CAMBRIDGE SCIENCE CENTRE

Open Up Science

BLOODHOUND

SPEED SPECIAL ISSUE

An incredible 1,000mph is the goal of Bloodhound LSR, a UK engineering mission to break the land speed record. Inside you can replicate some of the challenges building this car faces. And, you can visit a full-size model of the car in our Cambridge Gallery this Summer!

Bloodhound LSR

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LSR stands for Land Speed Record, which is what the Bloodhound team aim to smash. Bloodhound LSR has already been driven at over 600mph and has the record in its sights.

When completed, this super speedy car will be able to zoom from 0mph to 1000mph (1610kmph) in under a minute. To get to 1000mph, it uses a rocket engine and a jet engine. At 1000mph, normal breaks can't slow the car down, so it needs a parachute to stop safely!

The rocket engine gets super-hot, twice the temperature of the inside of a volcano – 3000°C – and at top speed, the car has to cope with 20 tonnes of drag, which is the weight of three and a half elephants. At that speed, normal tyres would explode! So, the wheels are solid metal and weigh 95kg each – more than the average grown-up!

To do high speed tests Bloodhound LSR needs a large area that is very flat, with still air and solid ground. The team chose Hakskeen Pan in South Africa. However, it wasn't perfect when they found it, and a team of volunteers had to pick up every stone and pebble from the ground. In total they removed 6000 tonnes of stones from the track to make it perfectly smooth.

Bloodhound LSR Quiz

(Answers at the back)

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1. What does LSR stand for?
   - A. Long Speedy Rover
   - B. Land Speed Record
   - C. Loud Sound Resonator
   - D. Love Science Ride

2. How many times hotter than a volcano does the rocket get?
   - A. 1.5
   - B. 3
   - C. 2
   - D. 1.75

3. Bloodhound LSR has to withstand 20 tonnes of drag. How many elephants is this equivalent to?
   - A. 3.5
   - B. 2.5
   - C. 2
   - D. 5

4. What are Bloodhound LSR's tyres made of?
   - A. Metal
   - B. Rock
   - C. Leather
   - D. Glass

5. Where is the test site for Bloodhound LSR?
   - A. London
   - B. Russia
   - C. The rainforest
   - D. South Africa

Speedy divers

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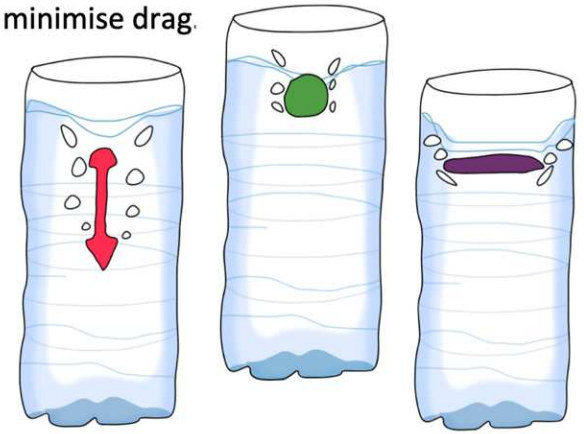
Drag is a force that pushes moving things back in the other direction, slowing them down. If we want to go REALLY fast, we need to design a shape that will minimise drag.

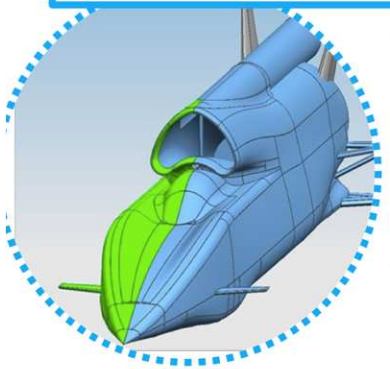


What you'll need

- 2 or more large plastic drinks bottles
- Modelling clay or blue tack
- Water

What to do

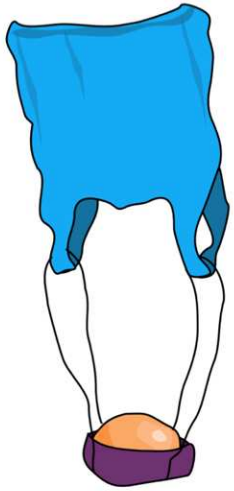
1. With help from an adult, cut the top off the large plastic bottles.
2. Fill these bottles nearly to the top with water, with the same amount in each bottle.
3. Form your modelling clay into equal sized blobs.
4. Using your clay, go wild and try different designs for your divers!
5. Race your different divers against each other to see which is the fastest. Be sure to drop them at the same time and from the same height so that it's a fair test.



