# Elastic Motion (Springs) and Oscillations

> The wonderful thing about Tiggers
> Is Tiggers are wonderful things
> Their tops are made out of rubber
> Their bottoms are made out of springs
> They're bouncy, trouncy, flouncy, pouncy
> Fun, fun, fun, fun, FUN!
>
> **Tigger's Song** From *Winnie the Pooh and Tigger Too*

## Equipment

- Various colored springs
- Mass hangers with masses
- Motion detector
- Force probe

## Objective

Data collection

- Quantitative analysis of oscillating spring and mass

Data analysis

- Determine the spring constant
- Determine oscillation period.
- Show energy is conserved (advanced)

Physics Concepts

- Hooke's law, spring constant and elastic potential energy

## Conceptual (C-Level)

Given two identical springs (with spring constant k) and a mass

- If both springs are hooked together in serial, what is the effective spring constant?
- If both springs are hooked together in parallel, what is the effective spring constant?

## Basic Lab (B-level)

Determine the spring constant of your spring using three different methods.

- Directly measure the spring stretch as a function of applied force (mass)
- Hang a mass from your spring and set the system oscillating. Use the force probe and motion detector to plot Force vs. Distance for the oscillating system.
- Plot x(t) for your oscillating spring-mass system. Find the resonant frequency and hence spring constant from the sinusoidal curve fit to the data.

## Advanced/Extended Lab Ideas (A-level)

Show that the total energy of the oscillating spring-mass system is conserved.

- Identify the different energy terms in the system.
- Carefully define the zero for your potential energy terms.
- Is there an exponential decay to the total energy? Comment on its relevance.