

## Introduction

These are 'design, make and test' projects. Pupils will need access to a variety of materials and tools. It is difficult to predict in advance precisely what materials or tools will be required. The *Throwers* activity in particular, might be done in a technology laboratory, where tools and materials might be more readily available.

## Safety issues specific to this mini-project:

Eye protection should be worn at all times when any of this practical work is in progress.

Because designs may vary, it is difficult to give a comprehensive list of materials needed.

The teacher must check designs for safety before work starts, and pupils should be guided away from hazardous materials. Issue tools and materials only on the authority of a teacher, not on request by pupils.

Ensure that you are familiar with proper use of tools, and the properties of materials used. Pupils will need to cut materials to shape and size. Materials should be clamped, either in a vice or with a g-clamp whilst being sawed.

Good housekeeping and recording will be needed to ensure that tools stay in the right place and are used correctly.

## Requirements

### Rollers:

Students will need access to empty cotton reels, drinks cans (well washed), plastic drinks bottles (well washed) and plastic film containers.

Transfer drives for the rollers can be made from matches (with the heads removed), lolly sticks or wooden splints. Slices of candle or round beads make suitable low friction bearings.

Centre punches are required for making holes in the bases of drinks cans, small bore cork borers can be used to make holes in the bottom of plastic bottles or film canisters. Take care that the can or bottle is firmly held or supported, and that hands are kept well out of the line of movement of the punch or borer.

A large selection of rubber bands of different sizes and thickness will be needed.

Metre rules or tape measures may be needed for measuring the distances travelled by rollers. Students may also require stop clocks for timing runs.

Some rollers perform better if extra mass is added. Dry sand is suitable.

### Throwers:

Several possible designs are shown on the pupil sheet for this project.

Most designs require softwood battens or board.

Pivots can be made from short lengths of dowel, or metal rod.

The 'target' for collecting balls thrown can be a waste-paper basket or small dustbin, or a more challenging target can be made from, for example, a beaker inside a trough, which is inside a larger trough. Loose sand or crumpled paper in the target will reduce the likelihood of balls bouncing out again.

Some of the designs need a way of supporting the ball in position, ready to be thrown. Suitable holders can be made by moulding papier-mâché round half of a table-tennis ball. When dry, this can be fixed in place by glue of a small screw. An alternative is to use a tennis ball cut in half and fixed to the launcher, but this is less accurate.

A large supply of table tennis balls will be needed.