Oscillations

Additional Equipment

- Rotary motion sensor, motion detector and force probe
- String and stopwatch
- Pendulum apparatus (solid rod with adjustable masses)
- Various colored springs
- Various masses

Objective

Data collection

- Quantitative analysis of oscillatory motion

Data analysis

- Determine oscillation period and frequency (angular position, velocity and acceleration)
- Fit appropriate functions to data

Physics Concepts

- Hooke's law, oscillation, resonance frequency

Conceptual (C-Level)

Draw a schematic and force diagram for a simple pendulum (like a kid on a swing).

- If the pendulum is set in motion, draw $\theta(t)$ (the angular position as a function of time). Compare to $x(t)$ and $y(t)$.
- What is the resonant frequency?
- Draw an energy diagram for one complete oscillation.

Draw a schematic and force diagram for an object that is attached to a spring (hanging vertically).

- If the object is set into motion draw $F_s(t)$ (the spring force as a function of time). Compare to $y(t)$.
- What is the resonant frequency?
- Draw an energy diagram for one complete oscillation.

Basic Lab (B-level)

Investigate a simple pendulum (mass on a string).

- Using a timing device determine the oscillation frequency.
- Match observation to theory

Investigate a physical pendulum (swinging rod).

- Using the rotary motion sensor determine the oscillation frequency and decay constant.
- Match observation to theory.

Investigate a mass on a spring.

- Using the force sensor (or motion detector) determine the oscillation frequency and decay constant.
- Match observation to theory.
- Adjust the spring system oscillation frequency to match the simple pendulum's frequency

Advanced/Extended Lab Ideas (A-level)

Choose your own topic to investigate. The topics below are only meant as possible suggestions.

- Create and analyze a Wilberforce pendulum.
- Analyze (quantify) other oscillatory systems
- Demonstrate and analyze coupled oscillators.