Teachers notes and answers

Science curriculum links:	forces, working scientifically
Maths curriculum links:	shape, measuring, statistics
Suggested target audience:	KS2

Problems to solve

These activities could be blended with a practical lesson. Teams of children solve the problems and create their own magnetic racing game, they can collect their own data as well as answering the word problems. Alternatively, this resource could be used as a homework activity in advance of a lesson focused on a magnetic racing game (flipped learning) or as a follow up homework activity from such a lesson so that children can reflect on their learning and develop it further.

"Mr Jones' class has been learning about magnets, he planned a maths challenge lesson for the class to work in teams to solve some problems so that they can make a magnetic racing game".

1. The comparative test described in question 1 is a core Year 3 forces enquiry. Ideally children should be encouraged to repeat measurements to check for reliability and repeatability. It is a great opportunity to encourage increased accuracy by measuring to the nearest mm.

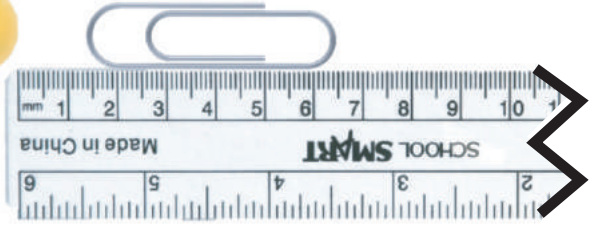
   For their first challenge, Mr Jones has asked the class to work in teams to use their measuring skills to find out which magnet is the strongest and would be best to use in their racing game. Ryan's group decided they would measure how close each magnet could get to a paper clip before the paper clip was attracted to the magnet.

(a) Measure how close each magnet got to the paper clip from the images below.

