A Types of Forces

In this section, I will

- identify different forces
- decide when to repeat observations to get reliable results
- suggest and explain how an investigation could be improved
- use science to support my points of view in discussions
- identify people who use science and describe how they use it

Thinking cap

If gravity pulls us towards the centre of the Earth, why is a ship able to stay on the surface of the sea?

Let's Explore!

What forces are acting on the coin?

You will need:
- Coin

1. Work in pairs.
2. Use your fingers to spin the coin.
3. Observe the spinning coin until it comes to a complete stop.
4. Discuss these questions:
   - **(a)** What forces do you think are acting on the spinning coin?
   - **(b)** What causes the coin to come to a complete stop?

Option

Watch!
Scan this page to take part in a quiz about forces.

Let's Learn

What Forces Are There Around Us?

In Stage 3, we have learnt that forces cannot be seen but we can observe their effects. There are different types of forces acting on us and around us all the time.

There is an **applied force** on the spinning coin in the activity on the previous page. This force acts when you push or pull an object.

We have learnt that gravity is a force that pulls us towards the centre of the Earth. This is why all objects fall onto the ground when they are released from a height.

Gravity and normal force are acting on the woman, but in opposite directions. This allows her to remain seated on the chair.

If gravity is acting on the woman sitting down, why isn't she pulled down through her chair?

Forces always act in pairs. There is an upward force acting against gravity. This is known as the **normal force**. It supports objects placed on surfaces.

Word Boost

released
upward
supports

Look at this picture of a ship. Why hasn't the ship sunk to the bottom of the sea due to gravity?

Water exerts an upward force that acts in the opposite direction to that of gravity. This is known as **upthrust**. Upthrust helps keep the ship from sinking to the bottom of the sea.

Tech Talk!

Ships play an important role in transporting people and goods from one place to another by sea. Ship builders are constantly developing new ways to build ships that are bigger, faster and able to sail for longer distances.

Find out why the design of a ship is important.

You have learnt that friction is a force that exists between two surfaces.

Friction opposes motion, so we are able to walk on the ground without slipping.

Skydivers use a parachute to land safely on the ground. Have you ever wondered how a parachute works?

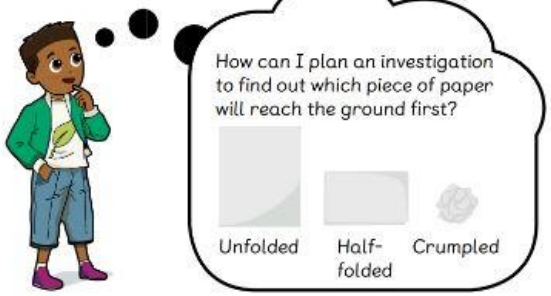
Gravity acts on the skydiver during the fall. At the same time, a force called **air resistance** acts against gravity. This lowers the speed at which the skydiver falls. Air resistance is the friction between moving objects and the air.

With all other factors being equal, an object with a larger surface area experiences greater air resistance. This is because a larger surface area is in contact with the air. The large surface area of a parachute allows the skydiver to experience greater air resistance. This helps to slow down the fall and helps the skydiver to land gently.

Word Boost

skydiver
parachute
factors
contact

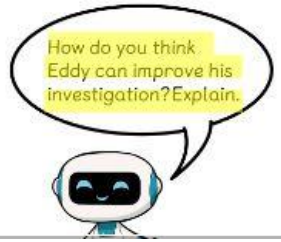
Eddy wanted to find out which piece of paper would reach the ground first when released from the same height.



He recorded the time taken for the pieces of paper to reach the ground as shown.

Paper	Time taken to reach ground (seconds)
Unfolded paper	4
Half-folded paper	2.5
Crumpled ball of paper	1

Eddy repeated the experiment two more times to ensure that the results were **reliable**. If the results are similar when the experiment is repeated, we say that they are reliable. However, if the results are very different, Eddy would need to find out if there is anything wrong with the way he conducted the experiment.



Science at Work

Aerodynamic engineers test the design of vehicles to make sure they will work well with and against forces. It is important to study the movement of air around an aeroplane. This ensures that it can be designed to overcome gravity and reduce air resistance.

Find out how an aeroplane overcomes different forces to take off into the air.

The force acting between the body of the fish and the water is known as **water resistance**. In Chapter 3, you have learnt that some fish have long and narrow bodies, which reduces the surface area pushing against the water. This reduces the water resistance and helps the fish to swim faster.

