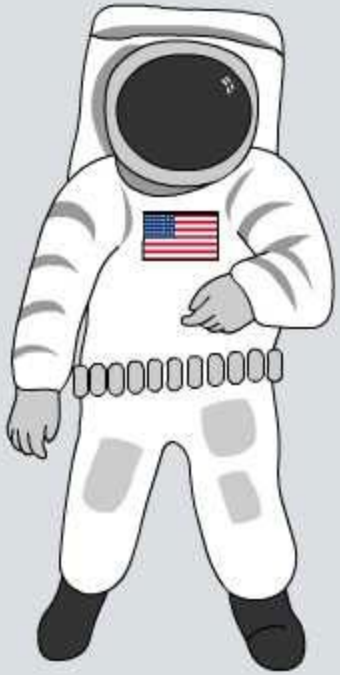
# Gravity



# What is gravity?

When the basketball is thrown, why does it fall back down?

There is a gravitational force pulling it towards the Earth. **Gravity** is a force that occurs between all objects.

Gravity always acts to pull objects towards each other. The Earth and the ball are pulling each other together.

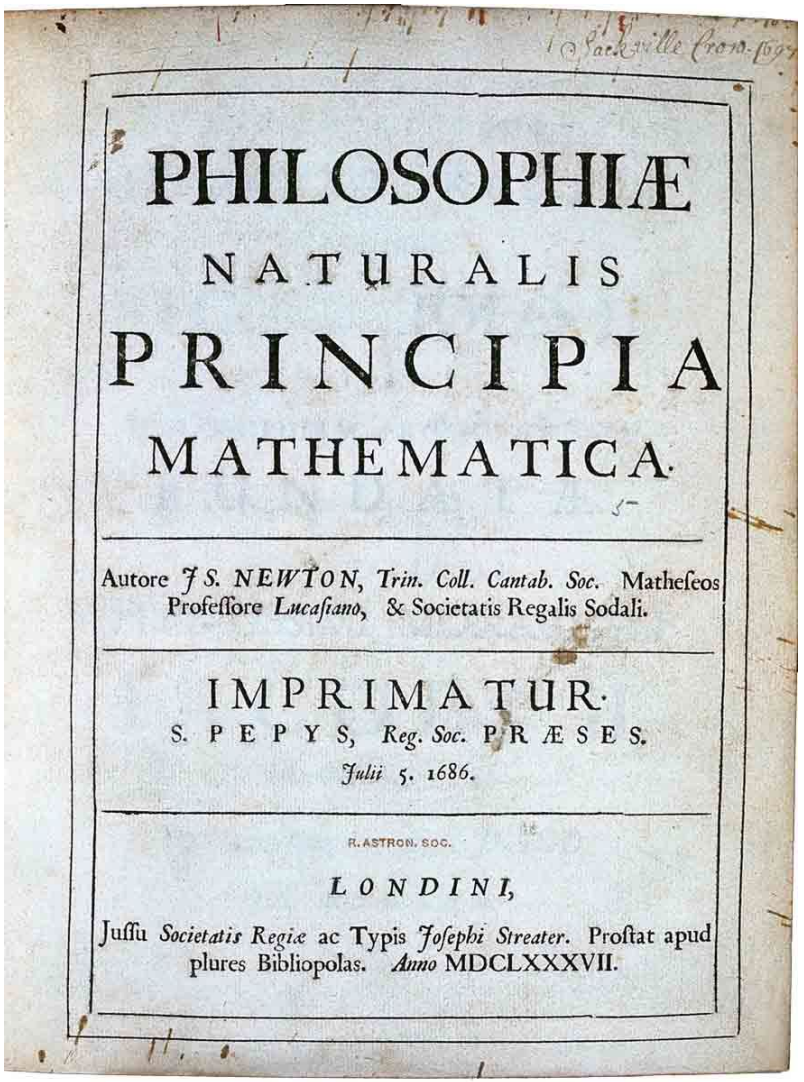
However, the ball moves much more than the Earth because it has a much smaller mass.

# Sir Isaac Newton

Sir Isaac Newton is a very famous physicist who lived in England in 1643–1727.