You probably don't think of air as anything like water, but they're actually quite similar. Both are fluids and flow around things. This means they both create drag. Fast planes and cars have to be specially designed to minimise the drag from the air! At 1000mph the force of drag on Bloodhound LSR will be equivalent to around 20 tonnes.

Egg-cellent Parachutes

Sometimes we need to take advantage of drag to slow us down – for example, when we are sky diving or slowing down a 1000mph car!



The shape and size of your parachute determines whether your egg floats safely and slowly to Earth or goes for a speedy SPLAT! The bigger the parachute, the more air it can catch. This means there is more drag pushing the parachute upwards, slowing the egg's fall down. Try experimenting with different parachute designs!

What you'll need

- A raw egg
- Some string or wool
- Sticky tape
- Parachute making materials: plastic bags, paper, balloons or whatever else you can find!

What to do

1. Make your parachute. This could just be a plastic bag, or you could try making one out of paper or whatever else you can find! A good technique is to cut a large square and make holes in the corners where your string can go.
2. Cut your string. You can choose how long it is, but all the pieces should all be the same length.
3. Use the string to tie your egg to the parachute. You can just sticky tape the string to the egg, or you could make it a basket.
4. Get some adult supervision and try dropping your egg-cellent parachute from different heights!

How fast?!

(Answers at the back)

Can you match the speed to the right description?

ZOOOOM!

28 mph	Top cruising speed of a commercial aeroplane
75 mph	The speed of sound in dry air at 20°C
91 mph	Usain Bolt's running world record
232 mph	The sky diving speed record, achieved by jumping from a height of 38,969m!
580 mph	The speed that the Blood-hound LSR car will reach
767 mph	The fastest anyone's ever gone on a skateboard
834 mph	The top speed for the fastest land mammal – a cheetah
1000 mph	Top speed of an F1 racing car

CD Hovercraft

Bloodhound LSR's smooth metal wheels don't experience much friction. Another way of lowering friction is to not touch the ground at all. How? Hovercraft!

What you'll need

- A sports water bottle top
- Blue tac
- Balloon
- An old CD or DVD

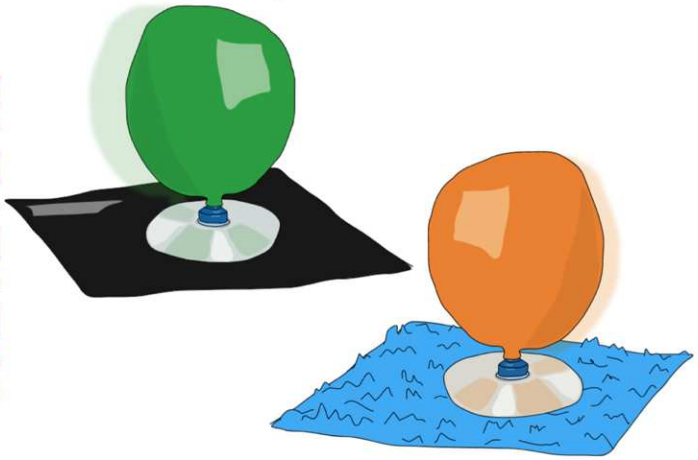
What to do

1. Roll the blue tac into a sausage shape and press it down on the centre of the CD in a circle around the hole.
2. Blow up the balloon and put it over the sports bottle top down. The bottle top should be down (closed).
3. Push the bottle top and balloon into the sausage of blue tac so it is secured, fully covering the central hole.
4. Place your hovercraft down and take it for a test drive! Open the sports bottle top and watch it glide!

Friction is a force between two objects that are trying to move across each other, and acts in the opposite direction of the movement. As the air comes out of the balloon, it spreads out under the CD so that the craft is floating on a cushion of air, therefore lowering the friction between it and the ground.

Try testing your hovercraft on different surfaces.

Which surface creates the least friction, allowing your hovercraft to move fastest?

