Challenge

9 Draw a force diagram to show the two forces acting on a box on a table.

Remember to:

- draw arrows to show the direction the forces are acting
- label the forces.

10 In each of the following pictures A and B:

a describe what the person is doing

b identify the force as a push or a pull force, or both

c explain why it is an applied force.

A

B

Picture A

a ____

b ____

c ____

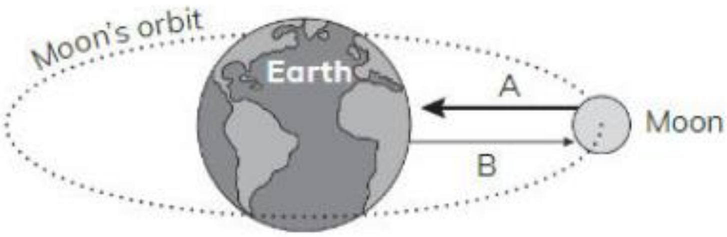
Picture B

a

b

c

5 Look at the diagram.



a Which force line, A or B, shows the force of gravity that the Earth exerts on the Moon?

b Why is A a thicker arrow than B?

Practice

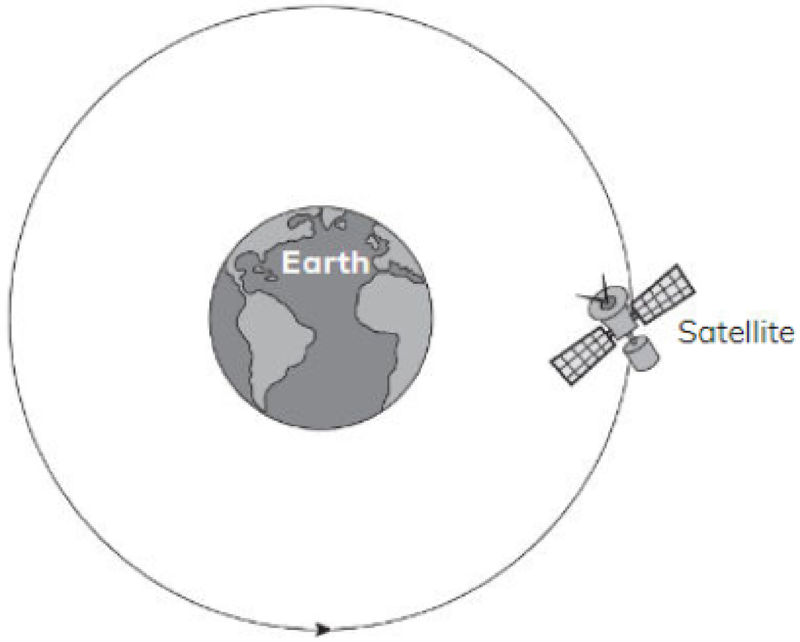
6 a What is a natural satellite?

b Give an example.

7 a What is an artificial satellite?

b Give an example.

8 Complete the diagram of an artificial satellite orbiting the Earth.



a Draw a force arrow to represent the force of gravity between the Earth and the satellite.

b Draw a force arrow to represent the force of gravity between the satellite and the Earth.

9 Explain why you drew one arrow thicker than the other.

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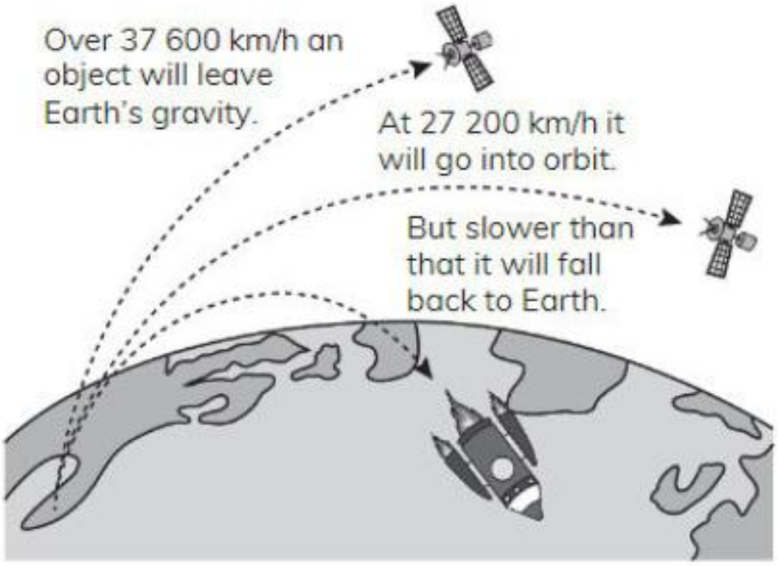
Challenge



10 What type of satellite is shown on the diagram?

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11 What launches the satellite into space?

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12 Why is it necessary for the satellite to travel at over 37 600 km/h when it leaves the surface of the Earth?

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13 When the satellite travels at 27 200 km/h, what path does it follow?

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14 What force keeps the satellite following this path?

