In this experiment we will investigate conservation of momentum for an explosion.

For this experiment you will need:
A track
Two trolleys fitted with card masks – these measure 5 centimetres.
Two light gates - These are attached to a timer.
A digital balance
Some extra masses
And a ruler

We will be carrying out a number of explosions so draw up a table to record the results. This should have headings for mass in kilograms, velocity in metres per second, and momentum in kilogram metres per second.

We will be recording values for
M1: Mass of trolley a. M2: Mass of trolley b.

V1: The velocity of trolley a after the explosion. V2: The velocity of Trolley b after the explosion.

M1v1: The calculated momentum of trolley a after the explosion. M2V2: The calculated momentum of trolley b after the explosion.

We will also calculate the total momentum.

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 after the explosion. Set up light gate B so that it measures the velocity of trolley b just after the explosion.

Let's begin the experiment.

Run 1: Measure and record the mass of trolley a and trolley b. The mass of trolley a is 0.553 kilograms b is 0.558 kilograms.

Position both trolleys on the track and press 'go' on the timer.

Set off the explosion and record the velocity of each trolley. Remember that one velocity should be negative.
Trolley a velocity: -1.198 metres per second. Trolley b: 1.220 metres per second.

Run 2: Add one mass to trolley a, measure and record its mass. The mass of trolley b remains the same.
Trolley a is 0.806 kilograms.
Set off the explosion and record the velocity of each trolley. Velocity trolley a: -0.832 metres per second, b: 1.302 metres per second.

Run 3: Add another mass to trolley a so that it has two additional masses. Measure and record the mass. 1.062 kilograms. Trolley b remains the same with no additional masses.

Set off the explosion and record the velocity of each trolley. Trolley a: -0.326 metres per second. Trolley b: 0.668 metres per second.

Run 4: Repeat the experiment. This time trolley a has no additional mass and trolley b has one additional mass. Trolley b: 0.810 kilograms.

Set off the explosion and record the velocity of each trolley. Trolley a: -0.685 metres per second. Trolley b: 0.461 metres per second.

Run 5: Repeat the experiment. This time trolley a has no extra mass and trolley b has two extra masses. Trolley b: 1.067 kilograms.
Set off the explosion and record the velocity of each trolley. Trolley a: -0.551 metres per second. Trolley b: 0.307 metres per second.

You can now calculate the momentum of each trolley by multiplying the mass by the velocity. Then add the momentum of the two trolleys together to find the total.

The momentum before the explosion was zero as the trolleys were not moving. Most of the results show that the total momentum after the explosion was also approximately zero.

As for all collisions, the total momentum before and after the explosion 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.