Anthony Jaku, Miguel Fernandez , Esteban Perez

Mr. Thomas

AP Physics C: Mechanics

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Spring Force Lab Report

Purpose:

To determine the graphical and mathematical relationship between mass of the washers and force of gravity on the spring

Apparatus:


Prometheon

Procedure:

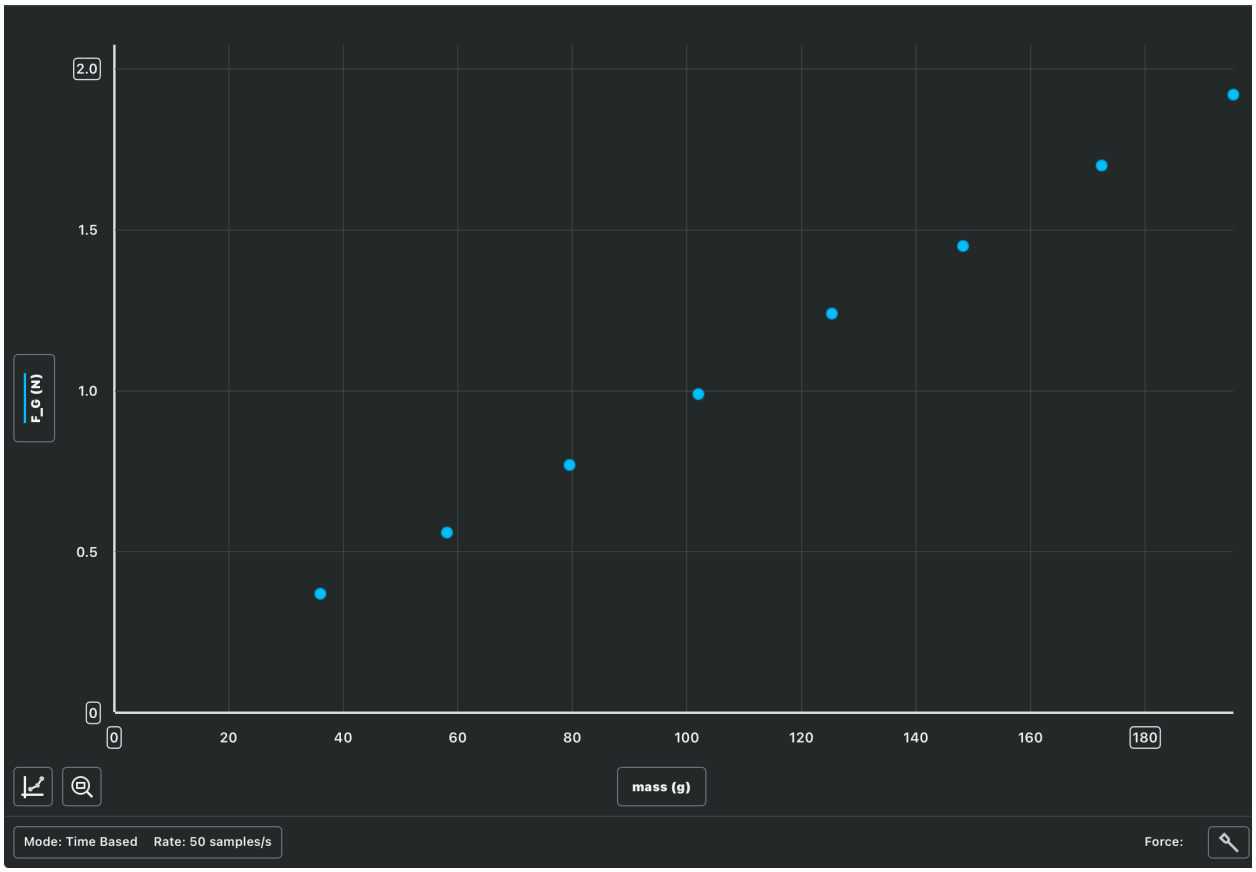
1. Zero the force sensor, then hang the spring with the hook ready for loading.
2. Add one washer stack, let it settle, then record the force reading shown by the sensor.
3. Increase the total mass by adding washers step-by-step, recording the single force reading for each mass value.
4. Perform this add-and-record sequence 8 times to obtain force data for 8 distinct masses.

