In this experiment, we're going to investigate conservation of momentum in an inelastic collision.

For this you will need:

A track
Two trolleys fitted with card masks – these measure 5 centimetres
Two light gates attached to a timer and power supply
A digital balance
And some extra masses

Connect the timer and set it up to measure two velocities. Set the mask size to five centimetres.

Next set up the light gates. Set up light gate A so that it measures the velocity of trolley a just before the collision. Set up light gate B so that it measures the velocity of both trolleys together just after the collision.

We will be carrying out a number of collisions so draw up a table to record the results.

Add columns for:
M1: Mass of trolley a
M2: Mass of trolley b
U1: Initial velocity of trolley a before the collision
V2: Final velocity of trolley a and trolley b together after the collision
M1U1: The calculated initial momentum
M1 + M2 all multiplied by V2: The calculated final momentum

Let's begin the experiment.

Run 1: Measure the mass of the trolleys in kilograms to three decimal places. First, trolley a with no extra mass. Record in a table. 0.554 kilograms.

Measure the mass of trolley b with no extra mass and record it in the table. 0.558 kilograms.

Position both trollies on the track and press Go on the timer. Collide trolley a into trolley b on the track. Record the initial velocity of trolley a, 0.554 metres per second. And the final velocity of both vehicles. 0.267 metres per second.

Run 2: Repeat the experiment with one extra mass on trolley a. 0.806 kilograms. Trolley b remains the same.

Record the initial velocity of trolley a 0.357 metres per second, and the final velocity of both vehicles, 0.198 metres per second after the collision.

Now for Run 3: Repeat the collision with two extra masses on trolley a. 1.062 kilograms. Trolley b remains the same. Record your results.

Initial velocity of a is 0.554 metres per second. The velocity of both trolleys after the collision is 0.362 metres per second.

Repeat the experiment, this time, trolley a has no extra mass and trolley b has one extra mass. Trolley b with one extra mass is 0.810 kilograms.

Initial velocity of a is 0.577 metres per second. Velocity of a and b together after the collision is 0.222 metres per second.

And finally, Run 5: Again, trolley a has no extra mass and trolley b has two extra masses. Trolley b's mass is 1.067 kilograms.

The initial velocity of trolley a was 0.484 metres per second. The combined velocity after the collision was 0.155 metres per second.

You can then work out the momentum of trolley a before the collision and the momentum of trolleys a and b together after the collision.

The results show that the total momentum before the collision and after the collision are approximately equal.

This confirms the law of conservation of momentum which states that the total momentum before a collision is equal to the total momentum after the collision, in the absence of external forces.

You can also calculate the kinetic energy before and after the collision. Use the equation, Ek equals half mv squared, where Ek is the kinetic energy, m is the mass, and v is the velocity.

You should see that there is more kinetic energy before each collision than after the collision. Kinetic energy is not conserved in inelastic collisions.

For inelastic collisions, momentum is conserved kinetic energy is not conserved.