Oscillation of a leaf spring (Item No.: P1002900)

Curricular Relevance

Area of Expertise:	Education Level:	Topic:	Subtopic:	Experiment:
Physik	Klasse 7-10	Mechanik	Schwingungen und Wellen	Schwingung einer Blattfeder

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Intermediate	10 Minutes	10 Minutes	2 Students

Additional Requirements:

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional Information

In the previous experiments, the students determined the oscillation period of a spring and of a thread pendulum, and its dependence on the mass. They also determined the spring constant and pendulum length respectively.
In this experiment they should establish the dependence of the oscillation period on the mass and length of a leaf spring pendulum.
Graphs generated from the results should be investigated, and the analogy to a thread pendulum considered.

Remark

As the measured results show, neither of the curves go through the origin when extrapolated. The reason for this is on the one hand the failure to consider the mass of the leaf spring itself, and on the other hand the influence of internal damping, which is dependent on the amplitude and the oscillation period.

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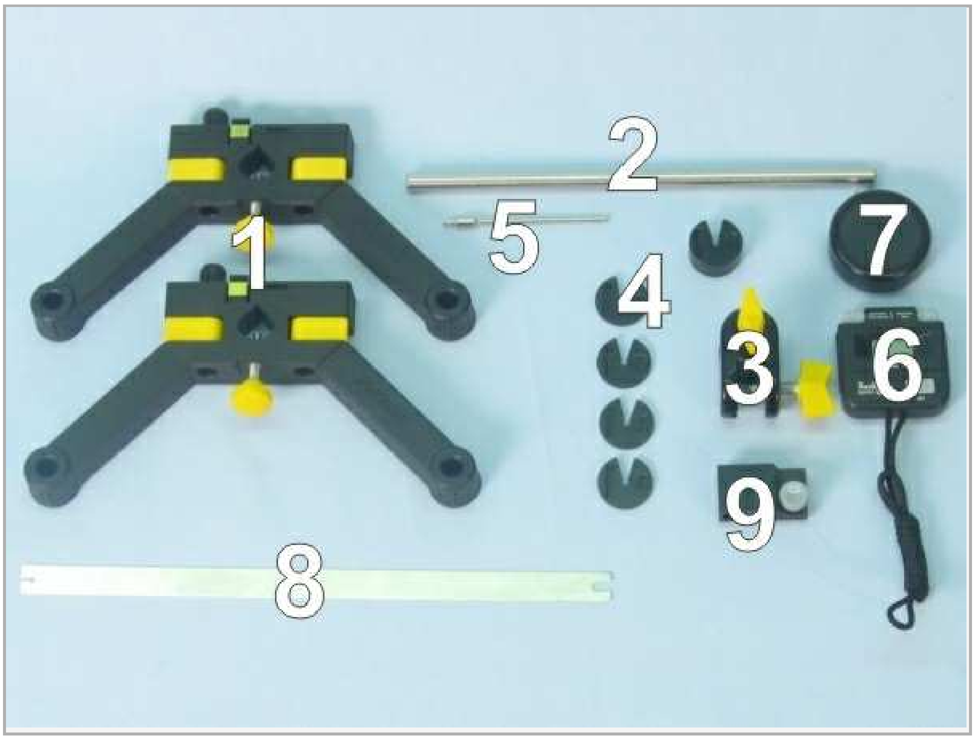
Task and equipment

Task

What is the effect of pendulum length and mass on the oscillation period of a leaf spring pendulum?

In this experiment you will determine the oscillation period of a leaf spring pendulum as a function of pendulum mass, and then as a function of pendulum length.

Equipment



Position No.	Material	Order No.	Quantity
1	Support base, variable	02001-00	1
2	Support rod, stainless steel, l = 250 mm, d = 10 mm	02031-00	1
3	Boss head	02043-00	1
4	Slotted weight, black, 10 g	02205-01	4
4	Slotted weight, black, 50 g	02206-01	1
5	Holding pin	03949-00	1
6	Stop watch 4	03078-00	1
7	Measuring tape, l = 2 m	09936-00	1
8	Leaf spring	02228-00	1
9	Leaf spring attachment	02228-05	1

Set-up and procedure

Set-up

Connect the two halves of the support base with the 250 mm support rod (Fig. 1). Clamp the bosshead to the support rod (Fig. 2).