Bar magnet 39 mm

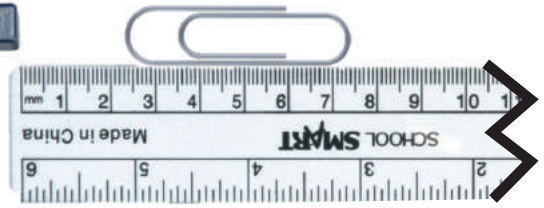
Magnetic marble

14 mm



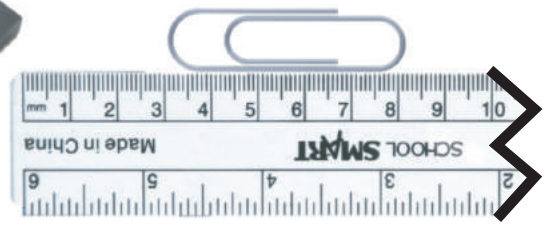
Small horseshoe magnet

23 mm



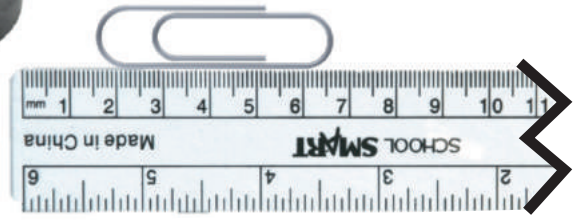
Flexible square magnet

31 mm



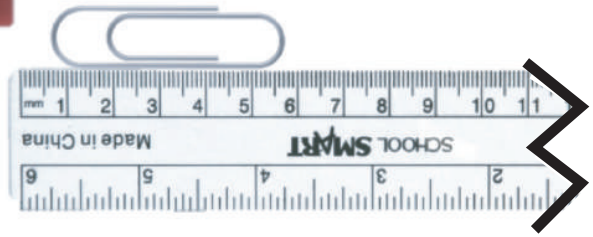
Ring magnet

16 mm



Large horseshoe magnet

7 mm

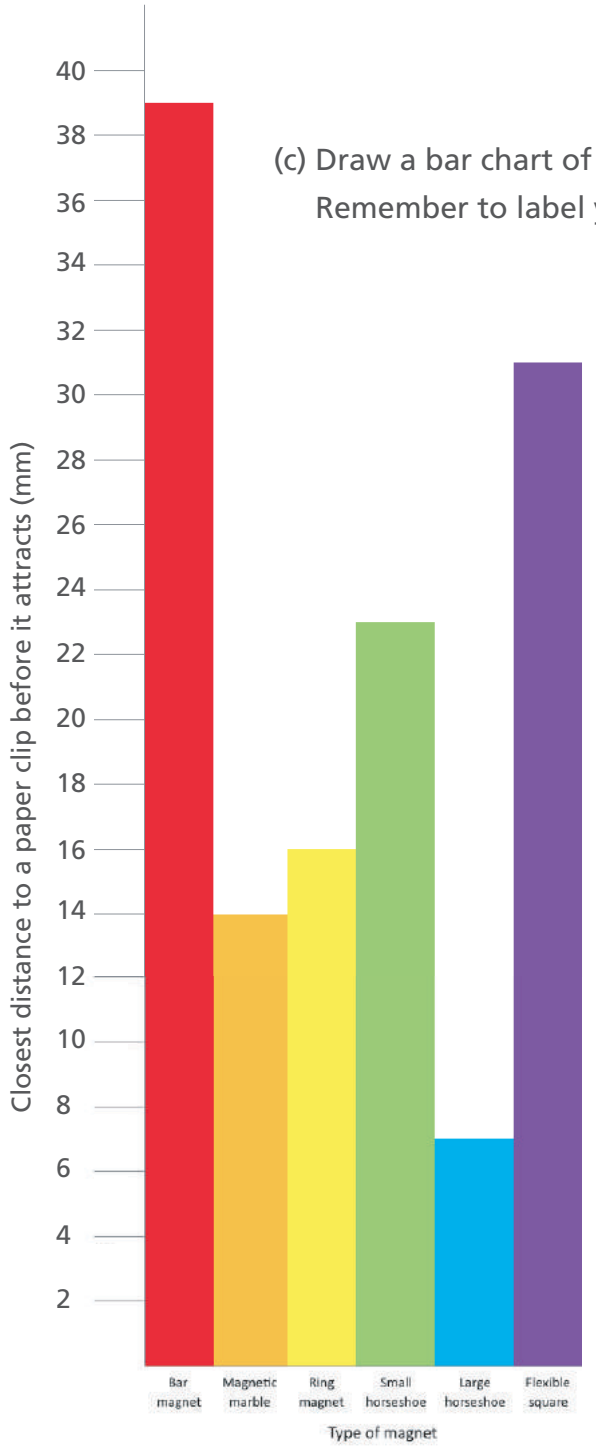


(b) Plan and draw a results table to record and organise the measurements you have made.

Children should design a two-column table, counting seven rows to include all their data. Simple table designs like this are the best way to get into good planning habits in terms of the number of rows and columns to include. This is also the time when children should understand that the units of measurement go in the heading and then they are not required with every measurement recorded.

Type of magnet	Closest distance to a paper clip before it attracts (mm)
Bar magnet	39
Magnetic marble	14
Ring magnet	16
Small horseshoe magnet	23
Large horseshoe magnet	7
Flexible square magnet	31

(c) Draw a bar chart of your results.
Remember to label you axes clearly.

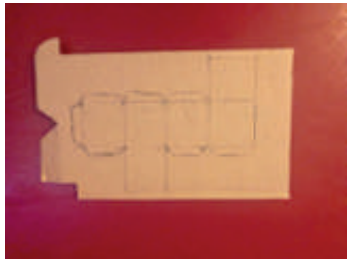


(d) Which magnet would be the best one to use for the magnetic racing game? Explain your answer.

