Laboratory report

Laboratory personel

Conducting the experiment: Nurmukhamed Orazbek,??????, [nur.orazbek005@gmail.com](mailto:nur.orazbek005@gmail.com)

List of equipment

* **Pendulum 4999** mathematical pendulum  
  L = 1.2 m cotton rope  
  m = 0.5 kg copper weight in the shape of a ball
* **Stopwatch and timer** application for android based smartphone devices  
  We are able to measure time with the precision of +/- 0.1 sec

Properties of the environment

Temperature: 19oC  
Pressure: 1026 hPa  
Relative humidity: 49%  
Location: U13, 18/A Bem square, 4032 Debrecen, Hungary  
Time: 06.10.2023. 14:00 – 16:00

The measurement method

1. We will fix the free end of the rope of the mathematical pendulum to the lattice of the lighting on the ceiling.
2. We grab the copper ball of the pendulum and move it out of the equilibrium position.
3. We release the pendulum, as a result it starts swinging.
4. We will record the swinging time, which is the period of this periodic motion. We will measure the total time of 20 swings of the pendulum, and increase the measurement precision.
5. We will repeat the experiment multiple times, and we will calculate the expected value.

The expected outcome

The measured value of g should be a quantity around 10 m/s2.

The calculation

From the scientific literature of mechanics we know:

The measurement data

|  |  |  |  |
| --- | --- | --- | --- |
| **Number of measurements** | **20T [sec]** | **T [sec]** | **g [m/s2]** |
| 1. | 15,213 | 0,76065 | 81,87875729 |
| 2. | 15,111 | 0,75555 | 82,9878593 |
| 3. | 15,301 | 0,76505 | 80,93965386 |
| 4. | 15,81 | 0,7905 | 75,81187419 |
| 5. | 14,991 | 0,74955 | 84,32177981 |

The outcome of the measurement

We measured the gravitational acceleration, and as a statistical random vairable it had an expected value (average) of 81,18798489 m/s2. This deviates largely from the expected outcome. The possible causes of this deviation:

* We will check the formula again, that may not be correct
* The measurement of time is not precise enough for this formula
* We did not confirm the length of the pendulum by measurement