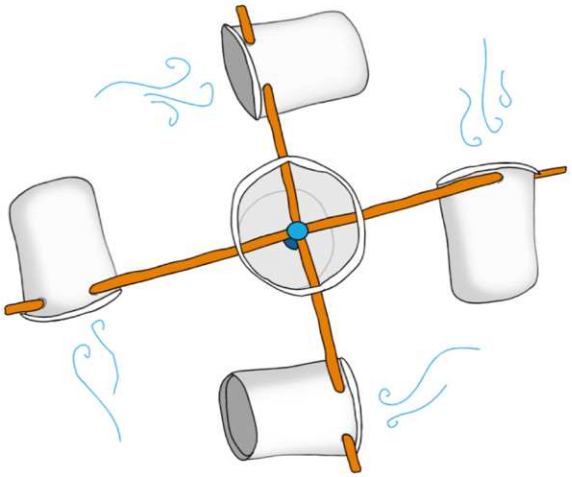


Wind speed

When trying to go fast, it's important to know the wind speed. The faster the wind is, the more you have to work against it to get moving! Scientists have to measure the wind speed to choose a very still day to test Bloodhound LSR. Anemometers are one way of measuring wind speed.

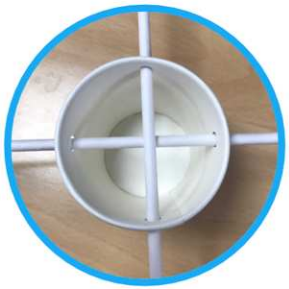
What you'll need

- Two straws
- A pencil with an eraser on the end
- Five paper cups
- A push pin
- A hole punch



What to do

1. Use the hole punch to make four holes in a one paper cup just below the rim, forming a '+' shape (two pairs of holes opposite each other, with one set slightly lower than the other).



2. Push the two straws through the holes.

Wind speed

3. Use a sharp pencil to poke a hole in the centre of the bottom of the cup.

4. Use the hole punch to make two holes around the other 4 cups, around 2-3cm apart.

5. Push the end of a straw through the two holes in each one of the cups, making sure all the cups are facing in the same direction (all clockwise or anticlockwise!).

6. Push the pencil, eraser end first, through the hole in the bottom of the central cup.

7. Press a push pin lightly through both of the straws and into the eraser.

8. Take you anemometer outside and hold on to the pencil. The faster the wind speed is, the faster it will spin!

Speed test

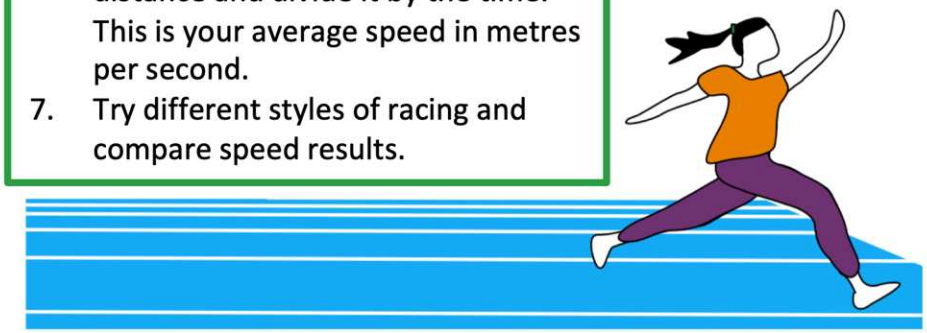
You wont be able to reach 1000mph like Bloodhound LSR, but how fast can you go?

What to do

1. Decide where you want the track to be and mark the start and end.
2. Measure the distance of your track using a tape measure in metres.
3. Fill in the distance in the record keeping template.
4. Prepare for the test! Get a friend ready to measure the time on the stopwatch in seconds.
5. 3…2…1 go! Record your time in the record sheet.
6. Using the calculator, take the distance and divide it by the time. This is your average speed in metres per second.
7. Try different styles of racing and compare speed results.

What you'll need

- A large ruler or tape measure
- A stopwatch (you can use one on a phone)
- Something to mark the start and end
- A calculator
- Record sheet template



(Answers at the back)

