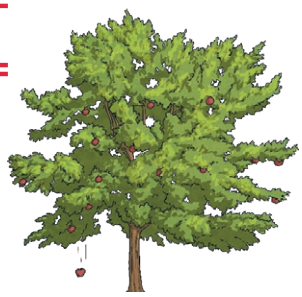
Forces and Motion

What Are Forces?



Forces control everything in the universe. They can be described as a push, a pull or a stop. Forces can change the direction or speed of a moving object and even change the shape or size of an object. Gravity is the force which pulls the Earth towards the Sun. It is the force which pulls a skier downhill.

Sir Isaac Newton



Sir Isaac Newton was a scientist and mathematician. He is famous for making a theory about gravity after he watched an apple fall to the ground from a tree. The apple fell to the ground due to the force of gravity. Force is measured in newtons in honour of his discovery. It can be measured with a newton meter.

Understanding Different Types of Forces



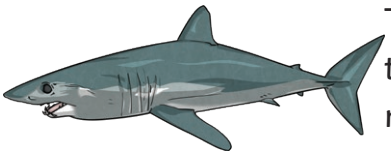
When two surfaces or objects touch, they create friction. This is called a contact force. Friction is the force which can push against an object and the force which stops or slows us when we are trying to move an object (for example when we push a door closed). Friction can also change the shape of an object. For example, we can mould and model clay or dough to change the shape of it.

Air resistance allows a parachute to stay open and float towards the ground.

A ship floats in the water because the force of the water pushing it up is the same as the force of gravity pulling it down. This is called upthrust.

Water resistance pushes against objects, making it harder for them to move through the water. The swimmer moving through the water uses their own force to push their body through the water, while the water resistance pushes against their body.

Many fish and water mammals have a streamlined body to make it easier for them to travel through the water. Shipbuilders and designers copy the streamlined shapes of sharks and other aquatic animals to help reduce water resistance in their designs.



The mako shark, with its tapered, streamlined shape, is the fastest shark in the world, with speeds of up to 60 miles per hour.

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Questions

1. What equipment is used to measure force? Tick one.

   - ◯ scales
   - ◯ newton meter
   - ◯ tape measure
   - ◯ balance scales

2. Fill in the missing word.

   Forces control everything in the _____.

3. Find and copy one word which explains how things can move quickly through the water.

   _____

4. Draw **four** lines and complete each sentence.

Forces can change the direction or ...	pulls the Earth towards the Sun.
Gravity is the force which ...	create friction.
When two surfaces or objects touch, they ...	speed of a moving object.
Friction can also change ...	the shape of an object.

5. Fill in the missing word.

   Friction is the force which can _____ against an object and the force which stops or slows us when we are trying to move an object.

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6. Summarise what you have learnt about water resistance using 25 words or fewer.

