Phys 20AL Week 1 In Lab Notes: Pendulum

Zih-Yu Hsieh

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1 Aim of Experiment

The aim for this experiment is to understand how the period of a pendulum is affected by the length of the pendulum, and the mass of the pendulum.

2 Environment Setup

1. Prepare a stand and fix it at the edge of the table, and prepare a protractor that is fixed horizontally on the top of the stand.
2. Prepare a clip and a nearly massless string, combine one end of the string to the clip and clip it onto the stand. This is used for controlling the length of the pendulum.
3. Put the other end of the string through a hole on the top of the stand to setup a pivot for the pendulum.
4. Hang the mass for the pendulum at the end of the string that passes through the hole in 3.

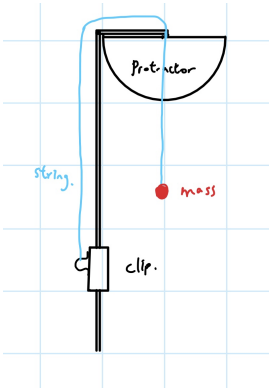

Figure 1: A Drawing of the Setup

3 Measurement, and Method of Measure

For each individual trial we'll record the length of the pendulum using tape measure or meter stick (unit: meter), use the mass scale to measure the hanged mass on the pendulum (unit: gram), and use the timer to measure the pendulum's period (unit: second).

- The lengths of the pendulum used are $0.3m, 0.4m, 0.5m$, and $0.6m$.
- The mass of the pendulum used are $5.5g, 20g, 66g$, and $71.5g$ (based on the provided weights).

For the experiment, we'll follow the procedure below:

1. First, fix a mass for the pendulum, then fix a length for the pendulum.
2. Raise the pendulum till it is $10°$ away from equilibrium and release.
3. Wait for the pendulum to complete 5 cycles, then record the period for the 6^{th} cycle.
4. Repeat Step 2 and 3 five times, with fixed mass and length.
5. Change the length of the pendulum, and repeat Step 2 to 4 for each desired length.
6. Change the mass of the pendulum, and repeat Step 2 to 5 for each desired mass.

Here, the idea is to first measure the affect of different lengths on the period of the pendulum when fixing the mass, then repeat similar process for each chosen mass.

4 Data and Uncertainties

Mass: 5.5g							
length(m) \ trial	1	2	3	4	5	Average	SD
0.3	1.08	1.04	1.13	1.15	1.06	1.092	0.0465832588
0.4	1.26	1.33	1.23	1.24	1.18	1.248	0.05449770637
0.5	1.41	1.48	1.38	1.43	1.39	1.418	0.03962322551
0.6	1.49	1.53	1.49	1.58	1.48	1.514	0.04159326869
Mass: 20g							
lengt \ trial	1	2	3	4	5	Average	SD
0.3	1.09	1.03	1.09	1.09	1.13	1.086	0.03577708764
0.4	1.06	1.29	1.29	1.19	1.24	1.214	0.09555103348
0.5	1.34	1.43	1.44	1.46	1.43	1.42	0.04636809248
0.6	1.59	1.51	1.58	1.51	1.53	1.544	0.03847076812
Mass: 66g							
length \ trial	1	2	3	4	5	Average	SD
0.3	1.01	1.08	1.11	1.04	1.09	1.066	0.04037325848
0.4	1.19	1.26	1.29	1.24	1.28	1.252	0.03962322551
0.5	1.34	1.43	1.44	1.46	1.43	1.42	0.04636809248
0.6	1.48	1.58	1.54	1.48	1.63	1.542	0.06496152708
Mass: 71.5g							
length \ trial	1	2	3	4	5	Average	SD
0.3	1.11	1.03	1.06	1.08	1.07	1.07	0.02915475947
0.4	1.23	1.23	1.34	1.21	1.23	1.248	0.05215361924
0.5	1.39	1.39	1.41	1.33	1.43	1.39	0.03741657387
0.6	1.54	1.54	1.53	1.51	1.58	1.54	0.02549509757

Some uncertainties (or sources of error) observed during the experiment includes: Air Resistence, error when doing measurement with raw eyes (when measuring length and angle of the pendulum), and Human's reaction time (when clicking the timer).