NEATH PORT TALBOT COLLEGE
COLEG CASTELL NEDD PORT TALBOT

School of Maths & Science
Science Practical

To Verify Newton's Second Law

◆ Aim

To show that the acceleration of a trolley is proportional to the force applied

◆ Introduction

A trolley is placed on a low friction surface. The acceleration of a trolley can be determined by timing its motion through a light beam. The force applied to make the trolley accelerate is varied and the corresponding acceleration calculated.

◆ Safety

Control Measures

- You are reminded of the need of good laboratory practice in order to maintain a safe working environment.

Hazards

General Hazard — Please try to catch the trolley before it hits the end of the track. Make sure that the retort stand is suitably supported.

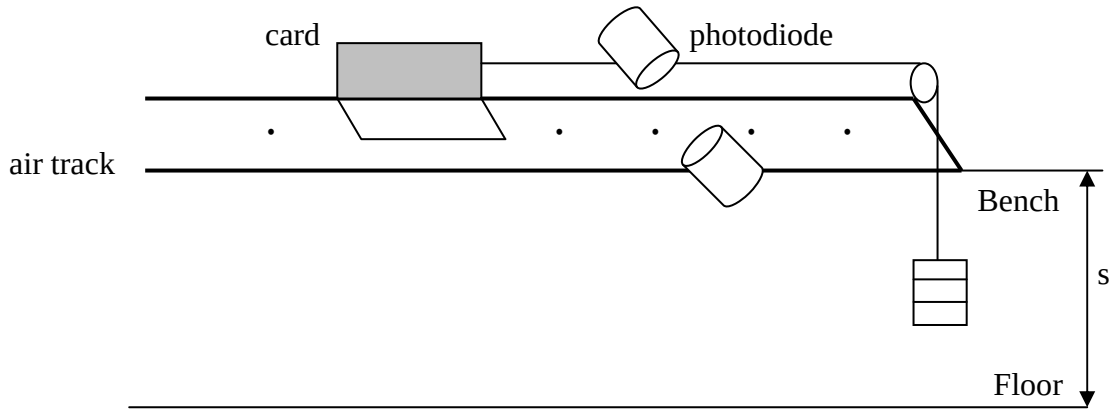
Electrical hazard — Timer and light gates work off mains electricity. Take care!

◆ Apparatus Required

Linear air track and air blower; electronic timer and photodiode assembly; set of weights; cotton; pulley; metre rule; retort stand, clamps and bosses; connecting leads.

◆ Procedure

1. Arrange the apparatus as shown in the diagram.



2. As the vehicle passes through the photodiode assembly the timer records the time for which the card interrupts the light beam. This is the time the vehicle takes to travel the length of the card. For more accurate results, the ‘effective length’ of the card is more important than the measured length. This is found by slowly moving the vehicle by hand along the track until the timer just stops. The distance moved is the effective length of the card which depends on the alignment of the lamp and cell.
3. Measure the effective length ‘x’
4. Attach cotton to the vehicle over a pulley to a small mass of 10g.
5. Pull back the vehicle until the mass is exactly 80cm above the floor. Make sure the card on the vehicle is more than 80cm from the light beam. This ensures that the forces acting on the vehicle ceases before the vehicle reaches the beam and that it travels through at constant velocity.
6. Release the vehicle and note its passage time through the beam. Repeat this twice more and find the mean.
7. Take further readings for 20g, 30g, up to 60g and tabulate your results on the next page.

force	t_1 (s)	t_2 (s)	t_3 (s)	t_{mean} (s)	x (m)	s (m)	v (ms^{-1})	a (ms^{-2})

8. Plot a graph of acceleration against force causing the acceleration.

9. What do you conclude from your graph?

N.B. since $v^2 - u^2 = 2as$ and u = 0, v = x/t then,

$a = v^2/2s$

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