Newton's Laws experiments

The use of simple experiments within the study of Mechanics helps students to visualise and experience what is happening. It gives the opportunity to confront and deal with some of the misconceptions they hold and also provokes discussion about the modelling that is involved in any study of Mechanics.

The first of these experiments involves students using constant acceleration equations to calculate the deceleration caused by a resistive force. The second involves observing connected particles over a pulley and verifying Newton's Second law.

Experiment 1: Sliding an object along the floor

Purpose: To develop a greater appreciation of the constant acceleration model and its dependence on constant resistance.

Equipment:
- An object for sliding along floor
- Measuring tape
- Stopwatch

- An object is slid different distances over the same section of a floor.
- On each occasion the distance travelled, s, and the time taken, t, are recorded.
- Following the collation of results the graph of s against t^2 should be plotted.

Notes:

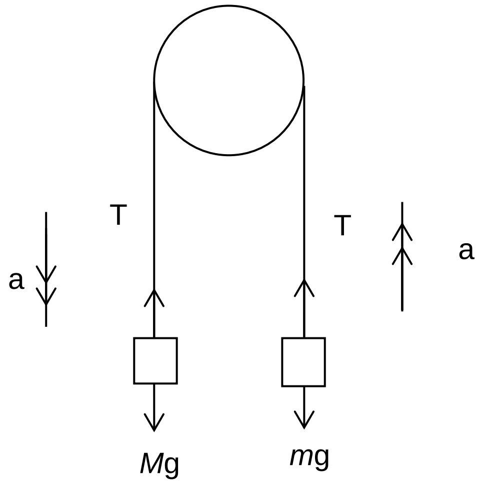
- If we assume the surface provides a constant resistive force then Newton's second law tells us that the deceleration is constant.
- From the constant acceleration formula $s = vt - \frac{1}{2}at^2$ with $v = 0$ our assumption indicates that plotting s against t^2 should result in a straight line through the origin.
- Some of the limitations of model include:
    - Regularity of frictional force
    - Impossibility of taking into account irregular motion such as skipping and rotating

Experiment 2: Verifying Newton's Second Law

Purpose: To consider motion of masses connected over a pulley and the equations which result in applying N2L

Equipment:
- Pulley & string
- 2 unequal masses
- Measuring tape
- Stopwatch

- Set up a pulley with objects of unequal mass suspended.



- Calculate the time taken for the system to move from rest through a given distance. Assume that the pulley is light and that there is no resistance to its turning.
- Check by experiment and comment on the results.

Notes:
- This works best if M and m are reasonably close.
- To minimise the effect of timing errors a large value of t is required and this is difficult to arrange.