Newton wrote down his ideas in the *Philosophiae Naturalis Principia Mathematica;* a very important book about forces and gravity.

Some accounts suggest that one of Newton's greatest discoveries occurred when an apple fell on his head and it made him think about the reason it fell…



PHILOSOPHIÆ
NATURALIS
PRINCIPIA
MATHEMATICA.

Autore *J S. NEWTON, Trin. Coll. Cantab. Soc.* Matheſeos Profeſſore *Lucaſiano,* & Societatis Regalis Sodali.

IMPRIMATUR.
S. PEPYS, *Reg. Soc.* PRÆSES.
*Julii* 5. 1686.

R. ASTRON. SOC.

*LONDINI,*

Juſſu *Societatis Regiæ* ac Typis *Joſephi Streater.* Proſtat apud plures Bibliopolas. *Anno* MDCLXXXVII.

# Gravity and Newton

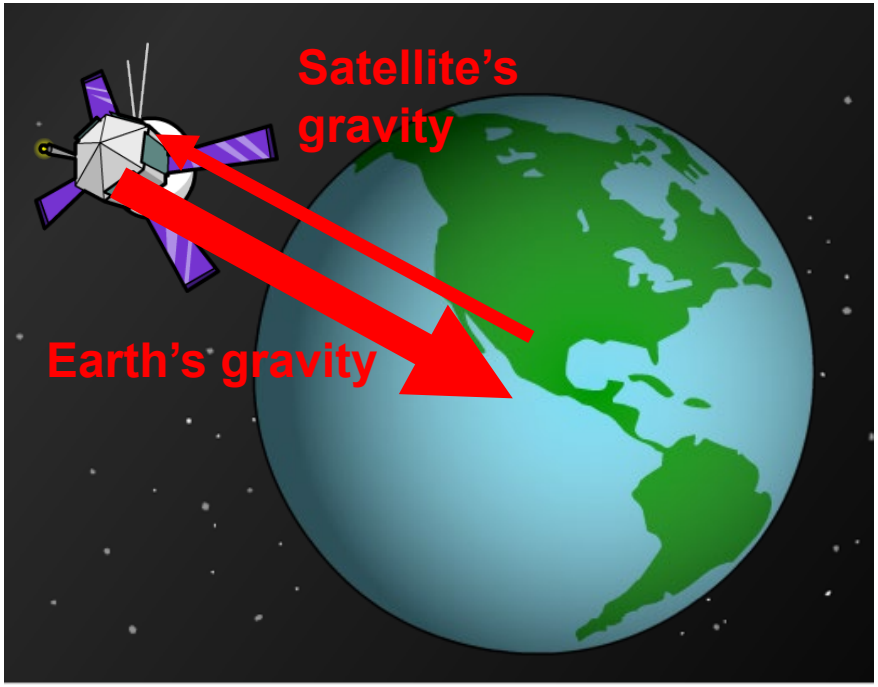
Newton realized that the motion of falling objects and objects orbiting in space must be caused by the same force – Gravity!

He wrote in the *Philosophiae Naturalis*, “It is an attractive force that makes apples fall from trees and the planets orbit the Sun.”

Other scientists had already noted the effects of gravity but Newton was the first to calculate the force of gravity on objects.

# What is gravity?

**Gravity** is an attractive force that acts between all objects that have mass. The size of the force depends on the masses of the objects.




All objects produce a gravitational force. This is very large for huge masses such as planets.

The Sun is so big that its gravity holds all the planets in the Solar System in orbit around itself. The gravity of the planets keeps moons and satellites in orbit around themselves. Gravity is the force that controls the motion of our entire Solar System!

# Gravity and distance

The force of gravity between two objects depends on their **masses** and the **distance** between them.

Spacecraft produce a very large force, called **thrust**, to overcome the force of gravity.

As a spacecraft gets further away from Earth, the force of gravity gets smaller.