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15 What happens to the satellite if its speed drops below 27 200 km/h?

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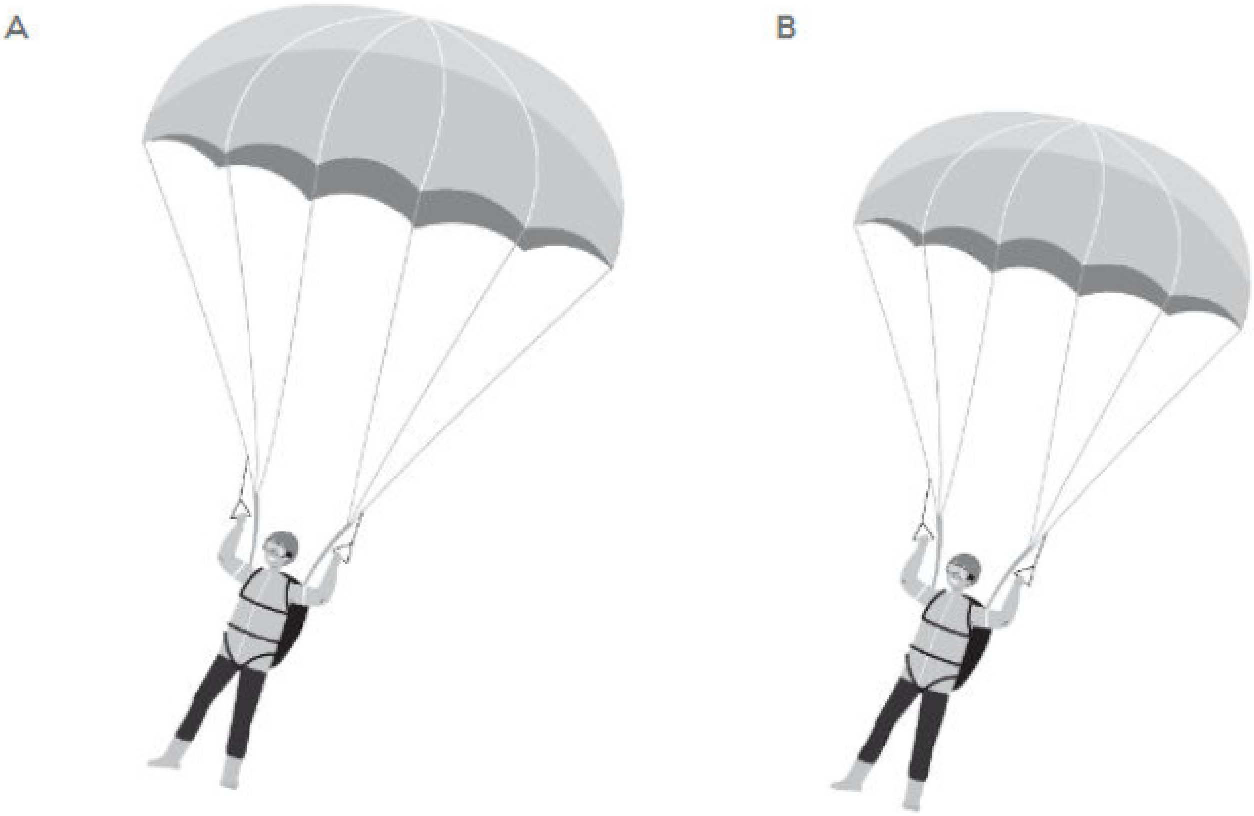
Practice

The drawing shows two people jumping with parachutes.



2 a Which parachute, A or B, will fall faster?

____

b Explain why.

____

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3 On the drawing, draw and label the forces acting on the parachutes.
Show the direction in which each force acts.

4 a Do you think the parachutes fall faster or slower when the person is heavier?

b Explain why.

c How could you test this idea?

Challenge

5 Look at the picture of a dolphin.

A dolphin can move very fast through the sea. Give two reasons why it can do this.

6 Look at the picture of a lorry.

Lorries travel for long distances on motorways.

a Which force slows down these lorries because of their size?

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b How do you think the design feature marked by the arrow helps the lorry to travel faster?

____

____

c How do you think the design feature marked by the arrow helps the lorry to save fuel?

____

____

Look at the picture of the person swimming.

10 Draw and label the four forces acting on the swimmer.

11 Name the three natural forces.

12 What does the swimmer have to do to overcome these forces and move forward?

13 How do swimmers make themselves more streamlined?

2 Your grandma drops a box of pins on the floor.

a Describe how you could help her pick the pins up easily using a magnet.

b Why does the magnet pick up the pins?

3 There is a mixture of iron nails and wood shavings on the floor of the workshop.

a How can you get the nails out using a magnet?

