PHY1002 Physics Laboratory (2022-2023 Term 2)
Short Report

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Experiment 3. Conservation of Energy (Ballistic Pendulum)

1. Fill in the table below from the pendulum experiment:

No. of Measurements	Angle θ (rad)	h (m)	v_0 (m/s)
1	0.283 ± 0.002	0.0143 ± 0.0007	5.20 ± 0.01
2	0.280 ± 0.002	0.0140 ± 0.0007	5.14 ± 0.01
3	0.281 ± 0.002	0.0141 ± 0.0007	5.16 ± 0.01
4	0.276 ± 0.002	0.0136 ± 0.0007	5.07 ± 0.01
5	0.276 ± 0.002	0.0136 ± 0.0007	5.07 ± 0.01
Average with Standard Error	0.279 ± 0.001	0.0139 ± 0.0001	5.13 ± 0.03

2. Fill in the table below with V_0 measured by photogate:

No. of Measurements	v_0 (m/s)
1	5.25 ± 0.08
2	5.24 ± 0.08
3	5.22 ± 0.08
4	5.26 ± 0.08
5	5.26 ± 0.08
Average with Standard Error	5.25 ± 0.007

3. How well does the initial speed, V_0, calculated from Equation 4, agree with the value measured directly using the photo gates? What does this show? Why is error analysis important?

   In order to assess the agreement between the initial speed, v_0, calculated from Equation 4, and the value measured directly using the photogates, we can determine the relative error, also known as the percent error, between these two values.

   $\text{Percentage Error} = \frac{|\texttt{Measured Value} - \texttt{Calculated Value}|}{\texttt{Measured Value}} \times 100\%$

   Using the given values, we have the percentage error $\frac{|5.25-5.13|}{5.25} \times 100\% \approx 2.29\%$

   The percent error of approximately 2.29% indicates that the initial speed calculated from Equation 4 agrees reasonably well with the value measured directly using the photogates. This small error demonstrates that the experimental setup and the theoretical model are consistent and reliable.

   Error analysis is important in any experimental study for several reasons:

   (a) Assessing the accuracy and reliability of the results: By quantifying the error, we can determine how well the experimental results agree with theoretical predictions or known values. This helps to establish the validity of the experiment and the model being tested.

   (b) Identifying sources of error: Analyzing errors allows us to identify potential sources of inaccuracies and inconsistencies in the experimental procedure or data collection. This information can be used to improve the experimental setup or methodology in future studies.

   (c) Comparing different methods or instruments: Error analysis can help to compare the performance of different experimental methods or instruments and identify the most accurate and precise approach.

— End of Laboratory Report —