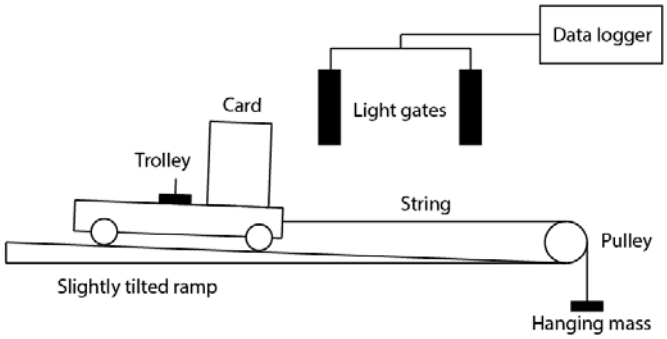
Edexcel Physics A Level

Core Practical 9

Investigating Change in Momentum

Method



- Set up apparatus as shown above with the pulley fixed to the edge of the desk and a string passing over it with one end attached to a pulley and the other end to a hanging mass
- Masses and a card are placed inside the trolley
- Measure the mass of the system, M, of masses both in the trolley and hanging off the string using a mass balance and the mass within the trolley only, m
- Measure the length of the card, L, using a ruler
- Release the trolley such that the hanging masses will fall vertically pulling the trolley along the ramp
- The initial and final velocity, u and v, of the trolley are calculated:

$$velocity = \frac{L}{t}$$

where t is the time recorded by the first light gate (for initial velocity) and second light gate (for final velocity)

- Calculate the change in momentum, Δp

$$\Delta p = M \times \Delta v$$

where Δv = v - u

- Calculate the force acting;

$$Force = \frac{\Delta p}{\Delta t}$$

where Δt is the time taken for the card to travel between the two light gates

- Repeat 3 times and calculate mean force
- Repeat procedure, moving the masses from the trolley to the hanger, recording $\frac{\Delta p}{\Delta t}$ and F (where F = mg, m is the mass in the trolley)
- Plot F against $\frac{\Delta p}{\Delta t}$ which should give a straight line, supporting the relationship;

$$F\Delta t = \Delta P$$

Impulse = Change in Momentum

Safety

- No major hazards, light masses are used so impact to feet etc. do not pose and major risks

Evaluation

- Assume mass of string negligible in the calculation of the mass of the entire system
- Assume the string is inextensible so that change in velocity of the hanging masses is the same as the change in velocity of the trolley
- Tilt ramp until trolley is just on the point of moving - to account for friction (friction changes the gradient as it makes the x axis variable smaller due to a larger t and a smaller velocity over the same distance)
- Using an air track negates the need for tilting the ramp
- Moving the masses from the trolley to the mass and the hangar makes sure the system is of constant mass
- Light gates can find acceleration also - use this to find a and plot essentially F=ma
- Considering energy of the trolley and energy of the falling mass - conservation of energy can also be investigated