



What is gravity?

The force that pulls things to the ground on Earth (and other planets) is called **gravity**. Gravity also holds Earth and the other planets in their orbits around the Sun. The force of gravity also exists on the Moon but it is not as strong as it is on Earth. This is because the Moon is much smaller than our planet.

Isaac Newton

Isaac Newton is considered one of the most important scientists in history. He was born in 1643 in England.



When most people think of Isaac Newton, they think of him sitting under an apple tree watching an apple fall. Some people even believe the apple fell onto his head. Newton understood that what makes things like apples fall to the ground is a specific kind of force — the force we call gravity. Newton thought that gravity was the force of **attraction** between two objects, such as an apple and the earth. He also thought that an object with more matter exerted the same force on smaller objects as they exerted on it. That meant that the large mass of the earth pulled objects toward it. That is why the apple fell down instead of up, and why people do not float in the air.

What should I already know?

- Know what a **force** is and be able to explain that a push and pull are types of forces.
- That when forces are applied to an object they allow them to move or stop moving.
- The strength of the force determines how far and fast an object moves.
- **Friction** is the **resistance of motion** when there is contact between two surfaces.
- The force that causes objects to move downwards towards the ground is gravity.
- That magnets have poles, and that opposite poles **attract**, while similar poles **repel**.

What are forces?

Forces are just pushes and pulls in a particular direction. Forces are shown by arrows in diagrams. The direction of the arrow shows the direction in which the force is acting. The bigger the arrow, the bigger the force.



Forces change the **motion** of an object. They will make it start to move or speed up, slow it down or even make it stop. *For example, when a cyclist pushes down on the pedals of a bike, it begins to move. The harder the cyclist pedals, the faster the bike moves. When the cyclist pulls the brakes, the bike slows down and eventually stops.*

What is friction?

Friction is a force between two surfaces that are sliding, or trying to slide, across each other. Friction always works in the direction opposite to the direction in which the object is moving, or trying to move. Friction always slows a moving object down. The amount of friction depends on the materials from which the two surfaces are made. The rougher the surface, the more friction is produced. Friction also produces heat. If you rub your hands together quickly, you will feel them get warmer. Friction can be a useful force because it prevents our shoes slipping on the pavement when we walk and stops car tyres skidding on the road. Sometimes we want to reduce friction. For example, we use oil to reduce the friction between the moving parts inside a car engine.



Water resistance and air resistance are forms of **friction**. Friction can sometimes be helpful and sometimes unhelpful. *For example air resistance is helpful as it stops the skydiver hitting the ground at high speed. Water resistance makes it harder to move through water so the swimmer has to work hard.*

FUN FACT: Gravity makes waves that move at light speed



What are examples of mechanisms?

Levers allow us to do heavy work with less effort . For example, trying to pick up a large heavy box is difficult, however if a lever is used it becomes much easier to move it.



lever

Pulleys also allow us to do heavy work – objects are attached to ropes and pulley wheels, and so instead of lifting heavy object upwards, we can pull on the pulley rope downwards.



pulley

Gears are toothed wheels. Their 'teeth' can fit into each other so that when the first wheel turns, so does the next one. This allows forces to move across a surface.



gear

Springs can be stretched by pulling them or squashed by pushing them. The greater the force pulling or pushing the spring, the greater the force the spring uses to move back to its normal shape.



spring

When a magnet **attracts** another material, there is a pulling force between the two objects.

When a magnet **repels** another material, there is a pushing force between the two objects.

If you observe an object being attracted to a magnet, this is magnetism.



Galileo Galilei (1564-1642) was an Italian scientist and mathematician who wondered about this.

In 1590, he decided to carry out an investigation to find the answer.

He climbed to the top of the Leaning Tower of Pisa with two balls of similar shape and size, but with different masses.

He dropped both of the balls from the top of the tower at the same time. Both balls hit the ground at the same time.

	Key Vocab
Fall	an unplanned and sudden descent to the ground
Gravity	A pulling force exerted by Earth (or anything else which has mass)
Forces	The pulling or pushing effect that something has on something else
Air/Water Resistance	As an object moves, air resistance slows it down. The faster the object's motion, the greater the air resistance exerted against it.
Friction	The resistance of motion when one thing rubs against another
Motion	The activity of changing position or moving from one place to another
Surfaces	the outside limit or top layer of something
Mechanisms	a mechanical device for doing something. It includes the idea of tools and machines, but is used for a wider range of objects, processes and ideas
Levers	A basic tool used to lift or pry things open
Pulleys	A simple machine that makes lifting something easier. A pulley has wheels or a set of wheels with grooves that a rope or chain can be pulled over
Gears	A part of machine that causes another part to move because of teeth which connect the two moving parts
Accelerate	Speeding up
Decelerate	Slowing down
Balanced force.	When two forces are equal and there is no motion