

Advanced Lab for Gravitational Acceleration

Name:

Date:

Partners:

Introduction:

The period of a simple pendulum is:

$$T = 2\pi\sqrt{\ell/g}$$

where ℓ is the length of the pendulum (remember how to measure the length?). If you solve it for g (gravitational acceleration), we will obtain this formula

$$g = 4\pi^2\ell/T^2.$$

Experimental g:

Use five different lengths. For each of them, let the pendulum swing for a number of cycles and record the average period of those cycles determined by the photogate. Find g for each length, and calculate the average. You have to use SI units (meters, seconds, etc.).

ℓ	T	g = 4 π^2 ℓ / T ²
(m)	(s)	(m/s ²)
(m)	(s)	(m/s ²)
(m)	(s)	(m/s ²)
(m)	(s)	(m/s ²)
(m)	(s)	(m/s ²)
Average gravitational acceleration g		(m/s ²)

Theoretical g:

• Location: (latitude) ϕ = _____°N (elevation) H = _____ km

• Theoretical value of g:

$$g = 9.780356 \cdot (1 + 0.0052885 \cdot \sin^2\phi - 0.0000059 \cdot \sin^2 2\phi) - 0.003086 \cdot H = \text{_____} \text{ m/s}^2$$

Error Analysis:

$$\frac{|\text{Avg. of the experimental data} - \text{the theoretical value}|}{\text{the theoretical value}} \times 100 = \text{_____} \%$$

In your report, be sure to address following problems:

- How does the length affect the accuracy?
- What are the most significant sources of errors in determination of g in this lab?