7. Explain what might happen if a ship was carrying very heavy loads.

8. Explain why the mako shark is able to reach such impressive speeds.

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Answers

1. What equipment is used to measure force? Tick one.

   ○ scales
   ✓ **newton meter**
   ○ tape measure
   ○ balance scales

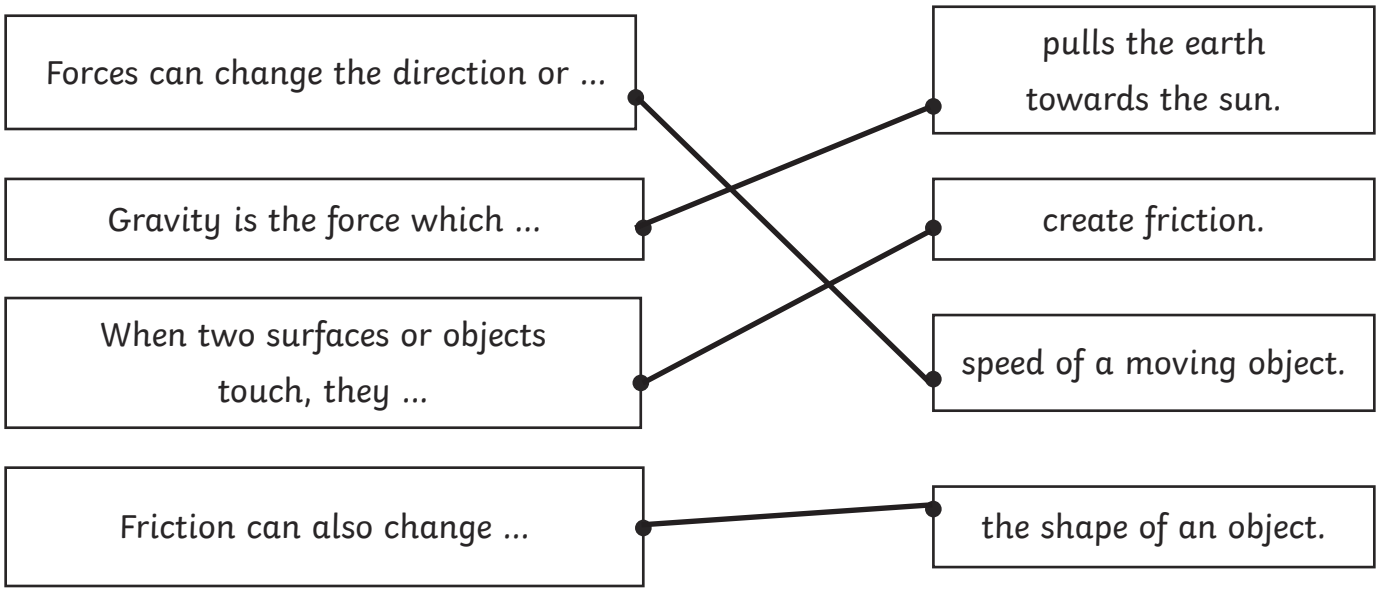
2. Fill in the missing word.

   Forces control everything in the **universe**.

3. Find and copy one word which explains how things can move quickly through the water.

   streamlined

4. Draw **four** lines and complete each sentence.



5. Fill in the missing word.

   Friction is the force which can **push** against an object and the force which stops or slows us when we are trying to move an object.

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6. Summarise what you have learnt about water resistance using 25 words or fewer.

I have learnt the water resistance pushes against an object. This makes it harder to move through the water, so it slows down.

7. Explain what might happen if a ship was carrying very heavy loads.

Pupils' own responses, such as: If the ship's load was very heavy, the ship might sink because it was heavier than the upthrust.

8. Explain why the mako shark is able to reach such impressive speeds.

Pupils' own responses, such as: The mako shark is very streamlined, which enables it to move quickly through the water.

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Forces and Motion

What Are Forces?



Forces control everything in the universe. When something stops or starts moving, it is because of a force. Forces can change the shape or size of an object and even the direction or speed of a moving object.

Friction occurs when there is contact between two surfaces or objects. It is a push against an object and the force which stops or slows us when we are trying to move an object. If an object is already moving, friction is slowing it down. This is why the ball you kick across a field eventually stops rolling away from you.

When something moves, there is more than one force involved. For example, if someone takes part in a skydive, the force of gravity will pull them towards the Earth and the force of air resistance will push against them. If two forces are working in the same direction, they will join together to make a stronger force. If equal forces are working in opposite directions, they will cancel each other out.

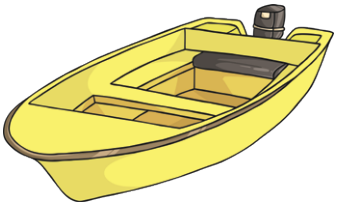


Forces are measured in newtons. The name 'newtons' was inspired by Sir Isaac Newton, who was an English scientist and mathematician. He was the first person to make a theory about forces after watching an apple fall from a tree. His theory described gravity as the force between all objects. It is this gravitational pull which keeps us on the ground.