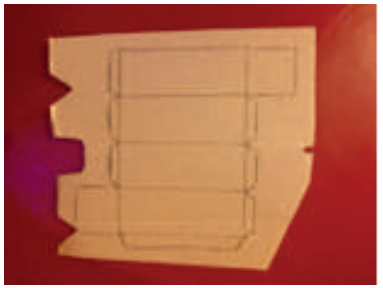
The best magnet for the game would be the bar magnet as it will attract the paper clip from the largest distance. This means that the cardboard on the magnetic race game can be quite thick and the magnet will still be able to attract the paper clips stuck to the paper car on top.

4. Mr Jones allows the children to plan and create their own racetrack on a piece of cardboard, he encourages them to add plenty of bends and turns so that it is challenging. He asks each team to include three 3D structures as part of their design.

(a) The first structure is a cube at the finish line which will be the winner's podium. Draw the net to make a cube structure.

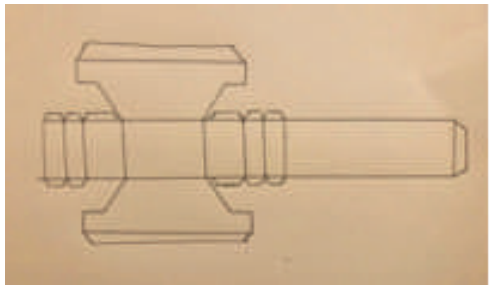


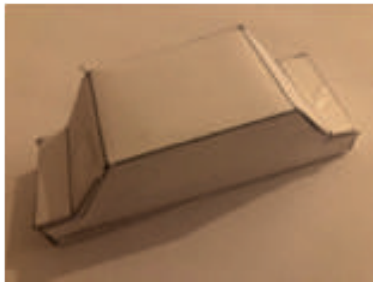
(b) The second structure will be a cuboid which will be the observation tower in the centre of the racetrack. Draw the net to make a cuboid structure.



(c) The final structure will be a square-based pyramid that will be a sculpture to mark the sharpest bend in the track. Draw the net to make a square based pyramid structure.

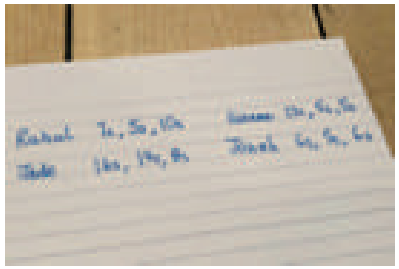
(D) Extra challenge: Jade thinks that the racing game will be better if the racing cars are also 3D models and she has sketched what she would like the car to look like. Can you design a net to make a 3D model of a car that looks like her design?





4. The children taped paper clips to the underside of their paper racing cars and placed them on the track. Two children held the game in the air while the racer held a magnet underneath the cardboard racetrack in a position where it was attracted to the paper car. They could then carefully move the magnet to drag the paper car around the track.

(a) Rahul's group decided that they would time each other completing the race so that they could find out who was fastest. They let everyone have three tries to get the fastest time. Plan and draw a results table to record and compare their data.