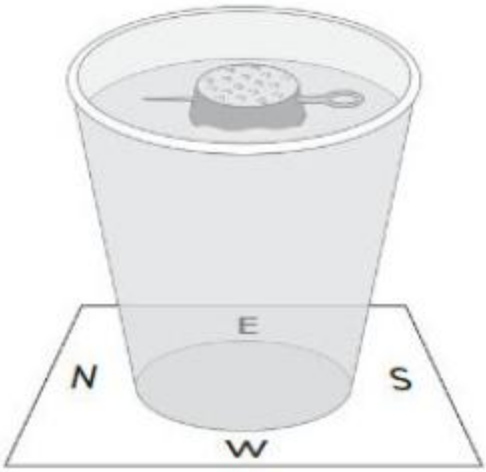
b Why does the magnet pick up the nails?

c Why doesn't the magnet pick up the wood shavings?

A compass has a magnetic pointer or needle that is attracted to the Earth's magnetic north pole.

Zara and Sofia decided to make a simple compass. They used a polystyrene cup and some water, a cork, a sheet of A4 paper and a pen, a bar magnet, a large steel needle, a small piece of sticky tape and some steel pins. Here are the steps they took to make the compass:

- They wrote the points of the compass ('N' for north, 'S' for south, 'E' for east and 'W' for west) at the edges of the A4 paper.
  They placed the paper on a flat surface far away from any metal objects.
- They put a little water in the cup. They placed the cup in the middle of the paper.
- They stuck the needle to the table with a small piece of sticky tape.
- They stroked the needle with one pole of the bar magnet. They stroked in the same direction and made sure the bar magnet was well clear of the needle at the end of each stroke.
- They continued stroking for about 5 minutes. Then they tested to see if the needle was magnetic by trying to pick up paper clips with it.
- They pushed the needle through the cork and floated it in the water in the cup.
- They turned the cup until the needle was lined up north–south on the paper. The needle stayed pointing north because it was attracted to the Earth's north pole.



4 Why did they use a steel needle to make the compass?

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5 Why did they stroke the needle with a magnet?

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6 Why did they test the needle by trying to pick up paper clips with it?

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7 Why did they use a cork to stick the needle through?

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8 Why did they use a polystyrene cup for the water?

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9 Why did they put the compass far from any metal objects?

____

Arun and Marcus had two bar magnets. They did an investigation to find out which magnet was strongest. They used a plastic ruler and a metal paper clip to compare the distance from which the magnets attract the paper clip.

Here is a table of their results:

Magnet	Distance in mm – first reading	Distance in mm – second reading	Distance in mm – third reading	Average (mean) reading in mm
Magnet 1 – N. pole	35	28	30	
Magnet 1 – S. pole	31	26	27	
Magnet 2 – N. pole	51	46	53	
Magnet 2 – S. pole	54	49	52	

1 Complete the table by filling in the average (mean) readings.

2 Why did they make three readings for each pole of each magnet?

____

3 Why did they use a metal paper clip and not a plastic-coated paper clip?

4 Which magnet was the strongest, Magnet 1 or Magnet 2?

5 Which pole of the strongest magnet was strongest, the north or the south pole?

6 What conclusion did Arun and Marcus make about the strength of magnets?

Practice

Marcus compares the strength of two bar magnets (A and B).
He has three pieces of card 10 × 10 cm and a steel screw.

This is what Marcus does:

- Step 1: Marcus places the screw on a table underneath one piece of card. He holds magnet A over the card. The screw sticks to the magnet through the card, so he can pick up the card and screw with the magnet.
- He repeats Step 1 with Magnet B and gets the same result.

- Step 2: he now puts two pieces of card between the magnet and the screw. The screw still sticks to the magnet through two pieces of card when he uses magnet A and magnet B.
- Step 3: he now puts three pieces of card between the magnet and the screw. The screw still sticks to the magnet through three pieces of card when he uses magnet A. But when he uses magnet B the screw does not stick to the cards.

7 Why does the screw stick to the magnet through the card when Marcus holds the magnet over the card?

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8 Which magnet was strongest, A or B? Explain why.

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____

9 List two ways that Marcus's experiment was a fair test.

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10 Could Marcus have used a cork or a plastic button instead of a screw to test the strength of the magnets? Explain why or why not.

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Challenge

Maglev stands for 'magnetic levitation'. 'Levitation' means floating above the ground. Magnets on the track push and lift the train up in the air by 3 to 15 cm. So a maglev train floats above the tracks on a 'cushion' of magnetic force. The magnets in the track are extremely strong and very expensive.

If a country wants to use a maglev train they have to build a completely new magnetic track. It is not possible to change an old train track into a maglev train track.

Maglev trains float on air. This means there is no friction with a track. This lack of friction allows these trains to reach speeds of more than 500 kilometres per hour.

Maglev trains have no wheels. This makes them quieter than normal trains.

Maglev trains use 30% less energy than normal trains.

11 What are Maglev train tracks made of?

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12 What keeps a Maglev train moving 3 to 15 cm above the track?

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13 Give three advantages of the Maglev train compared to a train that runs on metal tracks.

14 What is the main disadvantage of the Maglev train?

15 Find out which countries use Maglev trains.