Understanding Different Types of Forces

Forces can be grouped into contact forces and non-contact forces. Non-contact forces include gravity, magnetism and electrical forces, such as electrostatic. (You can feel this force if you rub a balloon against your hair.) Contact forces occur when materials are touching. We call this friction. Air resistance and water resistance are examples of this type of friction.

Air resistance is the type of force which occurs between the air and another material. Air resistance can slow objects down, for example a parachute falling to the ground or a vehicle travelling along the road.



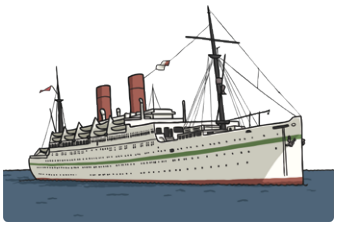
Water resistance is a type of friction which occurs between water and another material. Water resistance pushes against objects, making it hard for them to move through the water. Upthrust is a force that pushes objects up, usually in water.

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It keeps ships buoyant (floating) in the water because the force of the water pushing it up is equal to the force of gravity pulling it down.

If the weight of the object is greater than the upthrust, the object will sink.

Streamlined objects travel through the water more easily because they are designed to reduce friction. Designers often imitate the natural streamlined shape of aquatic creatures, such as sharks or dolphins.



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Questions

1. Fill in the missing word.

   Forces can change the _____ or size of an object and even the direction or speed of a moving object.

2. What is the name given to objects which are shaped to reduce air or water resistance? Tick one.

   - ○ energised
   - ○ streamlined
   - ○ artificial
   - ○ smooth

3. Draw four lines and complete each sentence.

Friction occurs when there is contact ...	friction is slowing it down.
If an object is already moving, ...	they will join together to make a stronger force.
If two forces are working in the same direction, ...	between two surfaces or objects.
If equal forces are working in opposite directions, ...	they will cancel each other out.

4. List two contact forces.

   _____

   _____

5. Fill in the missing word.

   When something _____ or starts moving, it is because of a force.

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6. Explain what forces a skydiver experiences when they dive from a plane.

7. Summarise what you have learnt about Sir Isaac Newton using 25 words or fewer.

8. Explain how upthrust can make objects float.

9. Explain how something that is streamlined can move more quickly through water than something that isn't.

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Answers

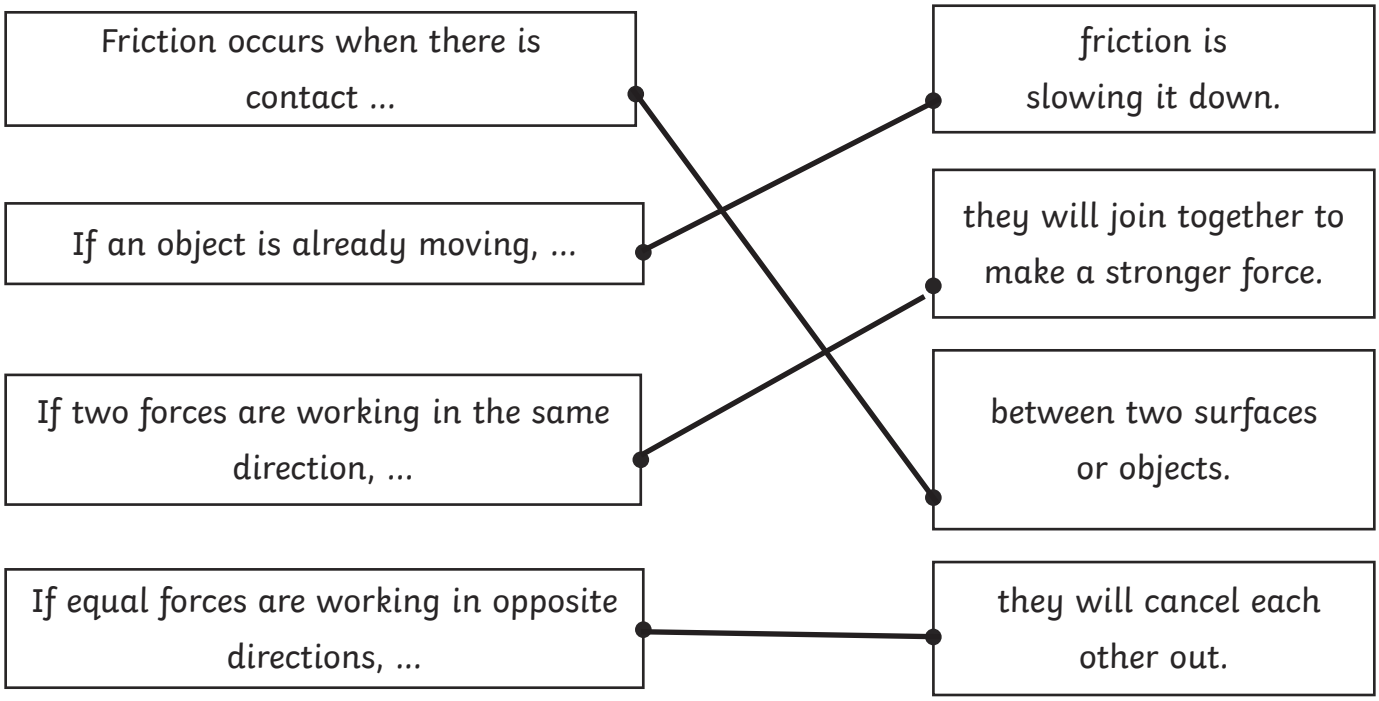
1. Fill in the missing word.