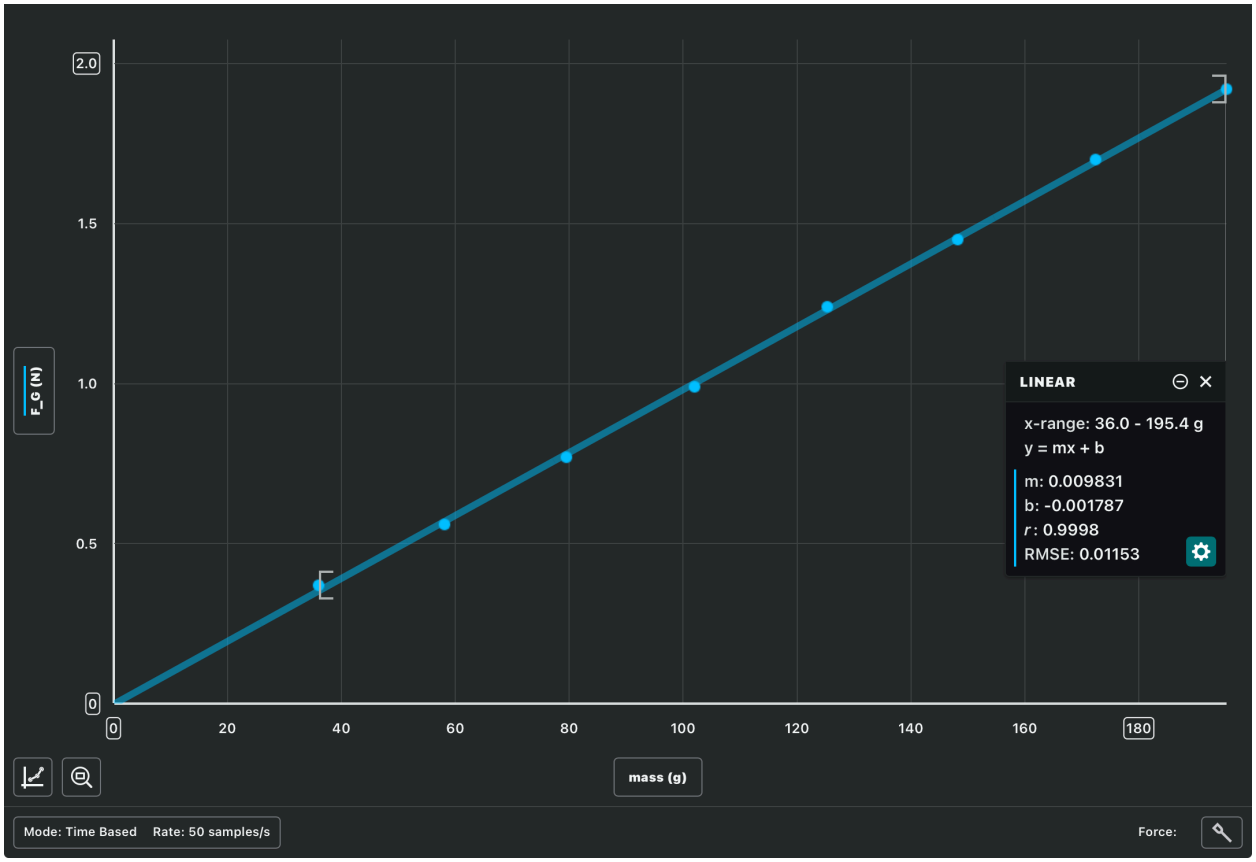
5. Plot the recorded force values versus the corresponding masses and fit a line to analyze the relationship.

Data Table:

	Data Set 1	
	mass (g)	Force (N)
1	36.0	0.37
2	58.1	0.56
3	79.5	0.77
4	102.0	99.00
5	15.3	1.24
6	148.2	1.45
7	172.4	1.70
8	195.4	1.92

Graphs and Analysis:





Fg = (0.009831 N/g) · m

g :kg = 1000:1

Fg = (9.831 N/kg) · m

Conclusion:

The results of the experiment demonstrate a direct proportionality between the gravitational force and the mass of the washers. As the mass increased, the measured force increased linearly, producing a best-fit slope of approximately 9.831 N/kg, which is very close to the accepted value of g=9.81 N/kg. This confirms the theoretical relationship $F_g = m \cdot g$, where the slope represents the gravitational field strength. The near-zero intercept suggests only minor instrument offset, and the correlation coefficient of 0.9998 indicates an excellent fit with minimal deviation.

Overall, the experiment successfully validated the proportional relationship between mass and gravitational force, with small discrepancies attributable to sensor calibration, oscillations, and measurement precision. With improved procedures and equilibrium control, the already strong agreement between experimental and theoretical values could be made even more precise.