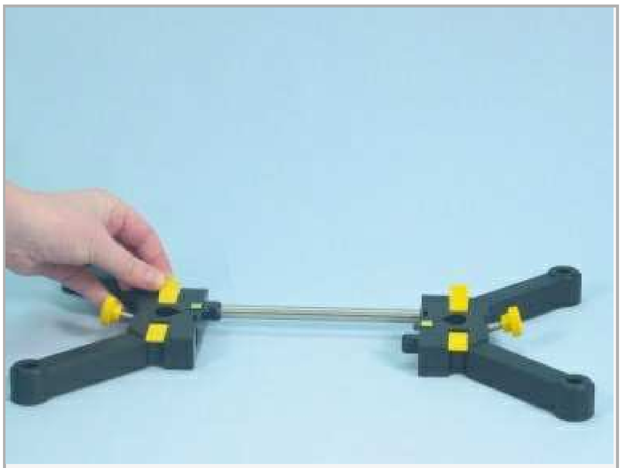


Fig. 1

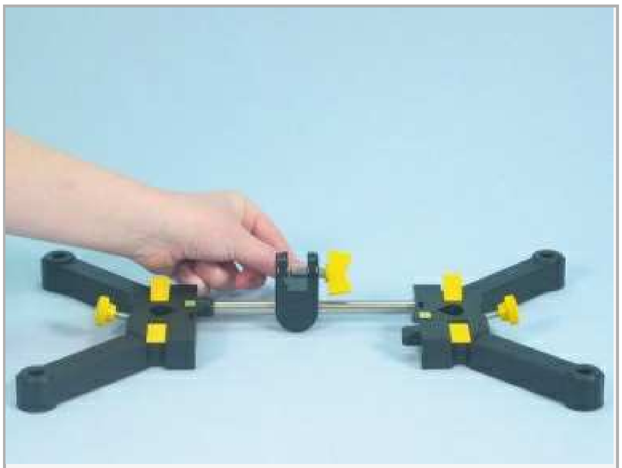


Fig. 2

Clamp the leaf spring in the leaf spring attachment (Fig. 3) and fix both to the bosshead (Fig. 4). Make sure that the leaf spring can oscillate horizontally above the table without touching it.

Fig. 3

Fig. 4

Insert the holding pin into the hole in the leaf spring attachment (Fig. 5).

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Fig. 5

Procedure

Part 1

- Make sure that the leaf spring is clamped into the bosshead in such a way that the total length of the leaf spring pendulum is l = 28 cm.
- Set the leaf spring pendulum in oscillation and determine the time t_{10} required for 10 oscillations. Record the result in Table 1 in the report.
- Now increase the additional mass m_a of the pendulum, in 10 g steps, up to a maximum of 60 g, by adding mass pieces to the holding pin (Fig. 6).
- In each case determine the time required for 10 oscillations and record the values in Table 1 in the report.

Fig. 6

Part 2

- Load the leaf spring attachment with 40 g and determine the time t_{10} required for 10 oscillations. Record the result in Table 2 in the report.
- Now shorten the spring pendulum in steps of 4 cm, down to a minimum of 16 cm, by clamping the leaf spring to the bosshead in different positions (Fig. 7).
- In each case determine the duration of 10 oscillations and record the values in Table 2 in ther report.