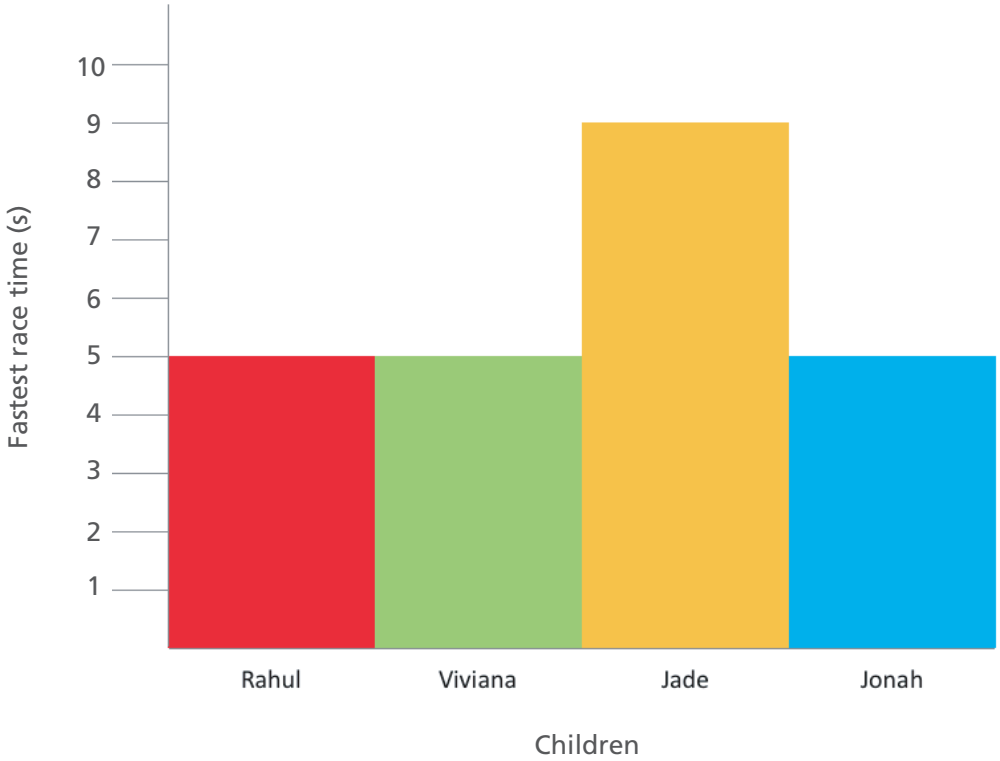


	Time to complete racetrack (s)		
	try 1	try 2	try 3
Rahul	7	5	10
Viviana	12	5	5
Jade	16	14	8
Jonah	6	5	6

(b) Based on the data, who do you think should be declared the winner? Explain your decision.

Three children got the same fastest time of 5 seconds to complete the track. I think that Viviana should be the winner of the race as she completed the track in 5 seconds twice, but Rahul and Jonah only completed the race in 5 seconds once.

(c) Draw a bar chart to compare the four children's fastest times around the racecourse.



(d) Super challenge: when scientists have sets of data, they calculate the mean average of the data set to help them compare their results. The mean of a set of data involves adding together all the quantities you have measured and dividing by the number of quantities there are.

For example:

The mean average of Rahul's race time is:

$$\frac{7s + 5s + 10s}{3} = \frac{22s}{3} = 7.3 \text{ seconds}$$

Calculate the mean average race time for (i) Viviana, (ii) Jade and (iii) Jonah.

(i) The mean average of Viviana's race time is:

$$\frac{12s + 5s + 5s}{3} = \frac{22s}{3} = 7.3 \text{ seconds}$$

(ii) The mean average of Jade's race time is:

$$\frac{16s + 14s + 8s}{3} = \frac{38s}{3} = 12.7 \text{ seconds}$$

(ii) The mean average of Jonah's race time is:

$$\frac{6s + 5s + 6s}{3} = \frac{17s}{3} = 5.7 \text{ seconds}$$

(e) Based on your mean average calculations, who do you think has won the race now?

Viviana and Rahul had the same mean average race time, but it wasn't as fast as Jonah's mean average race time. On average, it takes Jonah less time to complete the racecourse compared to anyone else in his group, so he should win the race.

The Ogden Trust

making physics matter

Age 7-11 years

Phizzi problem solving

Magnetic racing game

Problems to solve

Mr Jones' class has been learning about magnets; he planned a maths challenge lesson for the class to work in teams to solve some problems so that they could make a magnetic racing game.

1

For their first challenge, Mr Jones has asked the class to work in teams, using their measuring skills to find out which magnet is the strongest and would be best to use in their racing game. Ryan's group decided they would measure how close each magnet could get to a paper clip before the paper clip was attracted to the magnet.

