

Force and displacement

Subject: Physics

Overview:

This simple experiment shows how the resultant force exerted by a spring and mass changes as the starting displacement is changed.

Equipment required:

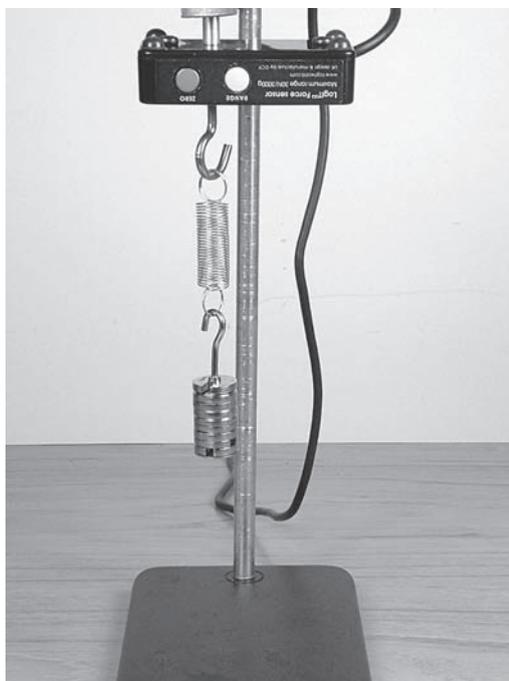
LogIT Force sensor.
LogIT datalogger.
Small spring.
Mass (we used 300g)
Clamp stand.
Ruler.

Hazards:

Do not allow large masses to be dropped in the lab as damage to person or equipment can result.
Always check your local regulations or the school advisory service such as CLEAPSS or SSERC for guidance on the use of any hazardous material.

Suggested method:

1. Screw the clamping rod into the base of the Force sensor.
2. Screw the hook into the top of the Force sensor.
3. Mount the force sensor into the clamp stand.
4. Gently hang the mass from the hook.
5. Start the logging software.
6. If using LogIT Lab, select the 'Setup' option on the 'Select New Activity' screen.
7. Choose 'Periodic', then '500' readings, then a timing interval of '20 milliseconds' for 10 seconds'.
8. With the spring stationary, zero the force sensor using the 'Zero' button on the side.
9. Displace the mass and release, then start logging.
10. Alter the displacement amount and press the 'O' key to Overlay the next trace.
11. When finished, use the 'smooth' function for each trace by placing the cursor into the readings box on the right of LogIT Lab and right click. From the menu select 'smooth'.



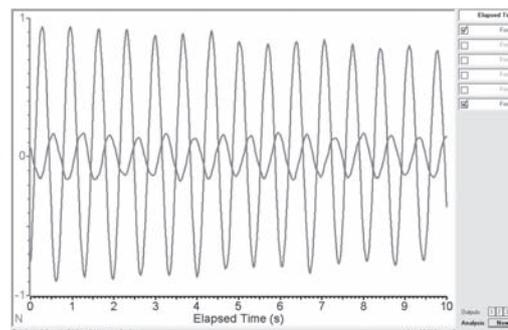
Note: By using the 'smooth' option, any signal to noise ratio errors which may have occurred during the experiment can be smoothed out. Some other third party force sensors use a switch mounted on the sensor to achieve the same result.

Results:

The graph shows two plots. The smaller one is a displacement of 1 cm and the larger plot is a displacement of 6 cm.

What has happened to the resultant force?
Has anything happened to the frequency of oscillation?
What does the graph show with regard the movement of the mass?
What would happen if you kept increasing the displacement?

Note: For clarity, the plots for 2,3,4 and 5 cm have been removed but can easily be analysed for further study.



Going further:

This experiment keeps the mass the same but varies displacement. What might happen if you kept the displacement the same but varied the mass? What effect might this have on the time period?
Investigate the simple pendulum using the force sensor. How might the time period for the pendulum be derived from the results?