Fig. 7

Report: Oscillation of a leaf spring

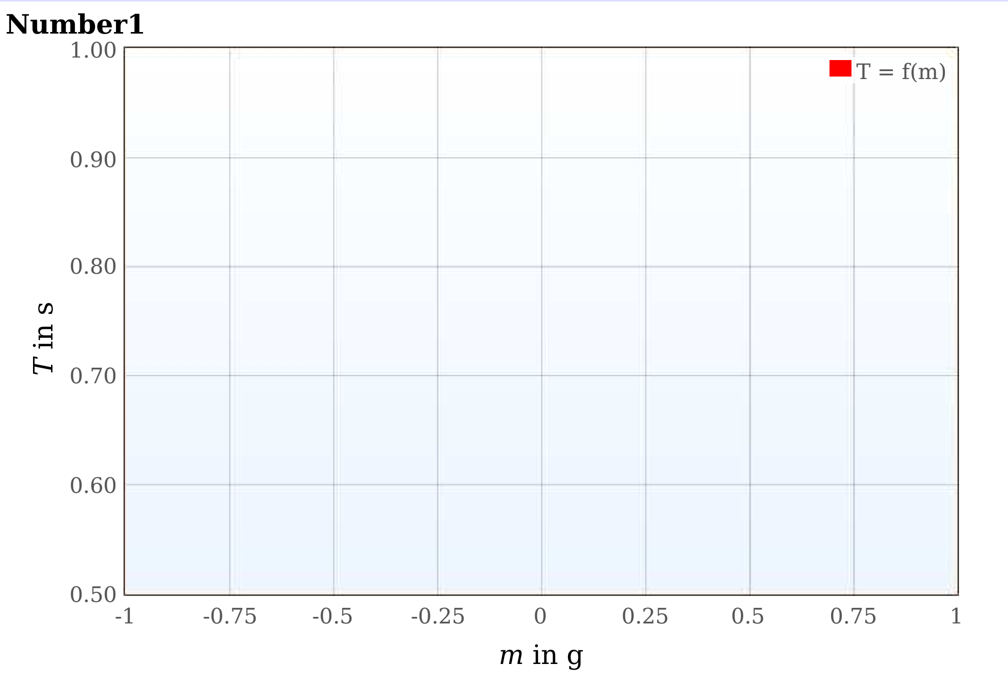
Result – Table 1

Enter your measured values of the experimental part 1 in the table.

Note: The mass of the leaf spring attachment with holding pin is 27 g. l = 28 cm

From the values of t_{10} for each mass calculate the oscillation periods T for one oscillation and add them to the table.

m_a in g	m in g	t_{10} in s	T in s
		5,3	0,53
		6,1	0,61
		7,0	0,70
		7,6	0,76
		8,3	0,83
		9,2	0,92
		9,8	0,98



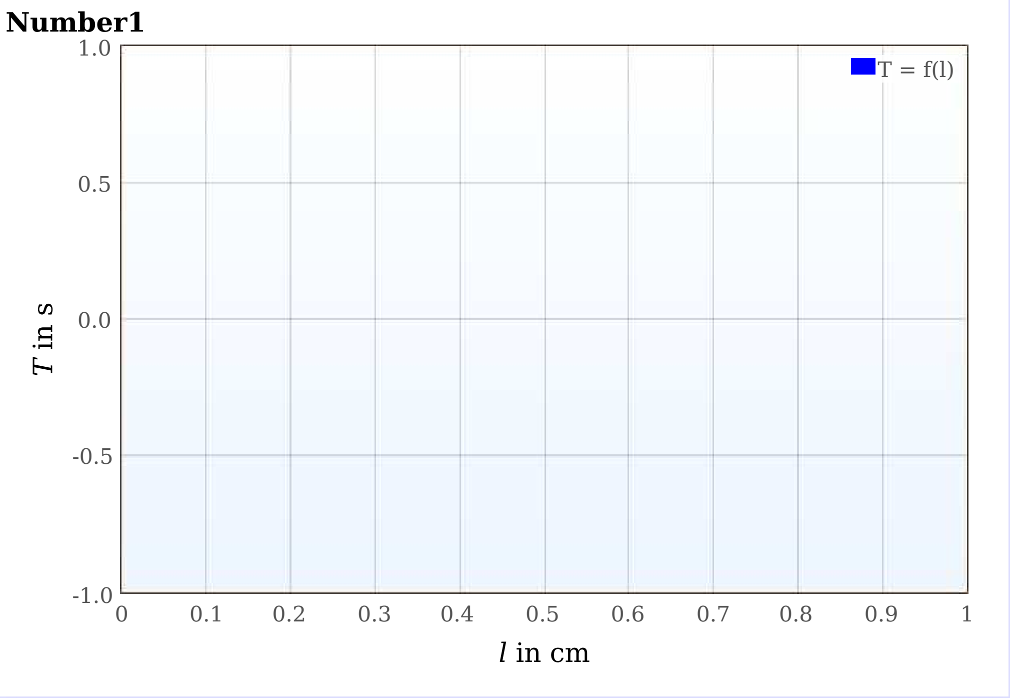
Result – Table 2

Enter your measured values of the experimental part 2 in the table.

Note: m = 40 g + 27 g = 67 g

From the values of t_{10} for each length calculate the oscillation periods T for one oscillation and add them to the table.

l in cm	t_{10} in s	T in s
	0	0
	0	0
	0	0
	0	0



Evaluation – Question 1

Look at the graph generated from Table 1 on the Results page (*T* as a function of *m*). What kind of curve do you see?

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Evaluation – Question 2

Look at the graph generated from Table 2 on the Results page (*T* as a function of *l*). What kind of curve do you see?

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Evaluation – Question 3

What is the effect of a reduction of the pendulum mass on the oscillation period of the leaf spring?

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Evaluation – Question 4

What is the effect of an increase of the pendulum length on the oscillation period of the leaf spring?

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Evaluation – Question 5

What analogies are there to a thread pendulum?

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