Chris Bero

PH114-08

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Daniel M., Eric M., Elizabeth S.

Oscillations

Statement of Purpose:

Our group will observe the correlation between a spring constant, mass pulled from equilibrium, and oscillation period.

Introduction:

Our group used a contraption consisting of a ring stand, force sensor, spring, masses, and ultrasonic distance sensor to measure the period of oscillations with differing masses. We then used this data to calculate the spring constant and determine the period of oscillation for each mass configuration.

Equipment:

Ring stand, meter stick, force sensor, masses, spring, distance sensor

Procedure:

1. Turn on the computer and open Datastudio
2. Set up ring stand with force sensor and spring
3. Calibrate force sensor
4. Measure equilibrium for spring
5. Add mass according to chart
6. measure displacement from equilibrium
7. repeat until chart is filled
8. Determine spring constant from linear fit in Datastudio
9. Reset Datastudio's run
10. Put 50 grams on spring, pull down 5cm and release
11. Record 10 periods
12. Calculate the average period of oscillation from Datastudio

Data:

Equilibrium Position = 0.034m

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Mass (g) | 20 | 30 | 40 | 50 | 60 | 70 |
| Stretch (m) | 0.059 | 0.089 | 0.113 | 0.139 | 0.175 | 0.209 |

Spring Constant K = -3.71N/m

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Peak | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Time (s) | 0.001 | 0.801 | 1.641 | 2.481 | 3.281 | 4.121 | 4.961 |
| Period (s) |  | 0.8 | 0.84 | 0.84 | 0.8 | 0.84 | 0.84 |

Average period T = 0.827s

Theoretical Value:

m = 0.050kg T=0.73s

Percent Difference = 11.73%

Analysis:

The data we collected during the experiment shows the relationship between a spring's k constant and the distance a hanging mass can displace the spring from equilibrium. As more mass is added, the displacement increases at a roughly linear rate. We found that the spring constant, k, can be calculated by viewing the relationship between mass and displacement. We saw that the period of oscillation of such a system can be determined from the mass and k constant as our data was reasonably close to the theoretical value. Sources of error may include inaccuracies in measuring equipment, a discrepancy in the k constant, or friction and drag due to air.

Conclusion:

In our experiment we discovered the relation between a system's hanging mass and its spring constant. We learned that the k constant may be found from the mass's weight and its effect on the spring's displacement. Our experiment also showed how the period and frequency of oscillation in such a system may be found from the gathered mass and constant.