pin	03949-00	1
6	Weight holder for slotted weights, 10 g	02204-00	1
7	Slotted weight, black coloured, 10 g	02205-01	4
7	Slotted weight, black coloured, 50 g	02206-01	1
8	Stop watch, digital, 24h, 1/100 s and 1 s	24025-00	1
8	Measuring tape, *l* = 2 m	09936-00	1
7	Fish line, in reel, *d* = 0.7 mm, 20 m 02089-00	02089-00	80 cm

Material required for the experiment



Setup

Part 1

First screw the split support rod together (Fig. 1). Setup a stand with the support base (Fig. 2), put the support rod in the support base (Fig. 3).

Fig. 1

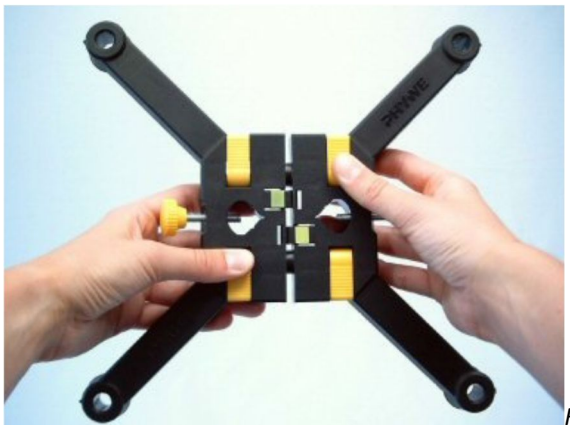


Fig. 2

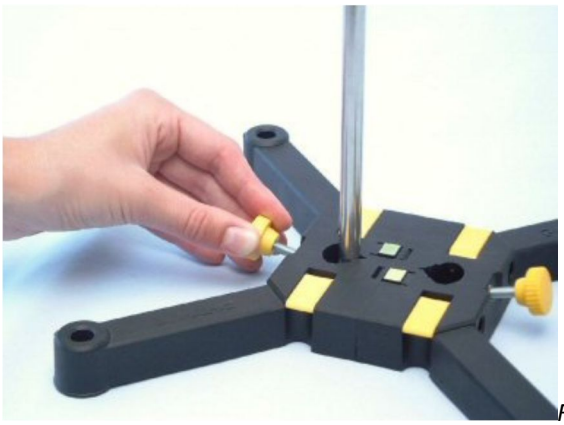


Fig. 3

Put the holding pin in the hole of the lever (Fig. 4). Fix the holding pin and the lever with the bosshead to the support rod.(Fig. 5).

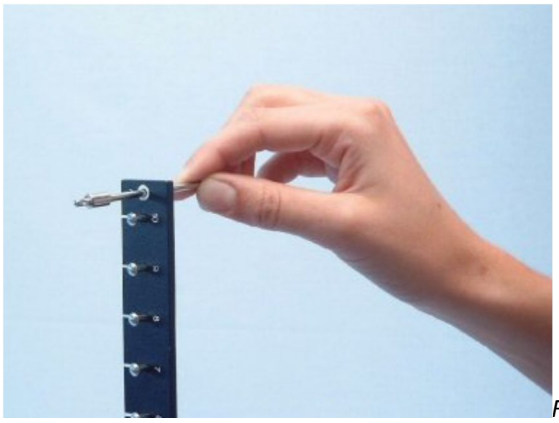


Fig. 4

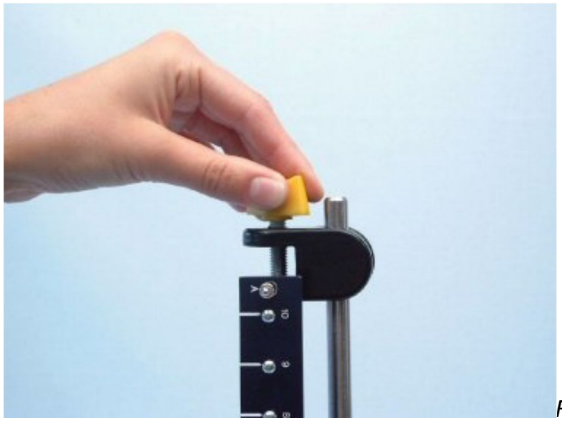


Fig. 5

Use the lever as a rod pendulum (physical pendulum) and hang it successively on the A, B, C, and D - holes on the left side of the lever (Fig. 6).


Fig. 6

Part 2

- Remove the lever.
- Fix the second bosshead to the support rod.
- Secure the holding pin with the upper bosshead so that the hole at its end is horizontal.

- Tie a piece of fish line to the hook of the weight holder and thread it through the hole in the holding pin (Fig. 7).
- Tie the fish line to the second bosshead (Fig. 8).

