Maritime University of Szczecin

Faculty of Marine Engineering

Department of Physics and Chemistry

Physics Laboratory

Laboratory Manual

Determination of the gravitational acceleration using a reversible pendulum

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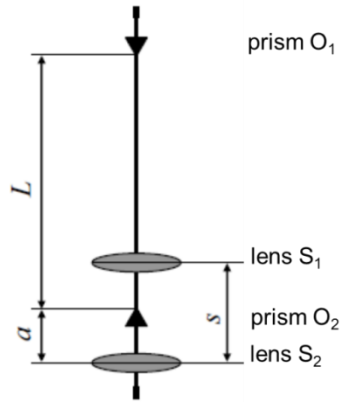
Equipment:

1. Reversible pendulum.
2. Ruler.
3. Stopwatch.

Exercise:

1. Check the distance between the individual elements of the reversible pendulum:



   - Prisms O_1 and O_2 should be placed at the distance L = 100 cm from each other;
   - Lens S_2 should be placed at the distance a = 22 cm from the prism O_2;
   - Lens S_1 should be placed at the distance s = 40 cm from the lens S_2.

2. Hang the pendulum on the prism O_1.
3. Measure time t_1 of ten whole pendulum's oscillations three times. If the difference between these three measurements of time exceeds 0.15 s, repeat the measurement and replace the outlied value.
4. Calculate average time $\overline{t_1}$ of ten oscillations.
5. Move the lens S_1 Δs = 10 cm in the direction of the prism O_1 and repeat time measurements described at point 3. Calculate time t_1 for subsequent distances s between the lenses. Continue this procedure until the distance between the lenses amounts to s = 100 cm.
6. Hang the pendulum on the prism O_2. Measure time t_2 and calculate the average time $\overline{t_2}$ of ten oscillations of reversible pendulum for the same distances s between the lenses as for prism O_1.
7. Calculate oscillation periods

$$T_1 = \frac{\overline{t_1}}{10} \quad \text{and} \quad T_2 = \frac{\overline{t_2}}{10}$$

   corresponding to given distances s between the lenses set for prisms O_1 and O_2, respectively.
8. Draw on one graph the dependence of oscillation periods T_1 and T_2 of the pendulum on the distance s between the lenses. From the graph read the times T_1 and T_2, which are the ordinates of points in which both curves intersect.

9. Calculate the average value of the oscillation period of the reversible pendulum corresponding to its reduced length L = 100 cm.

$$T_L = \frac{T_1 + T_2}{2}$$

10. Calculate the earth acceleration:

$$g = 4\pi^2 \frac{L}{T_L^2}$$

Table:

s [cm]	t_1 [s]	$\bar{t_1}$ [s]	T_1 [s]	t_2 [s]	$\bar{t_2}$ [s]	T_2 [s]
40						
50						
60						
70						
80						
90						
100						