Trevor N. tln32 Lab1 PHYS121 Sec: 118-B Section 11

	Weight (g) Tennis Ball	Length (cm) String	Diameter (cm) Tennis Ball	Length (m) Total	Period (s) 10 swings	Period (s) 1 swing	g (m/s²)	Weight (N)
1	58	65.5	6.31	0.68655	16.18	1.618	10.35321	0.55
2	58	65.7	6.35	0.68875	16.33	1.633	10.19645	0.53
3	58	65.8	6.40	0.69000	16.10	1.610	10.50890	0.54
4	58	65.9	6.41	0.69105	16.24	1.624	10.34421	0.54
5	58	65.7	6.21	0.68805	16.29	1.629	10.28617	0.55
6	58	66.1	6.30	0.6925	15.88	1.588	10.84123	0.55
7	57	66.0	6.21	0.69105	16.07	1.607	10.56422	0.53
8	57	66.3	6.26	0.69430	16.02	1.602	10.66026	0.52
9	57	66.2	6.18	0.69290	15.94	1.594	10.76598	0.51
10	58	66.2	6.28	0.69340	16.02	1.602	10.66642	0.52
mean	57.7	65.94	6.291	0.690885	16.107	1.6107		0.534
SD	0.48305	0.26331	0.07923	0.00251	0.14989	0.01499		0.0143
SE	0.15275	0.08327	0.02505	7.9493×10^{-4}	0.0474	0.00474		0.00452

$g = 4\pi^2 \frac{l}{T^2}$ $\quad g \approx 10.51277\ m/s^2 \simeq \boxed{g = 10.5\ m/s^2}$

$\delta_g = \sqrt{\delta_{gl}^2 + \delta_{gT}^2}$ $\quad \delta_g \approx 0.06304531 \simeq \boxed{\delta_g = 0.1\ m/s^2}$

$\delta_{gl} = \frac{4\pi^2}{T^2}\delta_l$ $\quad \delta_{gl} \approx 0.01209649$

$\delta_{gT} = -8\pi^2 \frac{l}{T^3}\delta_T$ $\quad \delta_{gT} \approx 0.06187395$

Result: $g = \boxed{10.5 \pm 0.1\ m/s^2}$

Procedure:

- Measure
  - Mass of Tennis Ball
  - Weight of Tennis Ball w/ scale
  - Length of string from Ball to end w/ meter stick
  - Diameter of Ball w/ calipers
  - Period of 10 swings w/ stopwatch

- Setup
  - Attach a string to a tennis ball w/ a loop on the other end.
  - Suspend the tennis ball by the string such that the tennis ball is only touching the string

- Measure Period by deviating the tennis ball from equilibrium by less than 5° off the vertical.

Our measurement only had one decimal place as we had to estimate that due to the stick being obstructed by the ball

- Analysis
  - Derive the length from the tip of the string to the center of the ball from the length & diameter measurements
  - Derive the time of one period from the measurement of 10.
  - Find the mean, SE, SD of all measurements
  - Calculate g from the formula of $g = 4\pi^2 \frac{l}{T^2}$ & the means of measurements
  - Derive δ_g from δ_T and δ_l

□PHYS115 □PHYS121 □PHYS123
□PHYS116 □PHYS122 □PHYS124
Lab Cover Letter

Author (*You*) Trevor N. Signature: Trevor N.

I declare that this assignment is original and has not been submitted for assessment elsewhere, and acknowledge that the assessor of this assignment may, for the purpose of assessing this assignment: (1) reproduce this assignment and provide a copy to another member of faculty; and/or (2) communicate a copy of this assignment to a plagiarism checking service (which may then retain a copy of this assignment on its database for the purpose of future plagiarism checking).

Lab Partner(s) Katherine

Date Performed 24/01/24 Date Submitted 25/01/24

Lab (*such as #1: UNC*) #1: UNC

TA: Phillip

GRADE (*to be filled in by your TA*) See your TA for detailed feedback.
An '*x*' next to a subcategory means you need to improve this aspect of your work.