   Forces can change the **shape** or size of an object and even the direction or speed of a moving object.

2. What is the name given to objects which are shaped to reduce air or water resistance? Tick one.

   - ○ energised
   - ✓ **streamlined**
   - ○ artificial
   - ○ smooth

3. Draw four lines and complete each sentence.



4. List two contact forces.

   water resistance

   air resistance

5. Fill in the missing word.

   When something **stops** or starts moving, it is because of a force.

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6. Explain what forces a skydiver experiences when they dive from a plane.

   Pupils' own responses, such as: The force of gravity is pulling the sky diver towards the earth. Air resistance is slowing their descent.

7. Summarise what you have learnt about Sir Isaac Newton using 25 words or fewer.

   Pupils' own responses, such as: I have learnt that Sir Isaac Newton was a scientist. He had a theory about gravity after he watched an apple fall from a tree.

8. Explain how upthrust can make objects float.

   Pupils' own responses, such as: Objects will float when the force of the water or liquid pushing an object up (which is the upthrust) is equal to the force of gravity pulling the object down.

9. Explain how something that is streamlined can move more quickly through water than something that isn't.

   Pupils' own responses, such as: A streamlined shape moves through the water more easily than a shape that isn't streamlined because there is less water resistance to slow it down.

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Forces and Motion

What Are Forces?



Everything in the universe is controlled by a force. Forces can make something stop or start moving. They can change the shape or size of an object and even the direction or speed of a moving object. When something moves, there is more than one force involved. For example, if someone takes part in a skydive, the force of gravity will pull them towards the Earth, while air resistance will push against them. This delicate balance of forces is what stops the skydiver from plummeting to the ground. If two forces are working in the same direction, they will join together to make a stronger force. If equal forces are working in opposite directions, they will cancel each other out. In a 'tug of war' game, the rope won't move if both teams are pulling with the same force.

Sir Isaac Newton

Force is measured in newtons. The name 'newtons' was inspired by Sir Isaac Newton, who was an English physicist and mathematician. When an apple falls from a tree, Newton theorised that a force must be acting upon the apple to pull it from the tree towards the ground. Gravity pulls the Earth towards the Sun. This gravitational pull explains how everyone and everything stays on the Earth. On Earth, the force of gravity is measured at ten newtons for every one kilogram of mass. (Mass is amount of matter or substance an object contains; it is measured in kilograms.) Jupiter has the strongest gravitational pull because it is considerably larger than Earth.

