Edexcel Physics IAL

Core Practical 9: Investigate the Effect of Force on an Object's Change of Momentum

Practical Notes

Core Practical 9: Investigate the Relationship Between the Force Exerted on an Object and its Change of Momentum

Equipment

- Trolley
- Slotted masses and hanger
- Bench pulley
- String
- Light gate
- Metre ruler
- Stop clock
- Runway
- Mass balance

Method

1. Attach the bench pulley to one end of the runway and position it so that this end hangs off the edge of the bench.
2. Secure the mass hanger to one end of the string and attach the other end to the trolley - pass the string over the pulley so that the trolley is on the runway and the mass hanger is sitting on the floor.
3. Move the trolley up the runway so the string becomes taut, but ensure the mass hanger remains touching the floor.
4. Pull the trolley further back up the runway until the mass hanger is lifted up to the pulley - add the five 10g masses to the trolley and hold it in place.
5. Release the trolley and start the stop clock - record the time it takes to reach the light gate (when the mass hanger reaches the floor) - record this time as T.
6. Also record them time reading given by the light gate - this is denoted by t.
7. Transfer a 10g mass from the trolley onto the mass hanger and repeat the process until all the masses are on the hanger. Each time, record the mass on the hanger, m.
8. Measure the distance that the trolley travels - this is denoted by d.
9. Measure the length of the interrupt card - this is denoted by L.
10. Use a mass balance to measure the mass of the trolley, string, masses and mass hanger - this is denoted by M.

Calculations

- Theory suggests that: Change in Momentum = Force x Time.
    - Change in momentum in this case is Mv, where v is the velocity of the trolley as it passes through the light gate and is given by L/t.
    - The force is mg, since it is the masses on the mass hanger that are providing the force.
    - Combining this produces Mv = mgT.
- Plot a graph of mT against v, and draw a line of best fit.
    - The gradient is equal to mT/v and so compare this value to your calculated value for M/g.

Tips

- The runway should be slightly inclined to compensate for the friction between the trolley and track.
- The graph you plot should form a straight line that passes through the origin.
- To develop the analysis further, error bars and the steepest and shallowest lines that pass through these bars can be drawn on - the gradients of these two lines can then be calculated, and if your value for M/g lies within these two gradients, it can be concluded that Newton's second law is being observed.

Safety Precautions

- Don't stand underneath the mass hanger since it can cause injury if it falls.