Practical 1 Momentum and momentum conservation – large trolleys

Purpose

The aim of this experiment is to study momentum and its conservation in an inelastic collision.

Safety

Lift the large wooden runway with care.
Set up the experiment away from the edges of the bench so that the trolleys do not fall off.

You will need:
- Two trolleys
- Two light gates and suitable interface
- Eight 100 g slotted masses
- Wooden runway
- Plasticene®
- Drawing pin
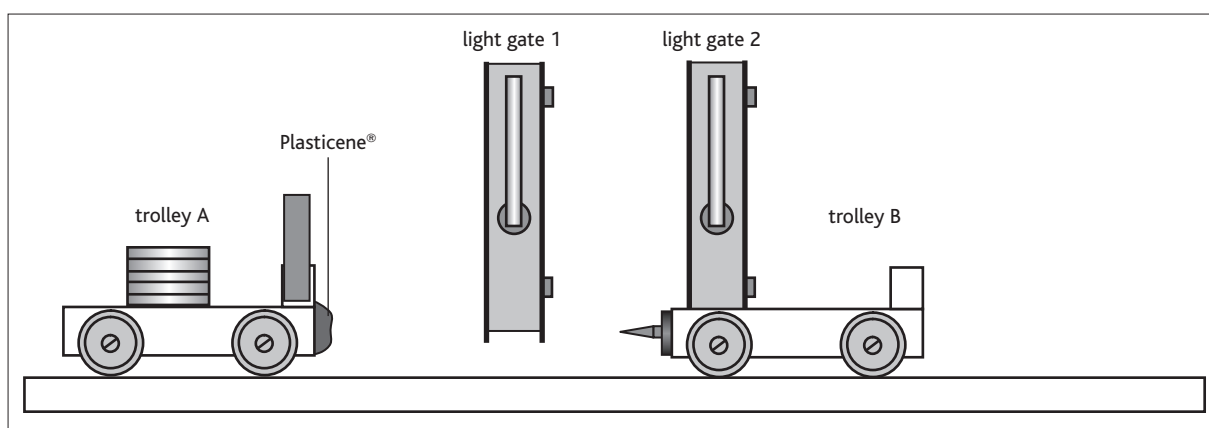- Adhesive tape
- Means of tilting the runway

Figure 1: Arrangement of large trolleys to investigate momentum and momentum conservation

Experimental instructions

Set up the apparatus as shown in the diagram with five slotted masses fixed onto trolley A. Compensate for friction by tilting the runway slightly. Check by giving one trolley a small push and confirming that it runs down the runway with constant speed.

Soften the Plasticene® and stick it to the front of one of the trolleys. Fix the drawing pin to the front of the other trolley with the adhesive tape, so it is facing out from the trolley as shown. Put the two light gates quite close together. This is to minimise the effects of friction as the trolleys collide.

Set the interface unit to record the speed of trolley A before the collision and the speed of the two trolleys (A and B joined together) after the collision.

Put trolley A at one end of the runway and trolley B just before light gate 2.

Give trolley A a push (not too large) so that it runs down the track, cutting through the light beam of light gate 1 and colliding with, and sticking to, trolley B. The two trolleys will now travel on, the mask on trolley A cutting through the light beam of light gate 2.

Repeat the experiment for differing initial speeds and trolley masses. Do not allow the trolleys to fall off the bench.

Analysis and conclusions

Use your results to test the law of conservation of momentum.

Calculate the total momentum of both trolleys before and after the collision.

Comment on the most important sources of error in your experiment and how they might be reduced.