Check Your Learning

What are the forces acting on the body of a person riding a bicycle?

Tick (✓) to show what you can do.

- ☐ I can identify different forces.
- ☐ I can decide when to repeat observations to get reliable results.
- ☐ I can suggest and explain how an investigation could be improved.
- ☐ I can use science to support my points of view in discussions.
- ☐ I can identify people who use science and describe how they use it.

Activity Book
Activity 6A, p. 50

B Force Diagrams

In this section, I will

- learn that an object may have many forces acting on it, even when at rest
- use force diagrams to show the different forces acting on objects
- use a diagram to explain a scientific idea
- ask a scientific question and find the best scientific way to get to the answer
- describe risks in practical work and ways to minimise them
- recognise the features of different scientific enquiries

Thinking cap

If I stand still, are there any forces acting on me?

Let's Explore!

What forces are acting on objects?

1. Take a walk around your school compound.
2. Identify an object that is moving and another one that is not moving.
3. Discuss these questions:
   (a) What forces are acting on each of the objects?
   (b) How would you show the forces in a diagram?

Let's Learn

How Do We Show Forces in Diagrams?

An object may have many forces acting on it, even when it is at rest. We can show the different forces, as well as the size of the forces acting on an object by using a **force diagram**.

In the example of the woman seated in a chair, the arrows in the diagram show the direction of each force. The size of the force is shown by the length of the arrow drawn.

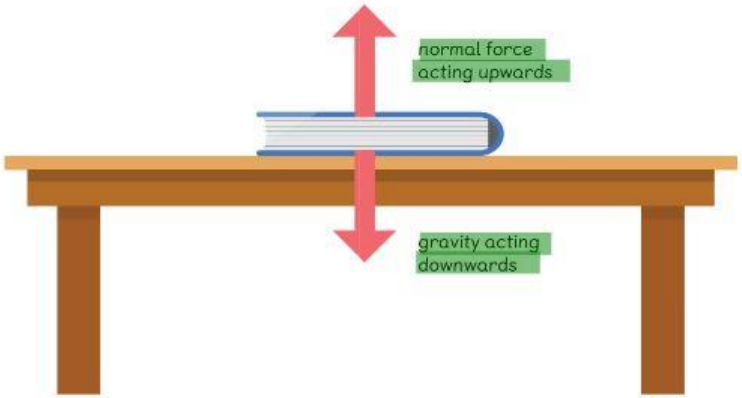
Gravity acts downwards, while normal force acts upwards. The forces act in pairs in opposite directions.

Look around you. Can you identify other examples of forces acting on objects at rest?

Word Boost

downwards
upwards

Look at the diagram of a book at rest on the table.



What do you notice about the size of each force? They are equal. When forces are equal, we say that they are **balanced forces**.

When there are balanced forces acting on an object, there will be no change in movement. A stationary object will continue to be at rest, while a moving object will continue to move at the same speed, in the same direction. Draw two force diagrams to show the forces acting on the car and the ball below on a separate piece of paper. Ensure that all forces are correctly labelled.

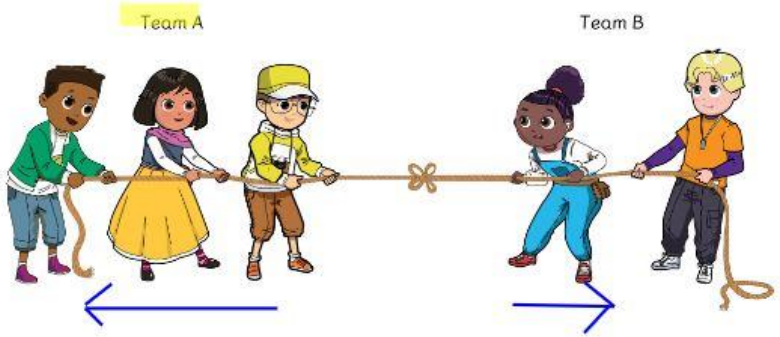
Balanced forces are acting on this car that is moving at the same speed in the same direction.

Balanced forces are acting on this stationary ball.

Word Boost

equal
stationary

The picture shows a tug-of-war competition between two teams. Which team do you think will win?



Team A is applying a greater force than Team B. When one of the pair of forces is greater than the other, we say that they are **unbalanced forces**.

When forces are unbalanced, stationary objects will start moving. For objects that are moving, unbalanced forces can result in a change of speed or direction, or both.

Using the stickers at the back of the book, show which team is winning by pasting the correct arrows in the correct directions on the picture above.