Understanding Different Types of Forces

Forces can be grouped into contact forces and non-contact forces. Non-contact forces include; gravity, magnetism and electrical forces, such as electrostatic. (You can feel this force if you rub a balloon against your hair, which makes your hair stand on end.) Magnetism is the force that occurs when a magnet pulls a metal or another magnet towards it. Nickel, iron and cobalt are all attracted to magnets. Steel is a mixture of metals. It is magnetic because it contains iron.



Contact forces create friction. These include air and water resistance. When we throw an object or push against an object, we generate thrust. If an object is already moving, friction (or drag) is slowing it down.

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Upthrust and Buoyancy

Upthrust occurs when the gas or liquid below something pushes up more than the gas or liquid above it. In liquids such as water, the weight of an object is pushing down and the upthrust is pushing up. If the weight is equal to or less than the upthrust, the object is buoyant and will float. If the weight of the object is greater than the upthrust, it will sink. An example of this might be marshmallows in hot chocolate, which are forced up due to upthrust.

Did you know...?

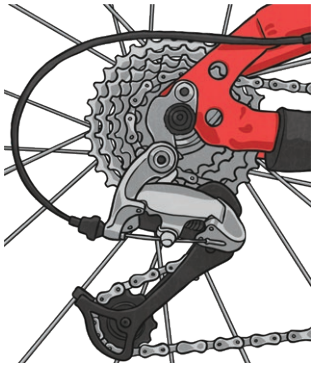
If you drop a feather and a hammer at the same time on the moon, they will both land at the same time. This is because there is no air resistance on the moon to slow the feather down.

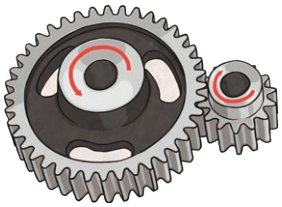
Mechanisms Used to Lift Forces



Pulleys can be used to make a small force lift a heavier object. The more wheels in a pulley, the less force is needed to lift a weight. Resting a lever on a pivot allows large weights to be lifted more easily.

Gears or cogs can be used to change the speed, force or direction of a motion, making it easier for cyclists to pedal. When two gears are connected, they always turn in the opposite direction to each other. Levers can be used to make a small force lift a heavier load. Slippery substances, such as oil, reduce friction and allow things to move together more smoothly. This is known as lubrication. Oil is used on cars and bikes as a lubrication.





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Questions

1. What kind of force acts to slow things down? Tick one.

   - ○ buoyancy
   - ○ friction
   - ○ gravity
   - ○ electrostatic

2. Fill in the missing word.

   When something moves, there is more than one _____ involved.

3. Draw **four** lines and complete each sentence.

Everything in the universe is ...	friction (or drag) is slowing it down.
If an object is already moving, ...	they will join together to make a stronger force.
If two forces are working in the same direction, ...	controlled by a force.
In a 'tug of war' game, the rope won't move if both teams are ...	pulling with the same force.

4. Magnetism is the force that occurs when a magnet pulls a metal or another magnet towards it. Find and copy an example of a metal which is attracted to the magnet.

   _____

5. Fill in the missing word.

   When two gears are connected, they always _____ in the opposite direction to each other.

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6. Summarise what you have learnt about buoyancy using 25 words or fewer.