Paper Subtotals (points)

( ) ***General*** **(6)**
____ Sig. figs.
____ Units
____ Clarity of Presentation
____ Format

( ) ***Abstract*** **(4)**
____ Quantity or principle
____ How measurement was made
____ Numerical Results
____ Conclusion

( ) ***Intro & Theory*** **(9)**
____ Basic principle
____ Main equations to be used
____ Apparatus
____ What will be plotted
____ Fitting parameters related

( ) ***Exp. Procedures*** **(15)**
____ Description
____ Stating and justifying uncertainties
____ Data Record
____ Quality of Lab Work

( ) ***Analysis & Error Analysis*** **(20)**
____ Discussion
____ Equations & Calculations
____ Presentation inc. Graphs, Tables
____ Results Reported & Reasonable
____ Underlined items addressed

( ) ***Discussion & Conclusions*** **(6)**
____ Numerical comparison of results
____ Logical conclusions
____ Discussion of pos. errors
____ Suggestions to reduce errors

( ) **Paper Total (60 points)**
(30 points for CME or EPF)

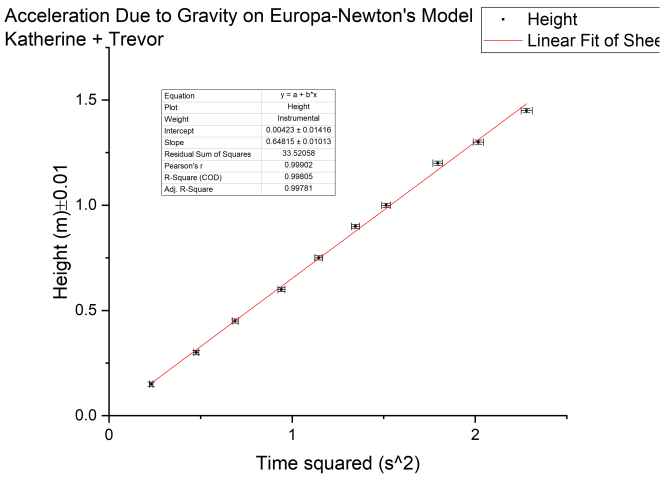
( ) **Notebook (10 points)**
____ Format (*proper style, following directions*)
____ Apparatus (*brief description of equipment, including sketches*)
____ Data (*including computer file names and manually recorded data*)
____ Experimental Technique (*describing your procedures; stating & justifying uncerts.*)
____ Analysis (*results and errors*)

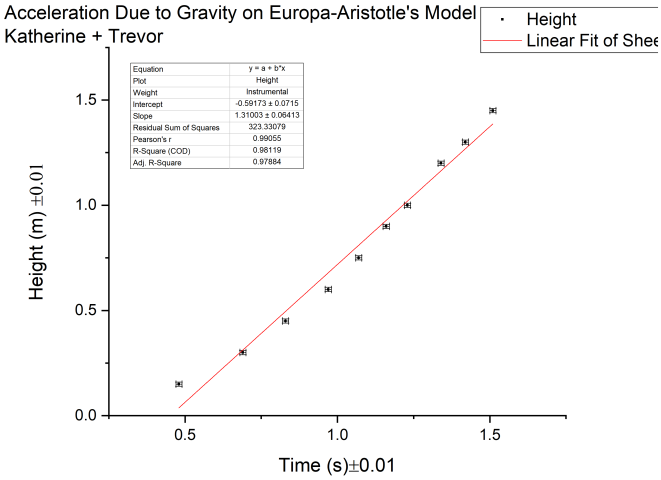
( ) **Worksheet(s)/Fill-in-the-Blank-Report (30 points)** *if applicable*

( ) **Adjustments** – late submissions, improper procedures, etc. – or bonus points for exceptional work.

( ) Total Grade

Graded by _____ *(TA's initial)*





a_N and δ_{aN} are shown on the graph

Newton's model is significantly closer to modeling the data than Aristotle's model. As you can see in the variance in the slope, Newton's has around 6x less variance and roughly one order of magnitude higher correlation (r). The data points on Newton's graph stay significantly closer to the fit line whilst Aristotle's model has a consistent and predictable deviation from the line of best fit. I would report a value of $0.65 \pm 0.001 \frac{m}{s^2}$ to my supervisor.