3. Measuring the force 2

60 mins

Children investigate the impact of adding various shapes of card to the lorry front (known as fairings) to find out whether there is any impact on the air resistance.

OBJECTIVES

- Identify the effects of air resistance, water resistance and friction that act between moving surfaces.
- To show that smoothing the air flow reduces air resistance.
- Planning different types of scientific enquiries to answer questions.

RESOURCES

(Per group of 4 children)

- Activity sheet 6
- Toy vehicle, as used in the previous activity
- Hair dryer
- Metre rules and 30 cm rulers
- A4 card with lorry front from Activity sheet 4
- Thick elastic band 'standard force launchers'
- Newton force meter
- Sheet of A4 paper

INTRODUCING THE ACTIVITY (10 minutes)

Referring to the pictures of lorries with cab fairings, raise the question as to their use. From the previous experiments, the children have discovered that increasing the surface area of the front increases the air resistance. Can the children find out what effect different shapes attached to the front of their vehicle have on the air resistance, and thus the distance it travels? A challenge could be set to discover which group can produce the best design to give the greatest increase of distance travelled.

MAIN ACTIVITY (40 minutes)

They already have data on the distance their lorry travelled with an A5 card front. Using the sheets of A4 card with the same A5 sized drawing of the 'lorry' on it, the sides and top can be folded or bent to various angles to form fairings. These can be attached to the front of the vehicle in the same way, and using the same standard force launcher to provide a force of 2 Newtons the children can discover the effects of these on the distance travelled against the 'wind'. Activity sheet 6 provides an opportunity to record predictions, measurements and conclusions.

This activity can be tailored by the teacher to suit the class or groups. Some groups may need teacher direction on folding the fairings while others could respond to the more open challenge of producing a range of designs. The results of the experiments can be compared with the previous activity's results to discover which shape gives the greatest increase of distance travelled. Again, results can be repeated in groups of three, and the central value taken as the 'average', or older groups allowed to use a calculator to generate an average value.

PLENARY (10 minutes)

The results should show that by folding the card back at the top and sides, the air resistance is reduced, allowing the vehicle to travel further, even though the front area is still large. To help the children understand what happens, they can be reminded of the effort needed to walk through water in the swimming pool. When standing and walking, the effort required is quite great, and if they look behind themselves the water can be seen swirling in behind them in a very confused way. If they then push off in the swimming position, without paddling or kicking, the water behind them does not show nearly as much swirling (or turbulence) and it is much easier to move through the water.

OPTIONAL ACTIVITY (10 minutes)

If a video clip can be found (perhaps from a local secondary school), the children can be shown 'wind tunnel tests'. In these tests, smoke is blown into the air passing round objects designed to be streamlined (or not). The smoke enables scientists to see the air movement, and how smoothly it is passing round an object.

Discussion points and questions can include:

- *What does the air do when it passes around a square or 'non-smooth' shape?*
  The air seems to swirl around the shape.
- *In what direction does the air seem to move behind a box-like shape?*
  The air moves in all directions, sometimes in the same direction as the main flow and sometimes in the opposite direction.
- *What happens to the air around a smooth shape?*
  The air parts easily to let the shape through and then comes back together behind the shape.