Racing Riddle

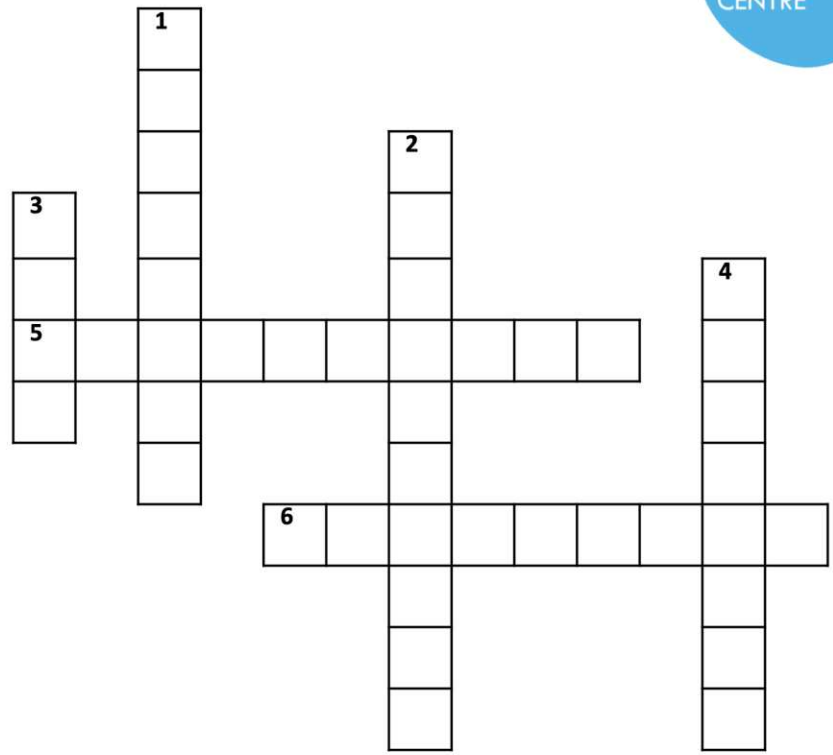
Nina, Harry, Casey and Jay are in a race.
Nina beats Harry
Jay beats Casey
Casey beats Nina.
Who came in first place?

Speed test record sheet

	Distance (m)	Time taken (s)	Speed Distance ÷ Time (m/s)
Walk			
Run			
Skip			
Hop			

Can you come up with your own idea?

Quick-Fire Crossword



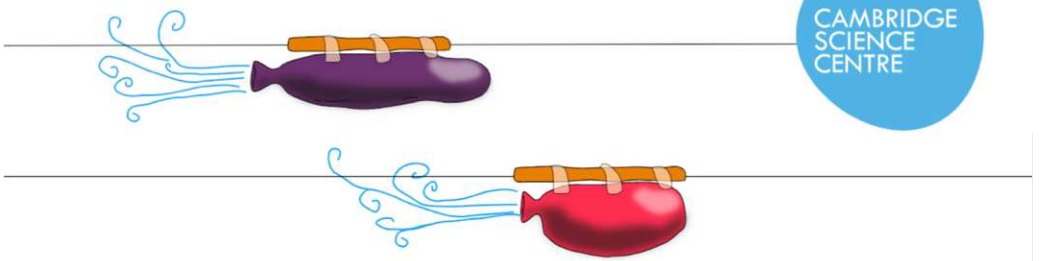
Down

1. The test site for Bloodhound LSR.
2. A land device that minimises friction by not touching the ground.
3. The force that pushes moving things backwards in air or water.
4. The force between two objects that are moving across each other.

Across

5. A device used to measure wind speed.
6. Bloodhound LSR uses this to slow down.

Balloon rocket racers



What you'll need

- A balloon
- Some thin string (thread or floss works best!)
- A straw
- Sticky tape
- A peg

What to do

1. Thread the string through the straw.
2. Set up the string racing tracks. Tie the string with the straw on it so that it's completely flat. This could be from a chair to a door handle or if you're outside you could tie it between two trees.
3. Blow up the balloon. Don't tie it, but twist and peg the end so the air doesn't come out.
4. Using a few pieces of sticky tape to attach the balloon to the straw.
5. Release the peg and watch the rocket take off!
6. Get your friends to set up their own rocket and race!

This is how the Bloodhound LSR car works. It has a jet engine and a rocket. These blast hot air out of the back of the car, pushing the car forwards.

Puzzle Solutions

Did you get the answers right for our puzzles?

		H												
		A												
		K				H								
D		S				O								
R		K				V						F		
A	N	E	M	O	M	E	T	E	R			R		
G		E				R						I		
		N				C						C		
				P	A	R	A	C	H	U	T	E		
						A					I			
						F					O			
						T					N			

Bloodhound LSR Quiz

Q1 – B, Q2 – C, Q3 – A, Q4 – A, Q5 – D

Racing Riddle

Jay won the race!

How fast?!

Did you match the speed to the right description?

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We always want to improve, so let us know what you liked – or didn't like – about this issue!

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Visit Cambridge Science Centre this summer to see inside a full-size model of Bloodhound LSR, learn about the land speed record, and the new ways of engineering that let us build this amazing machine. Book now at: cambridgesciencecentre.org
Cambridge Science Centre is all about empowering children and young people to discover science for themselves.

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