

Exercise 102: GRAVITATIONAL ACCELERATION

Keywords: physical (mathematical) pendulum; damped harmonic motion; Newton's 2nd law of dynamics; reversible pendulum.

The exercise aims at determining the gravitational acceleration by reversible pendulum.

Measurements:

1. The reversible pendulum has two axes (A, B) and two lens-shaped weights (S_1, S_2). Measure the time of 10 pendulum cycles hanging on the A axis and calculate the period T_A .
2. Systematically change the position of the S_1 weight by 5-10 cm along the A-B distance. At each setup measure the the T_A period.
3. Reverse the pendulum by hanging it on the B axis.
4. By changing the position of the S_1 weight accordingly and measure the T_B period.

Report:

1. Plot the periods T_A and T_B as a function of the S_1 weight position (both curves on the same graph).
2. The crossing point of the curves represents the T period identical for both setups and indicates on the *reduced length*. A **reduced length** of a physical pendulum is the length at which a mathematical pendulum has the same period.
3. Based on the determined reduced length l_r , calculate the gravitational acceleration g :

$$T = 2\pi \sqrt{\frac{l_r}{g}} .$$

4. Summarise the results.