

#### Practical 5 Rate of change of momentum using a trolley



#### Purpose

The aim of this experiment is to investigate rate of change of momentum using a trolley on a runway.

#### You will need:

- Trolley
- White plastic track
- Board
- Two light gates and suitable interface
- Bench pulley

- Thread
- Twelve washers (mass 10 g each) (a set of slotted masses could be used instead of the washers)
- Sponge to put on floor below the masses

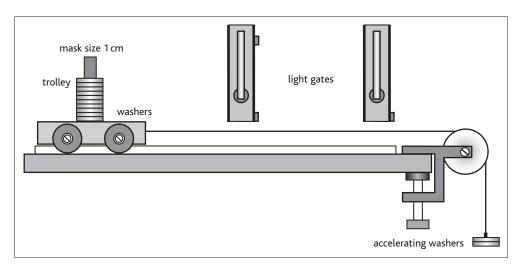


Figure 1: Using a trolley to investigate rate of change of momentum

### **Experimental instructions**

Set up your apparatus as shown in the diagram. Compensate the runway for friction by raising one end slightly. Check by giving the trolley a gentle push and measuring its velocity through both light gates – it should move along the runway at a constant velocity when there is no accelerating force on it. Set your interface unit to measure velocity at both gates and the time taken to travel between them.

Start with ten of your twelve washers on the trolley and the other two on the thread hanging down. The mass to be accelerated is the mass of the trolley and twelve washers while the accelerating force is the weight of the two suspended washers  $(0.2 \, \text{N})$ .

Allow the trolley to accelerate down the runway. Record the velocities of the trolley as it passes through light gates 1 and 2 and the time take for the trolley to travel between the gates. Repeat the readings and take an average.



# Practical 5 (cont.) Rate of change of momentum using a trolley

Repeat the procedure by taking one washer off the trolley and adding it to the suspended washers – the accelerating force is now  $0.3\,\mathrm{N}$  (same total mass). Carry on until you have only two washers left on the trolley. Record the values of accelerating force, velocity and momentum values at gates 1 and 2, the momentum change and the time between the light gates in a table.

## **Analysis and conclusions**

Calculate the rate of change of momentum for each accelerating force.

Plot a graph of rate of change of momentum against accelerating force.

Comment on the shape of graph and deduce the relationship between rate of change of momentum and accelerating force.