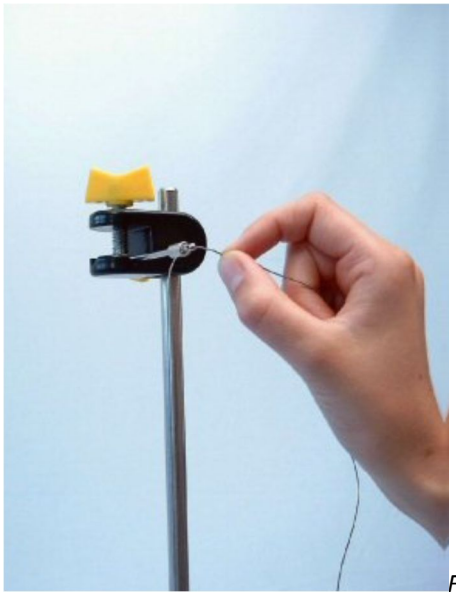


Fig. 7

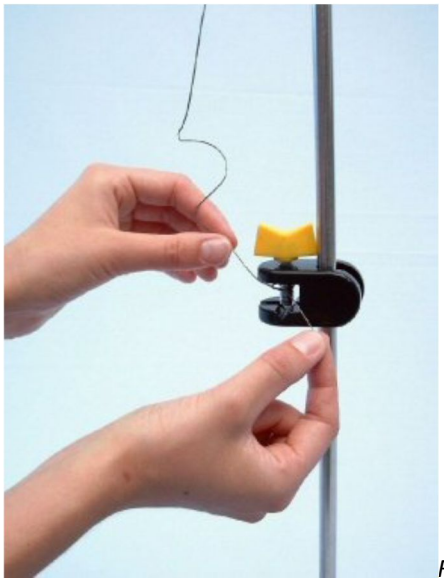


Fig. 8

- Place the weight on the weight holder so that the total weight is 70 g (Fig. 9).
- Adjust the height of the lower bosshead so that the total length from the upper anchor point to the middle of the weights is equal to the reduced pendulum length l_R of the reversion pendulum.


Fig. 9

Action

Part 1

- Deflect the lever and let it fall (Fig. 10).
- Measure the time t required for 10 oscillations at each suspension point.
- Record all the measured values in Table 1 on the Results page (for the names of the holes see Fig. 11).
- Measure the distance l_R between the suspension points A_{le} and C_{ri} and record this value in the table, too.
- Hang the lever on point C_{ri} and determine the time required for 10 oscillations again. Note the value in Table 1.


Fig. 10

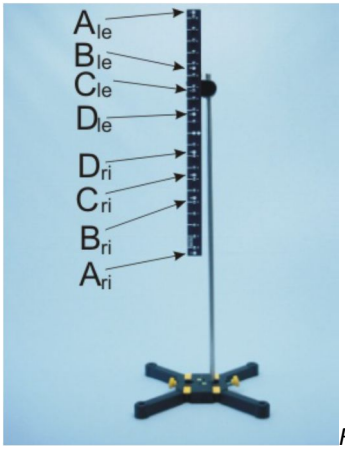


Fig. 11

Part 2

- Using the weight holder with a total mass of 70 g, set up a thread pendulum which length *l* is equal to the reduced pendulum length l_R of the reversion pendulum (part 1).
- Measure the time *t* required for 10 oscillations and note the value in Table 2 on the Results page.

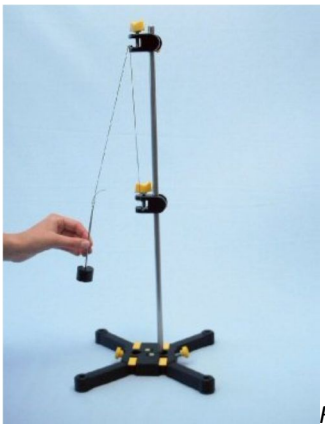


Fig. 12

In order to disassemble the support base you should press the yellow buttons (Fig. 13).


Fig. 13

Results

Part 1

Table 1, reversion pendulum

l_R = ____ cm

Suspension point	*t* in s	*T in s*
A_{le}		
B_{le}		
C_{le}		
D_{le}		
C_{ri}		

Part 2

Table 2, thread pendulum

l in cm	*t* in s	*T in s*

Evaluation

Part 1

Question 1.1:

From the time *t* required for 10 oscillations calculate the oscillation period *T* and record the values in the tables on the Results page.

Question 1.2:

Compare the oscillation periods with one another, what do you notice?

Question 1.3:

Do the oscillation periods for the suspension points C_{ri} and C_{le} differ?

Can you give reasons for this?

Question 1.4:

The distance between the suspension points A_{le} and C_{ri} is termed the "reduced pendulum length l_R". How large is it for this pendulum?

Question 1.5:

What can you say about its importance?

Part 2

Question 2.1:

Calculate the oscillation period *T* of the thread pendulum and record the value in Table 2 on the Results page.

Question 2.2:

Compare the oscillation period of the thread pendulum with that of the reversion pendulum for the suspension points A_{ri}, C_{le} and C_{ri}. What can you say about it?

Question 2.3:

Can you explain where the expression "reversion pendulum" (lat. Reversio = turn back) comes from?

Question 2.4:

Express the special property of a reversion pendulum in your own words.