



Practical 4 Rate of change of momentum using a linear air track



Purpose

The aim of this experiment is to investigate rate of change of momentum using a linear air track.

You will need:

- Linear air track
- Air blower
- Rider
- Two light gates and suitable interface
- Pulley suitable for fixing to the air track
- Thread
- Set of slotted masses (10 g)

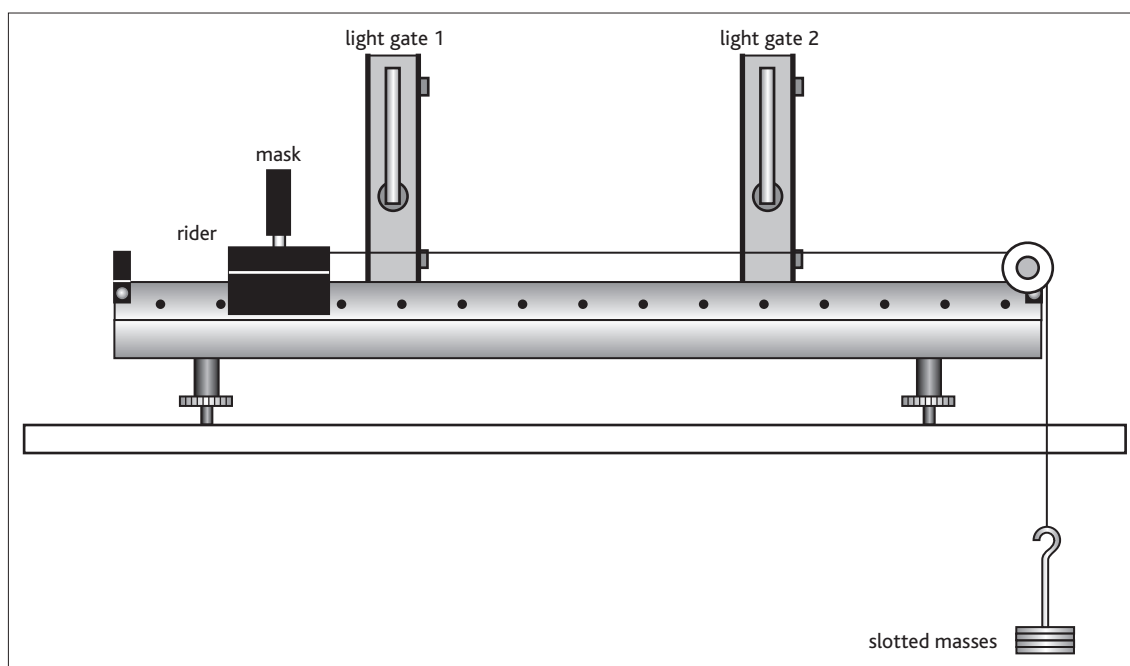


Figure 1: Using a linear air track to investigate rate of change of momentum

Experimental instructions

Set up your apparatus as shown in the diagram. Compensate the air track for friction by raising one end slightly. Check by giving the rider a gentle push and measuring its velocity through both light gates – it should move along the air track 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 six of your ten masses on the rider and the other four (including the hanger) on the thread hanging down. The mass to be accelerated is the mass of the rider and the set of slotted masses while the accelerating force is the weight of the four suspended slotted masses (0.4 N).

Hold on to the rider. Switch on the air blower and timing devices. Release the rider and allow it to accelerate down the track. Do not allow it to crash into the end of the track. Record the velocities of the rider as it passes through light gates 1 and 2 and the time taken for the rider to travel between the gates. Repeat the readings and take an average.



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Vary the accelerating force but keep the total mass constant by putting masses on the rider if they are removed from the hanger and vice versa. 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.