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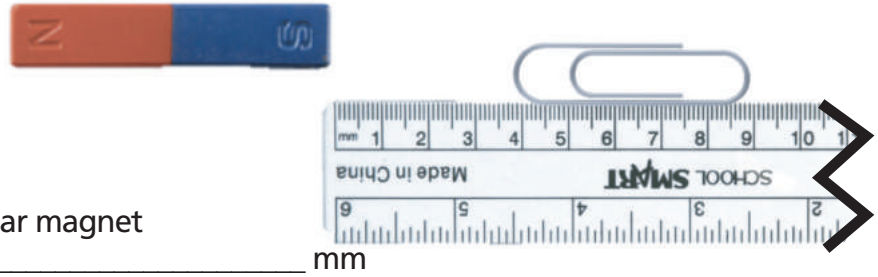
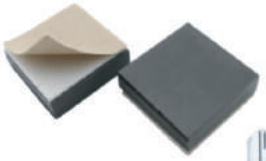


Bar magnet

_____ mm

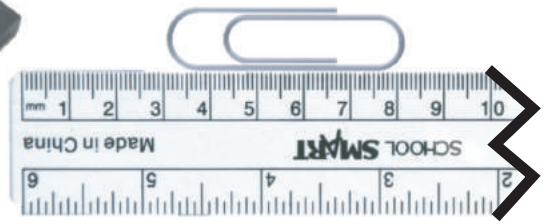
Magnetic marble

_____ mm



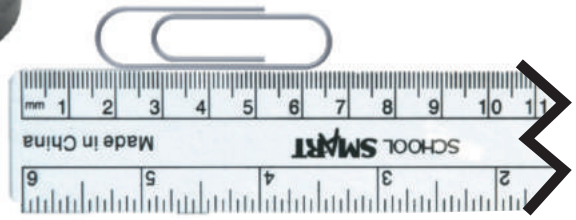
Flexible square magnet

_____ mm



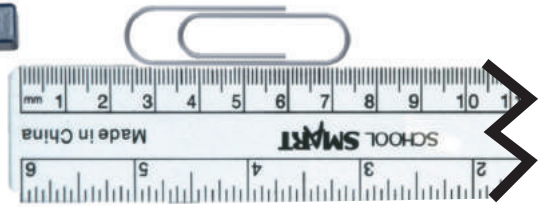
Ring magnet

_____ mm



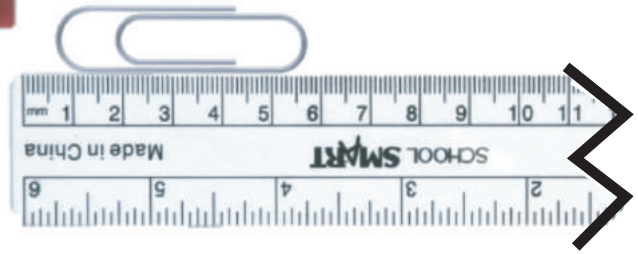
Small horseshoe magnet

_____ mm



Large horseshoe magnet

_____ mm



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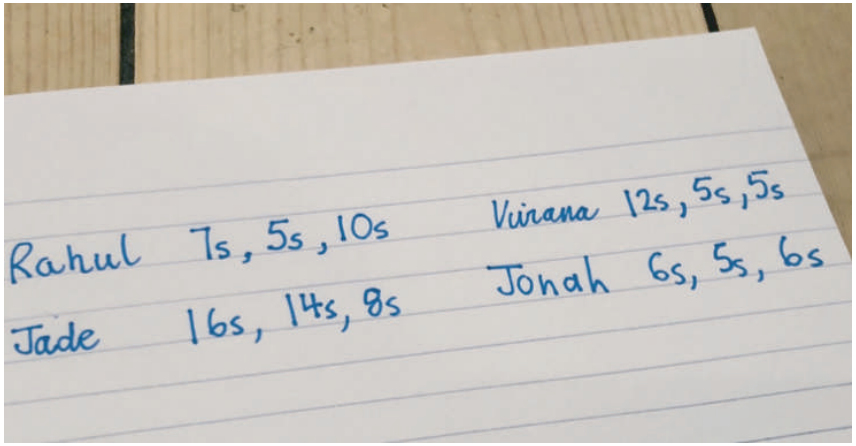

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