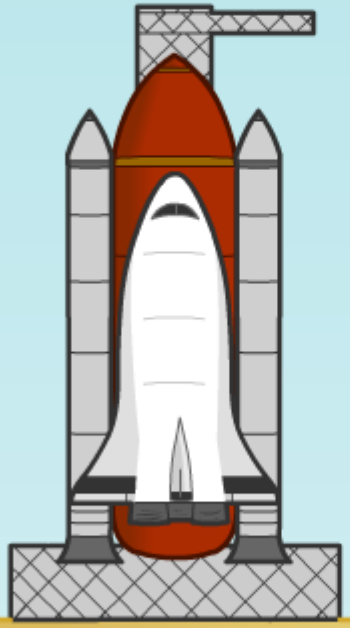

Why do spacecraft lose their large fuel tanks and booster rockets once they have left the Earth's surface?

# Gravity during a rocket launch

## Gravitational forces during a rocket launch

How do you think a rocket is affected by the Earth's gravitational field during take-off?

Click "**play**" to find out.



# What are mass and weight?

**Mass** is the amount of matter in an object and is measured in kilograms.

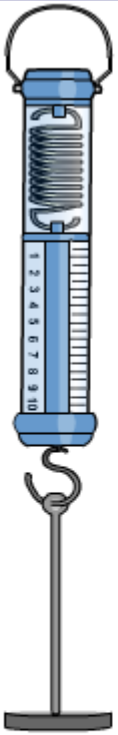
Mass is not a force.

An object, such as this satellite, has the same mass at any point in the Universe.


**Weight** is a force and is caused by the pull of gravity acting on a mass.

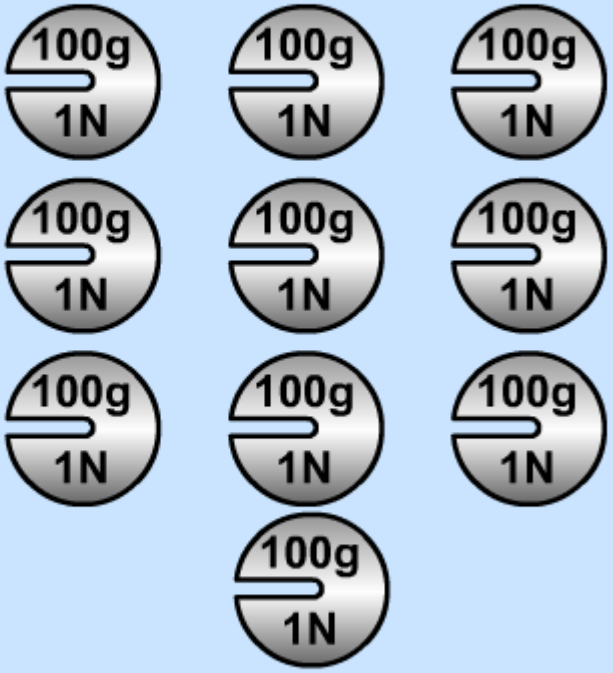
Weight is measured in **newtons** and has both magnitude and direction. An object's weight changes depending on where it is in the Universe.

# Investigating mass and weight



## What is the relationship between mass and weight?

**weight bank**




| mass (kg) | weight (N) |
| --- | --- |
| | |

# Mass and weight on the Moon

The force of gravity on the Moon is only one-sixth of that on Earth because the Moon has a much smaller mass.

Any object on the Moon weighs one-sixth of the amount it would weigh on Earth.

Astronauts can jump up 20 feet on the Moon due to there being such a low gravitational force.

However, the astronaut still has the same mass – they just weigh less because gravity is weaker.

# Mass and weight on different planets

# Weight and mass activity

## Does each statement apply to mass or weight?

| mass | weight |
| --- | --- |
| | |

value varies on different planets

solve

# Missing words about gravity

## Complete these sentences about gravity, mass and weight

**1.** Mass and _____ are not the same!

**2a.** Mass is the amount of _____ an object contains.

**2b.** Mass is measured in _____ and has the same value anywhere in the Universe.

**3a.** Weight is the force of _____ acting on an object's mass.

| | | | | |
|---|---|---|---|---|
| newtons | matter | force | gravity | greater |
| weight | kilograms | newtons | Earth | smaller |

hide solve