7. Describe an example of upthrust.

8. Summarise what you have learnt about gravity using 25 words or fewer.

9. Explain what happens when two forces are equal in 25 words or fewer.

10. Explain the difference between magnetic and non-magnetic metals.

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Answers

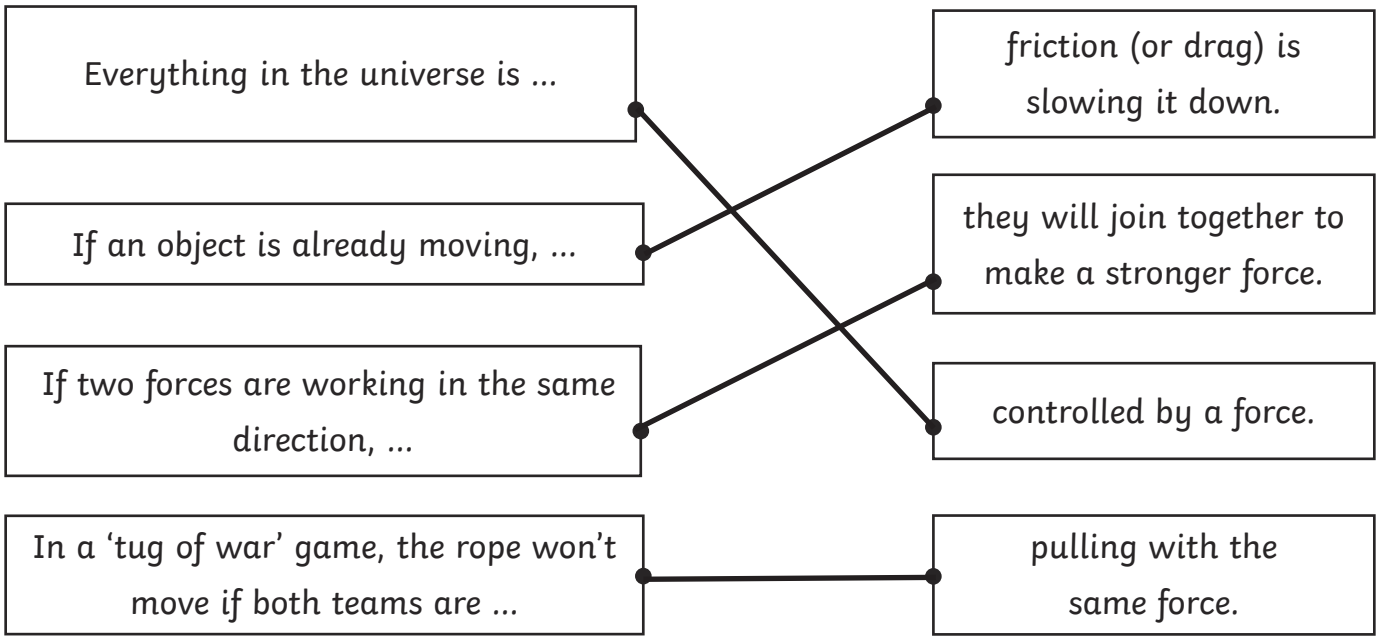
1. What kind of force acts to slow things down? Tick one.

   ○ buoyancy
   ✓ **friction**
   ○ gravity
   ○ electrostatic

2. Fill in the missing word.

   When something moves, there is more than one **force** involved.

3. Draw **four** lines and complete each sentence.



4. Magnetism is the force that occurs when a magnet pulls a metal or another magnet towards it. Find and copy an example of a metal which is attracted to the magnet.

   Accept any of the following: nickel, iron, cobalt, steel

5. Fill in the missing word.

   When two gears are connected, they always **turn** in the opposite direction to each other.

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6. Summarise what you have learnt about buoyancy using 25 words or fewer.

   Pupils' own responses, such as: I have learnt that if the weight of an object is equal to or less than the upthrust, it will float. Or; I have learnt that if the weight of an object is greater than the upthrust, it will sink.

7. Describe an example of upthrust.

   Pupils' own responses, such as: Floating in the swimming pool. Or; Marshmallows floating on top of the hot chocolate. Or; A ship floating on the ocean.

8. Summarise what you have learnt about gravity using 25 words or fewer.

   Pupils' own responses, such as: I have learnt that the gravitational pull of the Sun is what makes everything stay on the Earth. Or; Newton came up the theory of gravity after watching an apple fall to the ground.

9. Explain what happens when two forces are equal in 25 words or fewer.

   Pupils' own responses, such as: When two forces are equal, they will cancel each other and there will be no movement.

10. Explain the difference between magnetic and non-magnetic metals.

    Pupils' own responses, such as: Magnetic metals will be pulled towards a magnet but non-magnetic metals will not be attracted to a magnet.

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